



Decision Support System for HP Android Selection using FMADM Model (Fuzzy Multiple Attribute Decision Making) with Weight Product (WP) Method

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ABSTRACT

The emergence of mobile phones with various brands and quality as well as more competitive price variations, both domestic production and foreign production, resulted in increased interest in people's purchasing power. Often people make purchases only because they are interested in the latest models or appearance and facilities without being adjusted to their needs. This often results in a mismatch between the price of goods, functions and existing facilities. Fuzzy Multiple Attribute Decision Making (FMADM) is a method that can be applied in decision making software which is used to find optimal alternatives from a number of alternatives with certain criteria.

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1. INTRODUCTION

The development of information technology as it is today, encourages the emergence of information technology devices, this is often associated with the development of computers which are increasingly increasing. The emergence of mobile phones with various brands and quality as well as more competitive price variations, both domestic production and foreign production, resulted in increased interest in people's purchasing power. Often people make purchases only because they are interested in the latest models or appearance and facilities without being adjusted to their needs. This often results in a mismatch between the price of goods, functions and existing facilities.

Fuzzy Multiple Attribute Decision Making (FMADM) is a method that can be applied in decision making software which is used to find optimal alternatives from a number of alternatives with certain criteria. There are several techniques that can be used to solve problems in the FMADM model, including: Simple Additive Weighting (SAW), Weighted Product (WP), ELECTRE, Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and Analytic Hierarchy Process (AHP) where the calculation process of each method is different from the others. In this final project, the Weighted Product (WP) method is used because it determines the weight value for each attribute, uses multiplication to connect the attributes, where each attribute must be

ranked first with the attribute weight in question, then proceed with the ranking process to determine the best alternative from a number of alternatives. in this case the alternatives in question are conservation technology and types of computers.

2. RESEARCH METHOD

To help organize this research, it is necessary to have a clear framework in stages. This framework represents the steps that will be taken in solving the problems to be discussed. The research framework used is as shown in Figure 1 below:

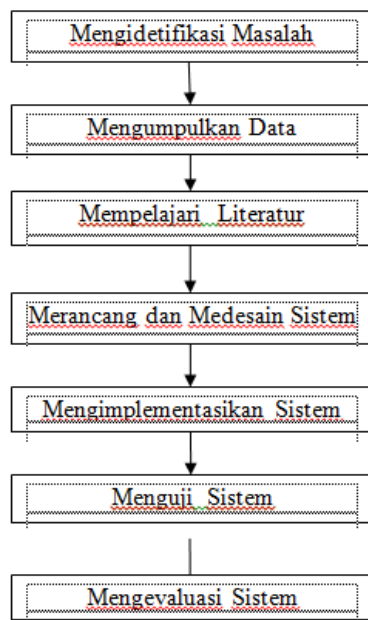


Figure 1. Research Framework

Based on Figure 1 above, the work arrangement in this study can be described as follows:

- a. Identify the Problem
This stage is an initial step in research to describe the problem that occurs and then looks for the problem formulation to continue the next stage.
- b. Collecting Data
This stage is a step where facts from a study are needed by collecting data based on the results of interviews and observations to conduct research and analysis of the decision support system for choosing an Android smartphone based on the specifications of potential buyers in smartphone stores so as to produce the data and information needed in the study.
- c. Studying Literature
This stage is a learning step in research by searching for theories obtained from journals, books, and the internet to complement the sources of study and theoretical concepts in research.
- d. System Design and Design
This stage is the system design that will be designed with context diagrams, DFD, flowcharts, file design, input and output design of the system display as well as system modeling to help the system design process.
- e. Implementing the System
This stage is a step in implementing the new system into the system existing systems (systems that are already running / old systems). At this stage it will created database and existing network.
- f. Testing the System
This stage is a step in which testing is carried out, where will test to determine whether the system designed already according to user requirements
- g. Evaluating the System

This stage is a step to measure, assess the system Designed whether the system is designed according to purpose system planning.

3. RESULTS AND DISCUSSION

To carry out the decision-making process, the data required is in the form of attribute data, namely input data from several alternatives. The alternatives needed are several types of HP. Each alternative has several criteria that have a value. There are 2 parts to data input, namely: fuzzy data input and non-fuzzy data input.

a. Fuzzy Data Input

There are several fuzzy input data for the decision making process, namely: screen and operating system.

b. Non-Fuzzy Data Input

Non-fuzzy data input for the decision-making process, including: processor speed, hard disk, memory, VGA and price.

