Journal of Computer Science and Information Technology
https://jcsitech-upiyptk.org/ojs
2023 Volume 9 Issue 3 Pg 154-159 e-ISSN: 2502-1486

Decision Support System in Selecting Used Motorbikes using the Multi Attribute Utility Theory (MAUT) Method

Adma Qhory Dwi Nanda*, Liga Mayola
Universitas Putra Indonesia YPTK Padang, Jl. Raya Lubuk Begalung Padang, Sumatera Barat – 25221, Indonesia
* admaqhory10@gmail.com

Abstract

Transportation is a useful tool for moving goods or people in a certain quantity, to a certain place, within a certain time period. The need for transportation has now become a primary need. Compared to public transportation, some people prefer to use private vehicles, especially motorbikes. Apart from being an agile and practical means of transportation when used to get through traffic jams both in the city and outside the city, motorbike fuel consumption is lower when compared to four-wheeled vehicles. As time goes by, there are more and more motorbike choices offered by motorbike manufacturers. With the large number of new motorbikes being released, coupled with increasingly intensive advertising about new motorbikes, some consumers are interested and encouraged to exchange (sell) their motorbikes and replace them with the latest motorbikes, so this creates used motorbikes that are still suitable for re-sale to consumers. other. Rifdah Motor Khatib is a company that operates in the field of selling used motorbikes. The problem experienced by Rifdah Motor Khatib was the difficulty in carrying out the used motorbike sales transaction process because the recording process still used manual methods , namely recording directly in the ledger and in the form of a note on the used motorbike purchases made. The process takes a long time to record the sale of a used motorbike. To overcome this problem, a decision support system was designed using the Multi Attribute Utility Theory (MAUT) method. From the research results, it was found that this system can help companies make decisions on selecting the best used motorbikes effectively and efficiently

Keywords: Motor, Multi Attribute Utility Theory, Decision Support Systems .

1. Introduction

Transportation is a useful tool for moving goods or people in a certain quantity, to a certain place, within a certain time period [1]. The need for transportation has now become a primary need. Compared to public transportation, some people prefer to use private vehicles, especially motorbikes [2]. Apart from being an agile and practical means of transportation when used to get through traffic jams both in the city and outside the city, motorbike fuel consumption is lower when compared to four-wheeled vehicles [3]. As time goes by, there are more and more motorbike choices offered by motorbike manufacturers. With the large number of new motorbikes being released, coupled with increasingly intensive advertising about new motorbikes, some consumers are interested and encouraged to exchange (sell) their motorbikes and replace them with the latest motorbikes, so this creates used motorbikes that are still suitable for re-sale to consumers. others [4].

Information systems are one of the factors that influence the success of an organization. Because information systems and technology continue to develop, an organization needs to design an IS/IT strategy. Planning includes defining organizational goals, establishing an overall strategy to achieve those goals and developing a comprehensive series of plans to integrate and coordinate an organization's work [5]. A system consists of a combination of subsystems that are smaller in reach or scope, but are also part of a larger supersystem [6]

A system is a collection of data elements, a network of interacting procedures, human resources, hardware technology and software that are interconnected to achieve certain goals or objectives that have the same goal [7] . A system, surrounded and influenced by its environment, is described by its boundaries, structure, goals and expressed in its functions. The meaning of system can be understood in terms of language [8].

Decision Support Systems (DSS) are flexible, interactive and adaptable computer-based information systems, which were developed to support solutions to specific, unstructured management problems [9]. Decision Support Systems use data, provide an easy user interface and can incorporate decision making thinking [10].

Multi-Attribute Utillity Theory (MAUT) is a scheme where the final evaluation, v(x), of an object x is defined as a weight added to a value relevant to its dimension value. The expression usually used to call it is utility value [11]. MAUT is used to convert several interests into numerical values on a scale of 0-1 with 0

Accepted: 06-10-2023 | Revised: 07-10-2023 | Published: 07-31-2023 | doi: 10.35134/jcsitech.v9i3.80

representing the worst option and 1 the best, this allows direct comparison of various measures [12]. The end result is a ranking order of alternative evaluations that describes the choices of decision makers.

