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Decision Support System in Determining the Route of Delivery of Goods with the MAUT and WP Methods at the Kasiyah Shop

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Abstract-*The rapid development of information technology has encouraged many companies to switch to digital platforms, including in the retail and trade sectors. Decision Support System (DSS) is one solution that can be used to help the route selection process. An effective and efficient goods delivery process is essential to support the success of logistics operations. An effective and efficient shipping process is essential to support the success of logistics operations. However, this process is often complicated and time-consuming, especially when companies receive many orders from different locations. To overcome this challenge, the use of a Decision Support System (DSS) can be the right solution. There are various methods that can be used in DSS to support the delivery route selection process, researchers conducted research using the MAUT (Multi-Attribute Utility Theory) and WP (Weighted Points) methods. The results of this study are expected to help improve the effectiveness and efficiency of the selection process, as well as ensure that the selected route has the necessary mileage to support the operational success of logistics companies.*

Keyword: *dss, maut, wp, website*

I. INTRODUCTION

The rapid development of information technology has encouraged many companies to switch to digital platforms, including in the retail and trade sectors. Logistics or e-commerce has become one of the main solutions in facilitating a more efficient and effective buying and selling process. Along with the growth of logistics, the need for competent and professional human resources in managing logistics operations is also increasing.

Decision Support System (DSS) is one solution that can be used to help the route selection process. DSS is a computer-based system designed to support decision making by analyzing data and generating recommendations based on predetermined criteria. In the context of route selection, DSS can help evaluate routes based on various criteria, such as time, cost, comfort, and others.

An effective and efficient goods delivery process is essential to support the success of logistics operations. However, this process is often complicated and time-consuming, especially when companies receive many orders from different regions. To overcome this challenge, the use of a Decision Support System (DSS) can be the right solution. DSS can help management in evaluating and selecting the best candidates based on various predetermined criteria.

There are various methods that can be used in DSS to support the shipping route selection process, including MAUT (Multi-Attribute Utility Theory) and WP (Weighted Points). This study aims to compare the use of the MAUT and WP methods in SPK for selecting shipping routes for logistics companies. The results of this study are expected to help improve the effectiveness and efficiency of the selection process, as well as ensure that the selected route has the necessary mileage to support the operational success of logistics companies.

II. RESEARCH METHODS

This Final Assignment report was written by the author using the Systems Development Life Cycle (SDLC) research approach. The SDLC is a system development methodology (Mulyani, 2016:28).

The process of developing and modifying systems, as well as the models and techniques employed to create these systems in accordance with user requirements, are the reasons we choose the SDLC. In general, this idea applies to information or computer systems. Planning, analysis, design, implementation, testing, and maintenance are the steps that make up the Software Development Life Cycle (SDLC), a pattern used to create software systems. This step entails a precise description of the project's goals, expectations, and anticipated challenges along with their resolution. At this point, the author uses interviews and observations to gather data in order to come up with

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answers. Figure 1 below provides an illustration of the SDLC method:

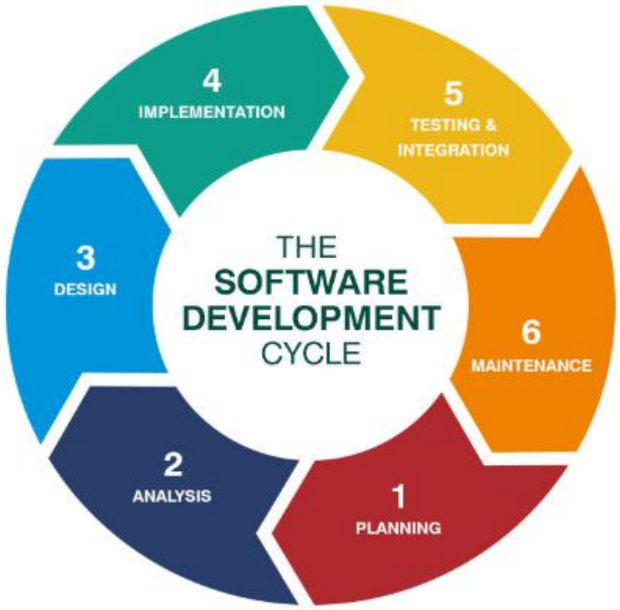

Figure 1. SDLC Methode

III. RESULT AND ANALYSIS

The author conducted a thorough observation of research activities at Kasiyah Store to obtain accurate information regarding the message archiving system that is being developed. To help the author analyze and build a message archiving application system, the author used several research aids, including the following:

3.1 MAUT Methode

The "MAUT (Multi-Attribute Utility Theory)" method is one of the frequently employed approaches in decision support systems. It is a multi-criteria decision-making strategy that compares and evaluates different options according to a variety of qualities or criteria. By giving each option a utility value, which is subsequently utilized to identify the optimal option, this strategy aids in the decision-making process. This approach uses ratios to combine multiple assessment criteria with disparate units of measurement. Steps of the MAUT method:

a) Normalization of Decision Matrix:

- Taking decision values with different dimensions

No.	C1	C2	C3	C4
R1	0,89	0,88	1	0,75
R2	0,78	0,75	0,89	0,88
R3	1	1	0,78	1

Figure 2. Conversion MAUT Skor

- Normalization formula: where X is the original value. After performing calculations for each criterion, the results obtained are shown in Figure 3.

Hasil	C1	C2	C3	C4
R1	0,5	0,52	1	0
R2	0	0	0,5	0,52
R3	1	1	0	1
Bobot	0,4	0,3	0,2	0,1

Figure 3. Skor Normalization

And multiplied by W which is the weight of each criterion.

Alteratif	C1	C2	C3	C4
R1	0,200	0,156	0,200	0,000
R2	0,000	0,000	0,100	0,052
R3	0,400	0,300	0,000	0,100

Figure 4. Skor Normalization

b) Determining the Score for Each Alternative:

- Calculate the score for each alternative by subtracting the sum of the values of the desired criteria from the sum of the values of the undesirable criteria.
- Formula :

$$V(x) = \sum_{i=1}^{n} W_i . v_i(x)$$

$$U(x) = \frac{x - xi^-}{xi^+ - xi^-}$$

where yi is the final score for alternative i. For the image, the resulting vector values will be presented in Figure 3.4 below:

Alteratif	C1	C2	C3	C4	Total	Rank
R1	0,200	0,156	0,200	0,000	0,556	2
R2	0,000	0,000	0,100	0,052	0,152	3
R3	0,400	0,300	0,000	0,100	0,800	1

Figure 5. Skor Vector

The advantages of using the MAUT method are:

- When dividing the subjective portion of an evaluation process into decision weight criteria with several choices, the MAUT technique offers a degree of adaptability and clarity. qualities that influence decision-making
- Because it can distinguish between competing criteria, it possesses a high degree of selectivity.
- Where the criteria may be cost-value or benefit-value

c) Rangking Alternatif:

Sorting the options according to the scores that were determined. The greatest option is the one that receives the highest score.

3.2 WP Methode

Semi-structured and unstructured decisions can be supported by a system called a Decision Support System (DSS). The "WP (Weighted Product)" method, a multi-criteria decision-making technique used to evaluate and compare many choices based on a number of factors, is employed by this decision support system while hiring new staff. This approach determines the final value for each option by multiplying each criterion value from the alternative by a predefined weight and then computing the product of these values. The best option is regarded as the one having the highest value. Steps of the MAUT method:

a. Criteria and Alternatif Identification:
Establish the standards that will serve as a guide for choosing options (Ai) and criteria (Ci).

b. Determination of Criteria Weight:
Calculate the weight and value of each criterion. Weight should be normalized so that the total weight equals 1.

$$\sum_{j}^{n} = 1 \;\; w_j = 1$$

c. Calculating the Final Score
- Calculate the value of vector S and the value of vector V.
- Formula:

$$S_i = \prod_{j=1}^{n} x_{ij}^{w_j}$$

The profit property has a positive exponent, wj, while the cost attribute has a negative exponent.

A presentation of the R1,R2 and R3 criteria calculation utilizing the WP computation is shown in Figure 3.5, 3.6 and 3.7 below.

S2 =	(0,78^0,4)*(0,75^(-0,3))*(0,89^0,2)*(0,88^0,1)
=	(0,905)*(1,090)*(0,976)*(0,987)
=	0,950

Figure 6. Vector S1

$$V_i = \frac{\prod_{j=1}^{n} x_{ij}^{w_j}}{\prod_{j=1}^{n} (x_j^*)^{w_j}}$$

S1 =	(0,89^0,4)*(0,88^(-0,3))*(1^0,2)*(0,75^0,1)
=	(0,954)*(1,039)*(1,000)*(0,971)
=	0,962

Figure 7. Vector S1

S3 =	(1^0,4)*(1^(-0,3))*(0,78^0,2)*(1^0,1)
=	(1,000)*(1,000)*(0,951)*(1,000)
=	0,951

Figure 8. Vector S1

Calculations are then made for every criterion that will be shown in Figure 3.8 using the WP method:

PENILAIAN VEKTOR V UNTUK PERANKINGAN						Rank
V1 =	0,962 / (0,962 + 0,950 + 0,951)	=	0,962 / 2,863	=	0,336	1
V2 =	0,950 / (0,962 + 0,950 + 0,951)	=	0,950 / 2,863	=	0,332	3
V3 =	0,951 / (0,962 + 0,950 + 0,951)	=	0,951 / 2,863	=	0,332	2

Figure 9. Calcuations Vector V

d. Rangking Alternatif

Using the determined scores, order the options. The greatest option is the one that receives the highest score.

Both of these techniques, MAUT and WP, offer an organized and methodical framework for analyzing and judging options according to a number of standards. The primary objective of each method is to assist decision makers in choosing the best option based on preset criteria, even though each one has a unique methodology and formula.

3.3 Criteria. Weight and Alternative

Kasiyah Shop is an UMKM that operates in the food sector originating from Sragen and has opened branches in Surakarta and Sukoharjo.

The selection criteria will be presented in the table below:

Kriteria Pemilihan:	
Waktu (Benefit)	C1
Biaya (cost)	C2
Keamanan (Benefit)	C3
Kepuasan (Benefit)	C4

Figure 10. Selection Criteria

A presentation of the C1,C2,C3,C4 criteria for normalization using the MAUT algorithm is shown in Figure 3.10, 3.11, 3.12, 3.13:

kriteria C1 :					
X- = 0,78 X+ =1					
R11 =	0,89 - 0,78 / 1 - 0,78	=	0,11 / 0,22	=	0,5
R21 =	0,78 - 0,78 / 1 - 0,78	=	0 / 0,22	=	0
R31 =	1 - 0,78 / 1 - 0,78	=	0,22 / 0,22	=	1

Figure 11. below will show the various

kriteria C2 :					
X- = 0,75 X+ =1					
R12 =	0,88 - 0,75 / 1 - 0,75	=	0,13 / 0,25	=	0,52
R22 =	0,75 - 0,75 / 1 - 0,75	=	0 / 0,25	=	0
R32 =	1 - 0,75 / 1 - 0,75	=	0,25 / 0,25	=	1

Figure 12. below will show the various

kriteria C3 :					
X- = 0,78 X+ =1					
R13 =	1 - 0,78 / 1 - 0,78	=	0,22 / 0,22	=	1
R23 =	0,89 - 0,78 / 1 - 0,78	=	0,11 / 0,22	=	0,5
R33 =	0,78 - 0,78 / 1 - 0,78	=	0 / 0,22	=	0

Figure 13. below will show the various

kriteria C4 :					
X- = 0,75 X+ =1					
R14 =	0,75 - 0,75 / 1 - 0,75	=	0 / 0,25	=	0
R24 =	0,88 - 0,75 / 1 - 0,75	=	0,13 / 0,25	=	0,52
R34 =	1 - 0,75 / 1 - 0,75	=	0,25 / 0,25	=	1

Figure 14. below will show the various

Alternative options that have been athered from various incoming data sources:

Alternatif :
Rute 1: Gudang A - Jalan Utama - Jalan Raya - Pelanggan B
Rute 2: Gudang A - Jalan Tol - Jalan Samping - Pelanggan B
Rute 3: Gudang A - Jalan Alternatif - Jalan Kota - Pelanggan B

Figure 15. alternative options

The weight of each criterion will be shown by the author in Figure 16. below:

Kriteria Pemilihan:		Bobot :
Waktu (Benefit)	C1	0,4
Biaya (cost)	C2	0,3
Keamanan (Benefit)	C3	0,2
Kepuasan (Benefit)	C4	0,1

Figure 16. The weight of each criterion

VI. CONCLUSION

Here are the findings derived from the three approaches utilized to assess the various options:

1. MAUT technique: With a score of 0.800, Alternative R3 is ranked first.
2. The WP approach: First place goes to Alternative R1, which has a score of 0.336.
3. Using the MAUT approach, Alternative R3 is clearly superior.

When assessed using the WP approach, Alternative R1 performs exceptionally well. The disparity in the approaches' outcomes indicates that the evaluation method may have an impact on which option is best. R1 is constantly ranked as the best option by the WP technique, whereas R3 receives the highest ranking by the MAUT method. Consequently, alternatives of both approaches have similarly strong results when making decisions, given the consistency of the results from the MAUT and WP procedures.

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