The process needed in the HP Selection Decision Support System is to determine the best type of cellphone from the many types of HP that are alternatives.

Determination of the best alternative type of HP is carried out by applying the SAW calculation process where it is necessary to multiply the result of the rank of the criteria variable (C_i) with the weight value (W_i). The criteria needed for determining alternative types of HP are as previously described. In the alternative ranking process for HP types, it is necessary to give weight values as shown below:

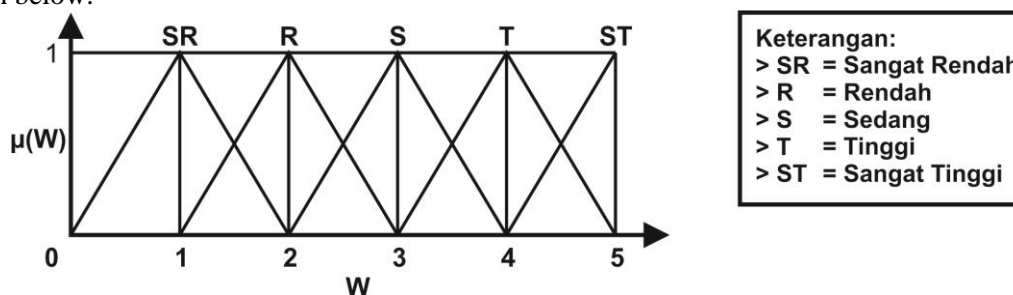


Figure 2. Value of Interest Level Weight

The value of the importance level of each criterion variable is given as in the table below:

Table 1. The weighted value of the level of importance between HP criteria

C_i	Kriteria	Bobot	Nilai (W_i)
1	Kecepatan Processor	5	0,104
2	Harddisk	4	0,084
4	Memory	4	0,084
4	VGA	4	0,064
5	Harga	5	0,084

Analysis of the Weighted Product Method

In selecting a cellphone using the Weighted Product method, criteria and weights are needed to perform the calculations so that the best alternative will be obtained. In the Weighted Product method, there are criteria needed to determine who will be tested as a scholarship recipient. The criteria are as follows:

Table 2. Criteria

Kriteria	Keterangan
C1	Kecepatan Processor
C2	Harddisk
C4	Memory
C4	VGA
C5	Harga

From each of these criteria the weights will be determined. The weight consists of six Weighted Product numbers, namely very low (SR), low (R), medium (S), middle (T1), high (T2), and very high (ST) as shown in Figure 3.

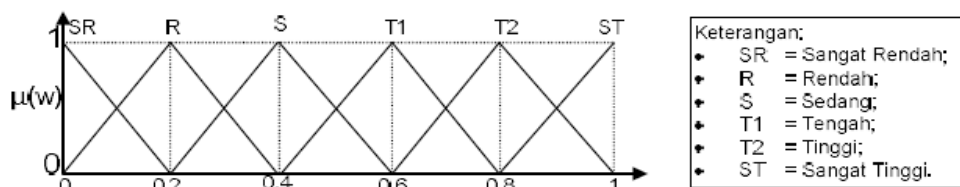


Figure 3. Weighted Product Numbers for Weights.

From the picture above, Weighted Product numbers can be converted to crisp numbers. For more details, the weight data is formed in Table 3.

Table 3. Weight

Bilangan Weighted Product	Nilai
Sangat Rendah (SR)	0
Rendah (R)	0.2
Sedang (S)	0.4
Tengah (T1)	0.6
Tinggi (T2)	0.8
Sangat Tinggi (ST)	1

An example for the application of the Weighted Product method in determining the selection of HP with the data from each cellphone is entered in table 4.

Table 4. HP Weight Value Data

Kode HP	Jenis HP	Kecepatan Processor	Nilai	
			Hardisk	Memory
HP-1	Acer	50	45	45
HP-2	Toshiba	70	77	70
HP-4	Asus	76	65	40

Weight Value Calculation

Based on the selection steps to determine the final result using the Weighted Product method, what must be done is: Give the value of each alternative (Ai) on each criterion (Cj) that has been determined.

a. Processor Speed

The Processor Speed variable consists of four Weighted Product numbers, namely Less (K), Enough (C), Good (B), Very Good (SB) as shown in Figure 4.