2. Research methodology

This research was conducted at the used motorbike dealer Rifdah Motor Khatib. This dealer is located at Jl. Khatib Sulaiman No. 30, Lolong Belanti Village, North Padang District, Padang City, West Sumatra, Indonesia. The steps taken by the author in this design are organized from the main points of discussion and are easier to understand. The sequence of steps that will be carried out in this research can be seen in the following picture :

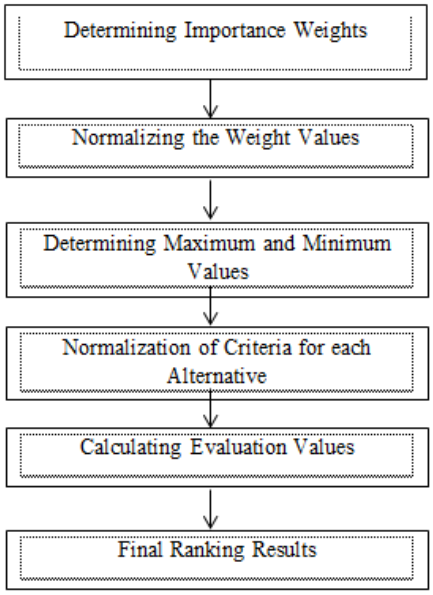

Figure 1. Research Framework

Multi Attribute Utility Theory (MAUT) is a scheme in which the final evaluation, v(x), of an object x is defined as the weight added to a value relevant to its dimension value. The expression usually used to call it is utility value .[4]

Normalization of the weight values of each criterion is necessary to overcome variations in the scale or range of values that may be used in assessing the criteria. This normalization step helps equalize the magnitude of the criteria so that they can be compared more fairly, so that we can identify the relative contribution of each criterion to decision making. Normalize the weight values of each criterion with the following equation:

$$w_i = \frac{w_i'}{\sum w_i'}$$

Furthermore, normalizing the criteria for each alternative using a utility function is a step in decision making which aims to measure the extent to which each alternative meets the predetermined criteria, taking into account the preferences or weights given to each criterion, using the following equation:

$$\text{Benefit}: U(x) = \frac{x - x_i^-}{x_i^+ - x_i^-}$$

$$\text{Cost}: U(x) = \frac{x_i^+ - x}{x_i^+ - x_i^-}$$

MAUT is used to convert several interests into numerical values on a scale of 0-1 with 0 representing the worst option and 1 the best. This allows direct comparison of various sizes . [5] For the calculation, the entire evaluation value can be defined using several equations, formulated as follows:

$$v(x) = \sum_{i=1}^{n} w_i \, v_i(x)$$

Where vi(x) is the evaluation value of the i object and wi is the weight that determines the value of how important the i element is compared to other elements. While n is the number of elements. The total of the weights is 1

3. Results and Discussion

The analysis process and results for selecting a used motorbike have several stages, namely:

3.1 MAUT Method Calculation Analysis

In this research, the criteria used in the used motorbike selection process have 4 criteria, namely:

Table 1 Criteria Data Results

Criteria	Information	Attribute
C1	Production year	Benefits
C2	Machine Capacity	Benefits
C3	Color	Benefits
C4	Type	Benefits
C5	Price	Cost

After the criteria have been determined, the calculation process can be seen in the following steps:

1. The importance weights used for each criterion are as follows:

Table 2 Importance Weights Calculation Example

Criteria	Importance Weight
Production year	4
Machine Capacity	5
Color	3
Type	3
Price	5

2. Normalize the weight values of each criterion

a. C1 Weight Normalization:

$$w_{C1} = \frac{4}{4+5+3+3+5} = \frac{4}{20} = \mathbf{0.2}$$

b. C2 Weight Normalization:

$$w_{C2} = \frac{5}{4+5+3+3+5} = \frac{5}{20} = \mathbf{0.25}$$

c. C3 Weight Normalization:

$$w_{C3} = \frac{3}{4+5+3+3+5} = \frac{3}{20} = \mathbf{0,15}$$

d. C4 Weight Normalization:

$$w_{C4} = \frac{3}{4+5+3+3+5} = \frac{3}{20} = \mathbf{0.15}$$

e. C5 Weight Normalization:

$$w_{C4} = \frac{5}{4+5+3+3+5} = \frac{5}{20} = \mathbf{0.25}$$

The following are examples of 10 alternative motorbikes that have alternative motorbikes with the following data :

