ROAD ELECTION DECISION SUPPORT SYSTEM TO WORK IN EAST JAKARTA

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***Abstract*— The increase in the number of roads is increasingly related to the number of kendarana volumes that must be carried out. This condition results in roads, especially the East Jakarta area, causing a buildup at certain titk points. This study aims to determine the best road to travel in order to avoid severe congestion alternatives. The trick is to give the decision to choose the road to be traveled smoothly with a low level of busyness of the road at least jammed under normal conditions. To determine the best path based on many criteria considerations, where the criteria can be measured quantitatively with the Exponential method, method Simple Additive Weighting (SAW) and method Weighted Product (WP). 3 Methods are used to numerically assess the priority value of each selected path , because this method is able to prioritize optimal alternatives. Usingcalculations can make it easier for vehicle users, especially the East Jakarta area, to choose roads that have low density for various types of problems to be analyzed. This test was conducted on 3 road datasets in 2014. With this system will help the path to make decisions more subjectively.**

Keywords—Decision Support System (SPK), Road selection, Exponential Method, Simple Additive Weighting (SAW) and Weighted Product (WP)

I. INTRODUCTION

Technological advances that are increasingly rapid today, are also very influential on the development of technology offering comfort, convenience, economy and realtime. The impact is that all kinds of information needs that were previously very difficult to obtain, are now able to be accessed by the public through supporting facilities, one of which is internet facilities accessed through Personal Computers (PC). Along with the development of this technology, a technology is also developed that is able to adopt human processes and ways of thinking, namely Artificial Intelligence technology. For this reason, from the various information above, the author intends to create a decision support system that can help bermorot kendarana users to obtain information about determining the road to pass without traffic jams. Making this decision in various ways or methods, according tothe needs of the user. Theetode that can be used are the Exponential method, the Simple Additive Weighting (SAW) and the Weighted Product (WP). These methods were developed to assist decision makers in making the best decisions on several decision alternatives to obtain an accurate and optimal decision. The Department of Transportation has the authority to carry out duties related to the management of road locations. The challenge that occurs in this era of globalization is the change in services according to the needs of the community. However, in the activities of increasing road priorities, the Department of Transportation still uses manual methods. Such manual decision-making mechanisms have fundamental flaws in the subjectivity of both decisions, experiences, and pressures of others so that decisions do not reflect effective decisions. This situation is certainly very inefficient in realizing improved road repair performance. This Decision Making System (SPK) method is able to determine accurate decision alternatives based on criteria such as road conditions, volume, road influence on the economy, and interests. The SPK methods that suit the needs of prioritizing road repairs are the Exponential Method, the Simple Additive Weighting (SAW) and the Weighted Product (WP) .

II. RESEARCH METHODS

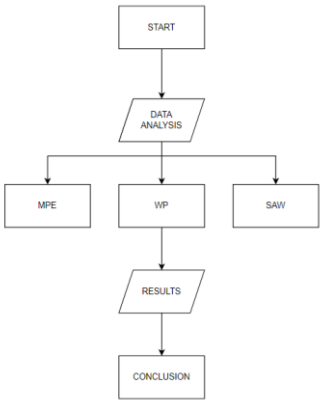

Figure 1. Research method flowchart

III. DATA ANALYSIS

In this case will find thebest alternative way to work. After conducting data research, we have found criteria data, namely congestion type, location, vehicle type, and description with the criteria data will then be calculated using the Exponential Comparison Method (MPE), *Weight Product (WP) Method*, Simple *Additive Weighting (SAW)* Method to get results from the data we process.

A. Exponential Comparison Method

The Exponential Comparison Method (MPE) is a method for determining priority order decision alternatives with multiple criteria. This technique is used as a helper for individual retrieval the decision to use a well-defined design model at the process stage. Different with the Bayes method, MPE will produce alternative values with more contrasting differences.