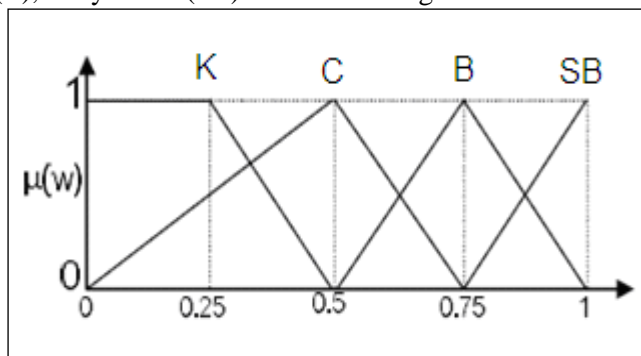


Figure 4. Product Weighted Numbers For Processor Speed

Information
K: Less

C: Enough
 B: Fine
 SB: Very well

From the picture above, Weighted Product numbers can be converted to crisp numbers. For more details, the processor speed data is formed in table 5.

Table 5. Processor Speed

Nilai (C1)	Bilangan Weighted Product	Nilai
$C1 \leq 0-50$	Kurang (K)	0.25
$C1 = 51-65$	Cukup (C)	0.5
$C1 = 66-75$	Baik (B)	0.75
$C1 \geq 76-100$	Sangat Baik (SB)	1

b. Hard disk

The hard drive variable consists of four Weighted Product numbers, namely Less (K), Enough (C), Good (B), Very Good (SB) as shown in Figure 5.

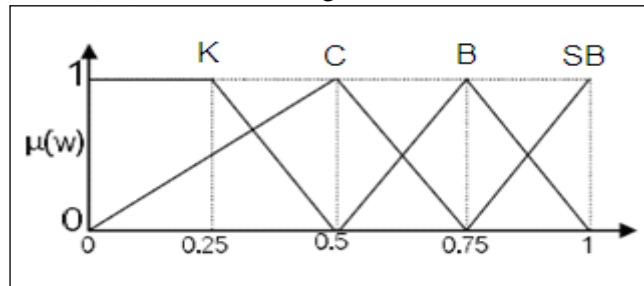


Figure 5. Product Weighted Numbers for Hard Drives

Information

K: Less
 C: Enough
 B: Fine
 SB: Very well

From the picture above, Weighted Product numbers can be converted to crisp numbers. For more details, the hard disk data is formed in table 6.

Table 6. Hard drive

Jumlah Text Hardisk (C2)	Bilangan Weighted Product	Nilai
$C2 \leq 0-50$	Kurang (K)	0.25
$C2 = 51-65$	Cukup (C)	0.5
$C2 = 66-75$	Baik (B)	0.75
$C2 \geq 76-100$	Sangat Baik (SB)	1

c. Memory

Memory consists of five Weighted Product numbers, namely Less (K), Enough (C), Good (B), Very Good (SB) as shown in Figure 6.

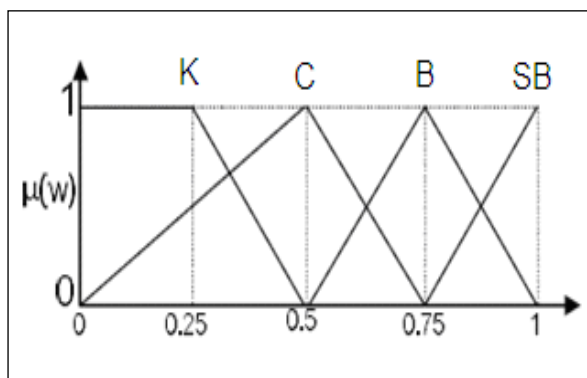


Figure 6. Product Weighted Numbers for Memory

Information

K: Less

C: Enough

B: Fine

SB: Very well

From the picture above, Weighted Product numbers can be converted to crisp numbers. For more details, the memory data is formed in table 7.

Table 7. Memory

Jumlah Memory (C4)	Bilangan Weighted Product	Nilai
C4 ≤ 0-50	Kurang (K)	0.25
C4 = 51-65	Cukup (C)	0.5
C4 = 66-75	Baik (B)	0.75
C4 ≥ 76-100	Sangat Baik (SB)	1

d. VGA

The VGA variable consists of five Weighted Product numbers, namely Less (K), Enough (C), Good (B), Very Good (SB) as shown in Figure 7.