Table 3 Alternative Calculation Examples

Alternative	Criteria				
	C1	C2	C3	C4	C5
A01	2014	110	5	2	Rp. 5,800,000
A02	2018	115	4	1	Rp. 12,400,000
A03	2019	150	1	1	Rp. 17,300,000
A04	2017	125	5	2	Rp. 9,800,000
A05	2017	150	5	3	Rp. 18,600,000
A06	2015	150	1	4	Rp. 21,000,000
A07	2015	250	1	5	Rp. 39,900,000
A08	2016	125	5	2	Rp. 10,800,000
A09	2019	155	3	1	Rp. 20,200,000
A10	2018	150	2	3	Rp. 19,000,000

3. Determine the maximum value and minimum value for each criterion as follows:

Table 4 Maximum and Minimum Table

Criterion Name	Value (x_i^+)	Minimum Value (x_i^-)
Production year	2019	2014
Machine Capacity	250	110
Color	5	1
Type	5	1
Price	39900000	5800000

4. Normalize the criteria for each alternative using a utility function

a. Normalization of A01 Criterion Values:

Normalization :

$$U_{C1}(A1) = \frac{2014-2014}{2019-2014} = \frac{0}{5} = \mathbf{0}$$

Normalization :

$$U_{C2}(A1) = \frac{110-110}{250-110} = \frac{0}{140} = \mathbf{0}$$

Normalization :

$$U_{C3}(A1) = \frac{5-1}{5-1} = \frac{4}{4} = \mathbf{1}$$

Normalization :

$$U_{C4}(A1) = \frac{2-1}{5-1} = \frac{1}{4} = \mathbf{0.25}$$

C5 Normalization :

$$U_{C5}(A1) = \frac{39900000-5800000}{39900000-5800000} = \frac{34100000}{34100000} = \mathbf{1}$$

b. Normalization of A02 Criterion Values:

Normalization :

$$U_{C1}(A2) = \frac{2018-2014}{2019-2014} = \frac{4}{5} = \mathbf{0.8}$$

Normalization :

$$U_{C2}(A2) = \frac{115-110}{250-110} = \frac{5}{140} = \mathbf{0.0357}$$

Normalization :

$$U_{C3}(A2) = \frac{4-1}{5-1} = \frac{3}{4} = \mathbf{0.75}$$

Normalization :

$$U_{C4}(A2) = \frac{1-1}{5-1} = \frac{0}{4} = \mathbf{0}$$

C5 Normalization :

$$U_{C5}(A2) = \frac{39900000-12400000}{39900000-5800000} = \frac{27500000}{34100000} = \mathbf{0.8065}$$

c. Normalization of A03 Criterion Values:

Normalization :

$$U_{C1}(A3) = \frac{2019-2014}{2019-2014} = \frac{5}{5} = \mathbf{1}$$

Normalization :

$$U_{C2}(A3) = \frac{150-110}{250-110} = \frac{40}{140} = \mathbf{0.2857}$$

Normalization :

$$U_{C3}(A3) = \frac{1-1}{5-1} = \frac{0}{4} = \mathbf{0}$$

Normalization :

$$U_{C4}(A3) = \frac{1-1}{5-1} = \frac{0}{4} = \mathbf{0}$$

C5 Normalization :

$$U_{C5}(A3) = \frac{39900000-17300000}{39900000-5800000} = \frac{22600000}{34100000} = \mathbf{0.6628}$$

d. Normalization of A04 Criterion Values:

Normalization :

$$U_{C1}(A4) = \frac{2017-2014}{2019-2014} = \frac{3}{5} = \mathbf{0.6}$$

Normalization :

$$U_{C2}(A4) = \frac{125-110}{250-110} = \frac{15}{140} = \mathbf{0.1071}$$

Normalization :

$$U_{C3}(A4) = \frac{5-1}{5-1} = \frac{4}{4} = \mathbf{1}$$

Normalization :

$$U_{C4}(A4) = \frac{2-1}{5-1} = \frac{1}{4} = \mathbf{0.75}$$

C5 Normalization :

$$U_{C5}(A4) = \frac{39900000 - 9800000}{39900000 - 5800000} = \frac{30100000}{34100000} = \mathbf{0.8827}$$

e. Normalization of A05 Criterion Values:

Normalization :

$$U_{C1}(A5) = \frac{2017-2014}{2019-2014} = \frac{3}{5} = \mathbf{0.6}$$

Normalization :

$$U_{C2}(A5) = \frac{150-110}{250-110} = \frac{40}{140} = \mathbf{0.2857}$$

Normalization :

$$U_{C3}(A5) = \frac{5-1}{5-1} = \frac{4}{4} = \mathbf{1}$$

C4 Normalization :

$$U_{C4}(A5) = \frac{3-1}{5-1} = \frac{2}{4} = \mathbf{0.5}$$

C5 Normalization :

$$U_{C5}(A5) = \frac{39900000 - 18600000}{39900000 - 5800000} = \frac{21300000}{34100000} = \mathbf{0.6246}$$

f. Normalization of A06 Criterion Values:

Normalization :

$$U_{C1}(A6) = \frac{2015-2014}{2019-2014} = \frac{1}{5} = \mathbf{0.2}$$

Normalization :

$$U_{C2}(A6) = \frac{150-110}{250-110} = \frac{40}{140} = \mathbf{0.2857}$$

Normalization :

$$U_{C3}(A6) = \frac{1-1}{5-1} = \frac{0}{4} = \mathbf{0}$$

C4 Normalization :

$$U_{C4}(A6) = \frac{4-1}{5-1} = \frac{3}{4} = \mathbf{0.75}$$

C5 Normalization :

$$U_{C5}(A6) = \frac{39900000 - 21000000}{39900000 - 5800000} = \frac{18900000}{34100000} = \mathbf{0.5543}$$

g. Normalization of A07 Criterion Values:

Normalization :

$$U_{C1}(A7) = \frac{2015-2014}{2019-2014} = \frac{1}{5} = \mathbf{0.2}$$

Normalization :

$$U_{C2}(A7) = \frac{250-110}{250-110} = \frac{140}{140} = \mathbf{1}$$

Normalization :

$$U_{C3}(A7) = \frac{1-1}{5-1} = \frac{0}{4} = \mathbf{0}$$

Normalization :

$$U_{C4}(A7) = \frac{5-1}{5-1} = \frac{4}{4} = \mathbf{1}$$

C5 Normalization :

$$U_{C5}(A7) = \frac{39900000 - 39900000}{39900000 - 5800000} = \frac{0}{34100000} = \mathbf{0}$$

h. Normalization of A08 Criterion Values:

Normalization :

$$U_{C1}(A8) = \frac{2016-2014}{2019-2014} = \frac{2}{5} = \mathbf{0.4}$$

Normalization :

$$U_{C2}(A8) = \frac{125-110}{250-110} = \frac{15}{140} = \mathbf{0.1071}$$

Normalization :

$$U_{C3}(A8) = \frac{5-1}{5-1} = \frac{4}{4} = \mathbf{1}$$

C4 Normalization :

$$U_{C4}(A8) = \frac{2-1}{5-1} = \frac{1}{4} = \mathbf{0.25}$$

C5 Normalization :

$$U_{C5}(A8) = \frac{39900000 - 10800000}{39900000 - 5800000} = \frac{29100000}{34100000} = \mathbf{0.8534}$$

i. Normalization of A09 Criterion Values:

Normalization :

$$U_{C1}(A9) = \frac{2019-2014}{2019-2014} = \frac{5}{5} = \mathbf{1}$$

Normalization :

$$U_{C2}(A9) = \frac{155-110}{250-110} = \frac{45}{140} = \mathbf{0.3214}$$

Normalization :

$$U_{C3}(A9) = \frac{3-1}{5-1} = \frac{2}{4} = \mathbf{0.5}$$

C4 Normalization :

$$U_{C4}(A9) = \frac{1-1}{5-1} = \frac{0}{4} = \mathbf{0}$$

C5 Normalization :

$$U_{C5}(A9) = \frac{39900000 - 20200000}{39900000 - 5800000} = \frac{19700000}{34100000} = \mathbf{0.5777}$$

j. Normalization of A10 Criterion Values:

Normalization :

$$U_{C1}(A10) = \frac{2018-2014}{2019-2014} = \frac{4}{5} = \mathbf{0.8}$$

Normalization :

$$U_{C2}(A10) = \frac{150-110}{250-110} = \frac{40}{140} = \mathbf{0.2857}$$

Normalization :

$$U_{C3}(A10) = \frac{2-1}{5-1} = \frac{1}{4} = \mathbf{0.25}$$

C4 Normalization :

$$U_{C4}(A10) = \frac{3-1}{5-1} = \frac{2}{4} = \mathbf{0.5}$$

C5 Normalization :

$$U_{C5}(A10) = \frac{39900000 - 19000000}{39900000 - 5800000} = \frac{20900000}{34100000} = \mathbf{0.6129}$$

Table 5 Criteria Normalization Matrix Results for Each Alternative

Alternative	Criteria				
	C1	C2	C3	C4	C5
A01	0	0	1	0.25	1
A02	0.8	0.0375	0.75	0	0.8065
A03	1	0.2857	0	0	0.6628
A04	0.6	0.1071	1	0.25	0.8827
A05	0.6	0.2857	1	0.5	0.6246
A06	0.2	0.2857	0	0.75	0.5543
A07	0.2	1	0	1	0
A08	0.4	0.1071	1	0.25	0.8534
A09	1	0.3214	0.5	0	0.5777
A10	0.8	0.2857	0.25	0.5	0.6129

5. Calculate the total evaluation by multiplying the normalization matrix of the criteria values and the weight values. After that, add up the results of the multiplication to find the value of the total evaluation for each alternative with the following equation:

$$v(A1) = (0.2 \times 0) + (0.25 \times 0) + (0.15 \times 1) + (0.15 \times 0.25) + (0.25 \times 1) = \mathbf{0.4375}$$

$$v(A2) = (0.2 \times 0.8) + (0.25 \times 0.0375) + (0.15 \times 0.75) + (0.15 \times 0) + (0.25 \times 0.8065) = \mathbf{0.483}$$

$$v(A03) = (0.2 \times 1) + (0.25 \times 0.2857) + (0.15 \times 0) + (0.15 \times 0) + (0.25 \times 0.6628) = \mathbf{0.4371}$$

$$v(A04) = (0.2 \times 0.6) + (0.25 \times 0.1071) + (0.15 \times 1) + (0.15 \times 0.25) + (0.25 \times 0.8827) = \mathbf{0.555}$$

$$v(A05) = (0.2 \times 0.6) + (0.25 \times 0.2857) + (0.15 \times 1) + (0.15 \times 0.5) + (0.25 \times 0.6246) = \mathbf{0.5726}$$

$$v(A06) = (0.2 \times 0.2) + (0.25 \times 0.2875) + (0.15 \times 0) + (0.15 \times 0.75) + (0.25 \times 0.5543) = \mathbf{0.3625}$$

$$v(A07) = (0.2 \times 0.2) + (0.25 \times 1) + (0.15 \times 0) + (0.15 \times 1) + (0.25 \times 0) = \mathbf{0.44}$$

$$v(A08) = (0.2 \times 0.4) + (0.25 \times 0.1071) + (0.15 \times 1) + (0.15 \times 0.25) + (0.25 \times 0.8534) = \mathbf{0.5076}$$

$$v(A09) = (0.2 \times 1) + (0.25 \times 0.3214) + (0.15 \times 0.5) + (0.15 \times 0) + (0.25 \times 0.5777) = \mathbf{0.4998}$$

$$v(A10) = (0.2 \times 0.8) + (0.25 \times 0.2857) + (0.15 \times 0.25) + (0.15 \times 0.5) + (0.25 \times 0.6129) = \mathbf{0.4972}$$

6. The final step is to sort the total evaluation scores from highest to lowest.

Table 6 Table of Ranking Results

No	Alternative	Total Evaluation	Ranking
1	***New V-ixion KS SE***	***0.5726***	**1**
2	Jupiter Z1	0.555	2
3	New Supra	0.5076	3
4	Aerox 155 GP	0.4998	4
5	CB150R Streetfire	0.4972	5
6	Beat FI Sporty CW	0.483	6
7	Ninja 250	0.44	7
8	Absolute Revo	0.4375	8
9	Vario 150	0.4371	9
10	KLX 150 BF SE	0.3625	10

From the table above, it can be concluded that the New V- ixion KS SE is the best alternative according to the weights and criteria that have been determined.