The formula for calculating the total value of each decision choice is as follows:

$$\text{Total Nilai } TNi = \sum_{j=1}^{m} (RKij)\ Bj$$

Information :
TNi : The total of value -i
RKij : The degree of relative importance of the -j criterion
Bj : The degree of importance of the -j decision criteria
n : Number of decision choices
m : Number of decision criteria

Table 1. Data Criteria

Code criteria	Name criteria	Weight
C1	Types on congestion	3
C2	Vehicle type	2
C3	Number of Interesection locations	3
C4	Long time stuck	2

Table 2. Congestion Level

Level	Information
1	Usual
2	Dense
3	Densely creeping
4	Bad

Table 3. Criteria value data

Criterion	Sub criteria	Value	Weight
Types on congestion	Office Congestion	4	3
	Large Vehicle Congestion	3	
	Public Transport Congestion	4	
	Congestion of Goods transport vehicles	2	
Vehicle type	Private Vehicles	4	2
	Truck Base	2	
	Intercity and interprovincial (AKAP) buses	3	
	Goods Car	1	
Number of Interesection locations	Jl Raya Pemuda (SD Tarakanita, Labscool)	4	3
	Jl. Raya Bogor (Front of Ps. Induk Kramat Jati)	3	
	Jl. Raya kalimalang (Pangklan Jati)	4	
	Prumpung (Viaducr Park)	2	
Long time stuck	Officers Required	2	2
	Contra Flow	3	

Table 4. Calculation

Code Alternative	Name criteria	Sub criteria	MPE
A1	Types on congestion	Large Vehicle Congestion	104
	Vehicle type	Truck Base	
	Number of Interesection locations	Jl Raya Pemuda (SD Tarakanita, Labscool)	
	Long time stuck	Contra Flow	
A2	Types on congestion	Public Transport Congestion	104
	Vehicle type	Intercity and interprovincial (AKAP) buses	
	Number of Interesection locations	Prumpung (Viaducr Park)	
	Long time stuck	Officers Required	
A3	Types on congestion	Office Congestion	97
	Vehicle type	Private Vehicles	
	Number of Interesection locations	Jl. Raya kalimalang (Pangklan Jati)	
	Long time stuck	Contra Flow	
A4	Types on congestion	Congestion of Goods transport vehicles	77
	Vehicle type	Goods Car	
	Number of Interesection locations	Jl. Raya Bogor (Front of Ps. Induk Kramat Jati)	
	Long time stuck	Officers Required	

** Limit of alternative value of roads worth taking 100

The conclusion from the calculation results obtained the best alternative value or the one that is worth taking is A3 with the acquisition of MPE value 105

B. Weighted Product

The Weighted Product method uses multiplication to connect attribute rating, where the rating of each attribute must be raised to the first rank with the weight of the attribute concerned. This process is the same as the process normalization. (Kusumadewi 2006)

The determination of the normalized weight value with the symbol W can be seen in the following formula :

$$w_j = \frac{w_i}{\sum w_j} \quad (3)$$

The determination of the value of the vector S can be seen in the following formula:

$$S_i = \Pi_{j=1}^{n} x^{w_j}$$

Information :
S : Alternative preference by analogy as vector S
x : Criterion value
i : Alternatives
j : Criteria
n : Many criteria

The determination of the value of the vector V can be seen in the following formula:

$$V_i = \frac{\Pi_{j=1}^{n} x_{ij}^{wj}}{\Pi_{j=1}^{n} (x_{ij^*})^{wj}}$$

V : Alternative preference with vector analogy V
x : Criterion value
w : Weight of criteria
i : Alternatives
j : Criteria
n : Many criteria

Table 5. Data Criteria

Code criteria	Name criteria	Category
C1	Types on congestion	Cost
C2	Vehicle type	Cost
C3	Number of Interesection locations	Cost
C4	Long time stuck	Benefits

Table 6. Linkert Scale

1	Very Low
2	Low
3	Enough
4	High
5	Very High

Table 7. Data Alternative

Code Alternative	Alternative Names
A1	Jl Raya Pemuda (SD Tarakanita, Labscool)
A2	Jl. Raya Bogor (Front of Ps. Induk Kramat Jati)
A3	Jl. Raya kalimalang (Pangklan Jati)
A4	Prumpung (Viaducr Park)

Table 8. Consideration

Street Names	Consideration			
	Types of congestion	Vehicle type	Number of Intersection locations	Long time stuck
Jl Raya Pemuda (SD Tarakanita, Labscool)	150	105	90	30
Jl. Raya Bogor (Front of Ps. Induk Kramat Jati)	270	200	120	20
Jl. Raya kalimalang (Pangklan Jati)	175	125	60	20
Prumpung (Viaducr Park)	125	100	80	15

Table 9. Vector value S of WP

S	Value of S
S1	0.047
S2	0.062
S3	0.057
S4	0.039
Total	**0.205**

Table 10. Vector value V of WP

V	Value of V
V1	0.229
V2	0.302
V3	0.278
V4	0.190
Total	**0.999**

The results of the vector value V above show the highest value in V2, where V2 represents the alternative A2 with the highest value.