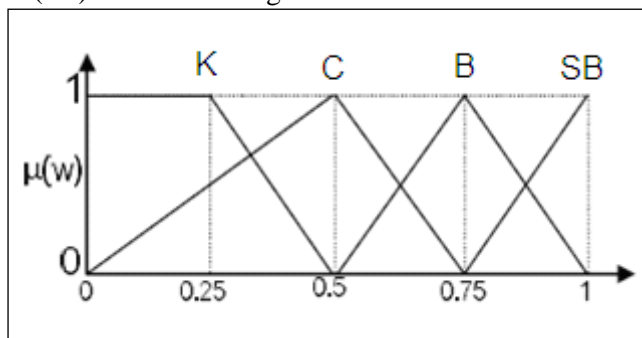


Figure 7. Product Weighted Numbers for VGA

Information

K: Less

C: Enough

B: Fine

SB: Very well

From the picture above, Weighted Product numbers can be converted to crisp numbers. For more details, the VGA data is formed in table 8.

Table 8. VGA

Jumlah Total Nilai (C4)	Bilangan Weighted Product	Nilai
C4 ≤ 0-500	Kurang (K)	0.25
C4 = 501-659	Cukup (C)	0.5

C4= 660-750	Baik (B)	0.75
C4>= 751-1000	Sangat Baik (SB)	1

e. Price

The price variable consists of five Weighted Product numbers, namely Less (K), Enough (C), Good (B), Very Good (SB) as shown in Figure 8.

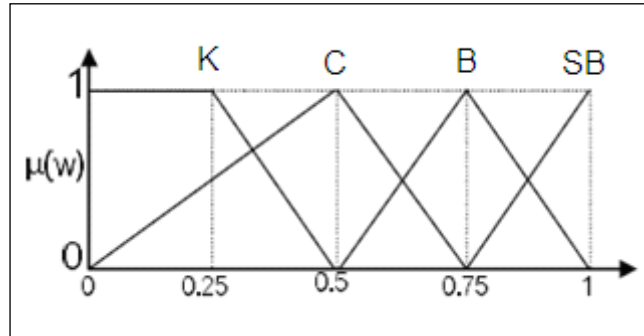


Figure 8. Product Weighted Numbers for Price

Information

K: Less

C: Enough

B: Fine

SB: Very well

From the picture above, Weighted Product numbers can be converted to crisp numbers. For more details, the price data is formed in table 9.

Table 9. Prices

Jumlah Rata-rata Nilai (C5)	Bilangan Weighted Product	Nilai
C5<= 0-50	Kurang (K)	0.25
C5= 51-65	Cukup (C)	0.5
C5= 66-75	Baik (B)	0.75
C5>= 76-100	Sangat Baik (SB)	1

To make it clearer, for example, the first cellphone from Table 9 above is the 1st cellphone = A1, the 2nd cellphone = A2 and the 4th cellphone = A4. The table below shows the suitability rating of each alternative on each criterion.

Table 10. Suitability Rating Of Each Alternative On Each Criterion.

Alternatif	Kriteria				
	C1	C2	C4	C4	C5
A1	0.25	0.25	0.25	0.25	0.5
A2	0.75	0.5	1	1	0.75
A4	1	0.25	0.5	0.5	0.25

Give the weight value (W)

To determine the weight of the HP Test set in the table below.

Table 11. Weights for HP

Kriteria	Bobot	Nilai
C1	Sedang (S)	0.4
C2	Sangat Tinggi (ST)	1
C4	Tinggi (T2)	0.8
C4	Sedang (S)	0.4
C5	Sedang (S)	0.4

From Table 11 it is obtained the weight value (W) with the data: W = [0.4 1 0.8 0.4 0.4]

Normalize matrix X to matrix R based on equation 1.