4. Conclusion

After conducting research with several stages needed to evaluate the decision support system by managing data from the Rifdah Motor Khatib company, the results were that the decision support system using the MAUT method can help companies make decisions effectively and efficiently and obtain the best alternative in accordance with the weights and criteria. which has been specified.

References

[1] Winata, K. (2017). Android-Based New Motorcycle Selection Decision Support System Using Simple Additive Weighting Method. JATI (Informatics Engineering Student Journal), 1(1), 739-746, DOI: https://doi.org/10.36040/jati.v1i1.2061

[2] Setiadi, I. (2019). Decision Support System for Selection of Used Cars Using AHP and SAW Methods on Nava Sukses Motor. String Journal, 3(3), 247-257, DOI: http://dx.doi.org/10.30998/string.v3i3.3582

[3] Murdianingsih, Y., Sitiumayah, U. (2020). Used Motorcycle Purchase Recommendation System Using the Fuzzy Tahani Method. Journal of ICT (Information Communication & Technology), 19(1), 17-26, DOI: https://doi.org/10.36054/jict-ikmi.v19i1.111 .

[4] Gusrianty, Oktarina D., Kurniawan WJ (2019). Decision Support System Using the Promethee Method to Determine Customer Satisfaction with Used Motorcycle Sales. SYSTEMS Journal, 8(1), 62-69, DOI: https://doi.org/10.32520/stmsi.v8i1.419 .

[5] Arifin, NA (2020). Decision Support System for Selection of Used Motorbikes Using AHP and SAW Methods. STRING Journal (Technology Research and Innovation Writing Unit), 5(2), 160-170, DOI: http://dx.doi.org/10.30998/string.v5i2.7739 .

[6] Saputra, YT, Fitriasih, SH, Setyowati (2019). Car Purchasing Decision Support System Using the Technique For Order Preference By Similarity Of Ideal Solution (TOPSIS) Method at Kelip Motor Karanganyar. TIKomSiN Journal, 7(1), 17-25, DOI: http://dx.doi.org/10.30646/tikomsin.v7i1.410 .

[7] Astuti, DPP, Mashuri (2020). Application of the Fuzzy Tsukamoto and Fuzzy Sugeno Methods in Determining Motorcycle Selling Prices. UNNES Journal of Mathematics, 9(2), 74-84, DOI: https://doi.org/10.15294/ujm.v9i2.33434 .

[8] Renaldy, Zakaria, TM (2020). Development of an Information System for Purchasing, Selling and Inventory of Used Motorcycles using Fast-Slow-Non Moving Analysis. Journal of Informatics Engineering and Information Systems, 6(3), 599-606, DOI: https://dx.doi.org/10.28932/jutisi.v6i3.3100 .

[9] Hadinata, N. (2018). Implementation of the Multi Attribute Utility Theory (MAUT) Method in the Decision Support System in Determining Credit Recipients. SISFOKOM Journal, 7(2), 87-92, DOI: https://doi.org/10.32736/sisfokom.v7i2.562.

[10] [Ramadiani, R., Rahmah, A. (2019). Decision Support System for Selection of Exemplary Health Workers Using the Multi Attribute Utility Theory Method. Scientific Journal of Information Systems Technology, 5(1), 1-12, DOI: https://doi.org/10.26594/register.v5i1.1273

[11] Adam, A., Fuad, A., Sirajuddin, HK, Kapita, SN (2020). Decision Support System for Selecting Outstanding Lecturers at Khairun University Ternate Using the Multi Attribute Utility Theory Method. JIKO (Journal of Informatics and Computers), 3(3), 166-172, DOI: http://dx.doi.org/10.33387/jiko.v3i3.2246

[12] Putra, RE, Na'am, J., Sumijan. (2020). Decisions to Selection of Outstanding Lecturers Using the Multi Attribute Utility Theory (MAUT) Method. Journal of Science and Informatics, 6(1), 9-14, DOI: https://doi.org/10.22216/jsi.v6i1.48