C. Simple Additive Weighting (SAW)

Method Simple Additive Weight (SAW), often also known with the term weighted sum method. The basic concept of the Simple Additive Weight method (SAW) is looking for a weighted sum of the performance rating on each alternative on all attributes. (Fishburn and McCrimon in Munthe 2013)

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{Max_i x_{ij}} \\ \dfrac{Min_i x_{ij}}{x_{ij}} \end{cases}$$

Information :
Rij : Normalized perfromance rating value
Xij : The attribute value that each criterion has
Max xij : The greatest value of each criterion
Min xij : The smallest value of each criterion

The preference value for each alternative (Vi) can be seen in the following equation

$$Vi = \sum_{j=1}^{n} w_j r_j$$

Information :
Vi : Rankings for ech alternative
wj : The wight value of each criterion
rij : Normalized performance rating value

Table 11. Data Citeria

Code criteria	Name criteria	Category	Weight
C1	Types on congestion	Cost	30
C2	Vehicle type	Cost	15
C3	Number of Interesection locations	Cost	35
C4	Long time stuck	Benefits	20

Table 12. Data Crips

Code criteria	Name Criteria	Crips	Value
C1	Types of congestion	3	65
C1	Types of congestion	5	85

C1	Types of congestion	6	95
C1	Types of congestion	4	75
C2	Vehicle type	8	85
C2	Vehicle type	7	75
C2	Vehicle type	6	65
C2	Vehicle type	9	95
C3	Number of Intersection locations	4	75
C3	Number of Intersection locations	5	95
C3	Number of Intersection locations	2	45
C3	Number of Intersection locations	3	55
C4	Long time stuck	7 minutes	75
C4	Long time stuck	6 minutes	55
C4	Long time stuck	8 minutes	85
C4	Long time stuck	9 minutes	95

Table 13. Data Alternative

Code Alternative	Alternative Names
A1	Jl Raya Pemuda (SD Tarakanita, Labscool)
A2	Jl. Raya Bogor (Front of Ps. Induk Kramat Jati)
A3	Jl. Raya kalimalang (Pangklan Jati)
A4	Prumpung (Viaducr Park)

Table 14. Data Value Alternative

	A1	A2	A3	A4
X1	3	8	4	7 minutes
X2	4	9	3	9 minutes
X3	6	6	2	8 minutes
X4	5	7	5	6 minutes

Table 15. Normalization Stage

	A1	A2	A3	A4
X1	1	0.76	0.73	0.78
X2	0.86	0.68	1	0.57
X3	0.68	0.86	0.64	0.89
X4	0.76	1	0.57	0.57

Table 16. Ranking Stage

	A1	A2	A3	A4	Total	Rank
Weight	30	15	35	20	-	-
X1	1	0.76	0.73	0.78	82.55	2
X2	0.86	0.68	1	1	91	1
X3	0.68	1	0.64	0.89	75.6	3
X4	0.76	0.86	0.57	0.57	67.5	4

From the results of the ranking, it can be seen that the alternative **X2** got the largest score, namely 91 So it becomes rank 1 (best alternative).

IV. RESULTS

From the Exponential Comparison Method (MPE) Algorithm, Weight Product (WP) Method, Simple Additive Weighting (SAW) Method, we can see the results of these calculations to determine which is the best path.

Table 17. Results

Street Names	Ranking		
	Exponential Comparison Method	Weight Product	Simple Additive Weighting
Jl Raya Pemuda (SD Tarakanita, Labscool)	3	2	2
Jl. Raya Bogor (Front of Ps. Induk Kramat Jati)	1	1	1
Jl. Raya kalimalang (Pangklan Jati)	2	3	3
Prumpung (Viaducr Park)	3	4	4

V. CONCLUSION

Based on the research that has been carried out, the following conclusions can be drawn:

1) With this decision support system, it can help to determine one of the opportunities for workers or road users in the East Jakarta area right, namely there are 4 road choices according to the real data we take on a website with five best alternative criteria based on the weight scale value of the criteria determined by the user.

2) By using the 3 methods that we use the road problems we face can help to determine the best road, so that the road that we determine as the right decision is **Jl Raya Bogor (Depan ps. Induk Kramat Jati)** is used as an alternative road that has the best chance.

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