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\max_i x_{ij}} & \text{Jika } j \text{ adalah atribut keuntungan (benefit)} \\ \frac{\min_i x_{ij}}{x_{ij}} & \text{Jika } j \text{ adalah atribut biaya (cost)} \end{cases} \quad (1)$$

Information :

r_{ij} = normalized performance rating value

x_{ij} = attribute value owned by each criterion

$\max_i x_{ij}$ = the greatest value of each criterion

$\min_i x_{ij}$ = the smallest value of each criterion

Benefit = if the greatest value is the best

Cost = if the smallest value is best

1. For Processor Speed.

So:

$$r_{11} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{0.25} = \frac{1}{0.25} = 4$$

$$r_{21} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{0.75} = \frac{1}{0.75} = 1.33$$

$$r_{31} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{1} = \frac{1}{1} = 1$$

2. For the number of hard drives.

So:

$$r_{12} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{0.25} = \frac{1}{0.25} = 4$$

$$r_{22} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{0.5} = \frac{1}{0.5} = 2$$

$$r_{32} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{0.25} = \frac{1}{0.25} = 4$$

3. For Test Value.

So:

$$r_{13} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{0.25} = \frac{1}{0.25} = 4$$

$$r_{23} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{1} = \frac{1}{1} = 1$$

$$r_{33} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{0.5} = \frac{1}{0.5} = 2$$

4. For the Total Amount.

So:

$$r_{14} = \frac{\max\{0.25 : 0.5 : 0.75 : 1\}}{0.25} = \frac{1}{0.25} = 4$$

$$r_{24} = \frac{\text{Max}\{0.25 : 0.5 : 0.75 : 1\}}{1} = \frac{1}{1} = 1$$

$$r_{34} = \frac{\text{Max}\{0.25 : 0.5 : 0.75 : 1\}}{0.5} = \frac{1}{0.5} = 2$$

5. For Average Value.

So:

$$r_{15} = \frac{\text{Max}\{0.25 : 0.5 : 0.75 : 1\}}{0.5} = \frac{1}{0.5} = 2$$

$$r_{25} = \frac{\text{Max}\{0.25 : 0.5 : 0.75 : 1\}}{0.75} = \frac{1}{0.75} = 1.333$$

$$r_{35} = \frac{\text{Max}\{0.25 : 0.5 : 0.75 : 1\}}{0.25} = \frac{1}{0.25} = 4$$

Perform the ranking process using the Simple Additive Weighting method

$$P(Y | X) = \frac{P(X \wedge Y)}{P(X)} = \frac{P(X | Y) P(Y)}{P(X)}$$

Jadi :

$$V1 = \frac{(4)^{(0.4)} + (4)^{(1)} + (4)^{(0.8)} + (4)^{(0.4)} + (2)^{(0.4)}}{0.4 + 1 + 0.8 + 0.4 + 0.4}$$

$$= \frac{11.84414}{4}$$

$$= 4.944481$$

$$V2 = \frac{(0.44)^{(0.4)} + (2)^{(1)} + (1)^{(0.8)} + (1)^{(0.4)} + (0.44)^{(0.4)}}{0.4 + 1 + 0.8 + 0.4 + 0.4}$$

$$= \frac{5.284617}{4}$$

$$= 1.761206$$

$$V4 = \frac{(1)^{(0.4)} + (4)^{(1)} + (2)^{(0.8)} + (2)^{(0.4)} + (4)^{(0.4)}}{0.4 + 1 + 0.8 + 0.4 + 0.4}$$

$$= \frac{9.80171}{4}$$

$$= 4.267247$$

The biggest value is on V1 so that the A4 alternative (HP to 4) is the alternative chosen as the best alternative. For more details, see table 12.

Table 12. Process Results

No	Nama	Processor	Hardisk	Memory	VGA	Harga	Hasil Akhir
1	HP 1	0.25	0.25	0.25	0.25	0.5	11.2
2	HP 2	0.75	0.5	1	1	0.75	4.464
4	HP 4	1	0.25	0.5	0.5	0.25	8.4

And to get the best value, it starts from the smallest value, so that the ranking results look like table 13.

Table 13. Ranking Results

No	Nama	Processor	Hardisk	Memory	VGA	Harga	Hasil Akhir
1	HP 2	0.75	0.5	1	1	0.75	4.944481
2	HP 4	1	0.25	0.5	0.5	0.25	4.267247
4	HP 1	0.25	0.25	0.25	0.25	0.5	1.761206

4. CONCLUSION

Decision support systems can help individuals determine the best type of Android cellphone from several alternative Android phones. Android phones that are used as alternatives

have no limitations, meaning that all Android phones can be used as alternatives in the calculation process. The Weighted Product (WP) method can be implemented in a decision-making system with a case study of selecting Android phones. Based on the results of the tests that have been done, changes in the value of the criteria and the number of alternatives are very influential on the results of the ideal alternative solutions obtained.

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