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Analysis of Recommended Mobile Selection Using the Weighted Product Method

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Abstract

Mobile is an electronic telecommunications device that has become a major requirement at this time, which is equipped with the advantages of the features of each device. The number of outputs or new breakthroughs from mobile phone manufacturers makes consumers have to be observant in choosing the right cellphone to use in their activities. Ignorance of the advantages and disadvantages of selected mobile phones can cause harm to consumers who use them based on their respective levels of interest. In this study, an analysis of the calculation of several alternative cell phone data will be carried out based on the criteria/attributes determined using the weighted product method which can solve the problem by multiplying to connect the attribute rating with the weighted attribute in question. It is hoped that this calculation analysis concept can become the foundation of knowledge about the weighted product method, especially in terms of selecting recommendation cellphones, as well as a basic sketch for developing the implementation of the weighted product method into future decision support system application programs.

Keywords: Mobile Phones; Criteria; Alternatives; Weighted Products.

1. Introduction

In everyday life, humans are always faced with problems to make decisions. To make a decision requires a consideration and comparison of various alternative options that can be selected through a certain mechanism to produce the best and optimal action or decision. Each problem will have a different solution with a decision that varies from a number of alternative decisions involving several variables.

Along with the rapid development of technology, mobile phones have become a basic need that must be owned by every human being. It aims to make it easier in everyday life. Therefore, every cellphone brand offers various types and various features that make users confused in choosing. There are many factors that must be considered in selecting a cellphone before making a purchase transaction based on the level of importance of each, for example, it must be in accordance with the budget, the quality of the cellphone itself, to the specifications of the cellphone to be purchased. This needs to be really ensured by the user not to make the wrong purchase which will harm himself.

In this study, an analysis of calculations will be carried out from some alternative cellphone data based on the criteria/attributes determined using the weighted product method to obtain the recommended alternative cellphones. Before actually making a final decision, the selection of alternatives is expected to provide a list of references to the decision maker (Muslimin B, 2016).

The WP (Weighted Product) method is used to solve the Multi Attribute Decision Making (MADM) problem where it is necessary to normalize the calculation by means of multiplication to link the attribute rating raised to the first rank with the relevant weight attribute (Abbas, 2016; Fauzan, Fitri, & Fadliansyah, 2017; Khairina, Ivando, & Maharani, 2016; N. Syafitri, Sutradi, & Dewi, 2007). In the weighted product method, the weight is calculated based on the level of importance (Devis, Khairina, & Hatta, 2016). The weighted product method evaluates several alternatives to a set of attributes or criteria, where each attribute is independent of one another (Devis et al., 2016).

It is hoped that this calculation analysis concept can become knowledge about the weighted product method as well as a basic sketch for the development of the weighted product method into future decision support application programs.

2. Methodology

The steps taken in solving the problem using the weighted product method are:

2.1. Planning Stage

The planning stage is carried out by collecting the required data, with the coverage of alternative mobile phones which will be ranked as the most recommended mobile phones. The following is alternative cellphone data that will be ranked in table 1

2.2. Calculation analysis stage

The following is a description of the analysis stage of the calculations carried out (Khairina et al., 2016; Komara, Djamal, & Renaldi, 2016; Supriyono & Sari, 2015):

a. Determine the criteria and assess the importance of each criterion.
b. Determine the range of values for each criterion and evaluate each alternative
c. Performing Normalization (Weight Improvement)

$$w_j = \frac{w_j}{\Sigma w_j} \quad (1)$$

Normalization or repair of weights is done to produce a value = 1, where j = 1, 2, 3, …, n is the number of alternatives while $\sum w_j$ is the total number of weight values.

2.3. Determining Vector Value (S)

$$S_i = \Pi_{j=1}^{n} x_{ij}^{wj} \quad (2)$$

where i = 1, 2, 3, …, n

Determine the value of the vector (S) by multiplying all the criteria with alternative results of normalizing or repairing weights that have a positive rank for benefit criteria and those that have a negative rank for cost criteria. Where (S) is the criteria preference, (X) is the criteria value and (n) is the number of criteria.

2.4. Determining Vector Value (V)

$$V_I = \frac{S_I}{\Sigma S_I} \quad (3)$$

where i = 1, 2, 3, …, n

Determine the vector value (V) that is used for ranking each of the total vector values (S) with the total vector value (S) which is the result of alternative preferences.

Table. 1. Mobile alternative data to be ranked

Alternative	Criteria						
	RAM Capacity	Internal Memory	Camera	Processor	Screen	Price	Battery
A1 (Samsung J1 Ace Smartphone – Black)	512 MB	4 GB	5 MP	Dual-core 1.3 GHz	4.3"	Rp1.300.000	1900mAh

A2 (Samsung J1 Mini Smartphone – Gold)	768 MB	8 GB	5 MP	Quad Core 1.2 GHz	4.0 Inch	Rp 1.125.000	1900mAh
A3 (Samsung Galaxy Note 5)	4 GB	32 GB	16 MP	Quadcore 1.5GHz	5.7 Inch	Rp. 7.699.000	3000mAh

3. Results and Discussion

The criteria used in testing are related to ram capacity, internal memory, camera capacity, processor, screen size, price and battery.

Table. 2. Criteria used

	Criteria	**Benefit/Cost**
C1	RAM Capacity	Benefit
C2	Internal Memory	Benefit
C3	Camera	Benefit
C4	Processor	Benefit
C5	Screen	Benefit
C6	Price	Cost
C7	Battery	Benefit

The weight given to each criterion includes several priority levels of weight between 1 to 9, namely:

Table. 3. Weight priority levels

Priority Level	**Weight**
Absolutely important	9
Very important	8
Important	7
Simply more important	6
Pretty important	5
Not important enough	4
Not important	3
Very unimportant	2
Absolute not very important	1

Furthermore, also determine the level of importance and weight of each criterion into fuzzy numbers with the scope as shown in the following table:

Table. 4. Level of importance and weight of each criterion

Importance level	Weight Value
Very Good	5
Good	4
Enough	3
Bad	2
Very bad	1

Convert the variables from each of the criteria into fuzzy numbers based on the weight values in Table 4 above regarding the level of importance and weight of each criterion shown in Tables 5 to Table 11 below:

1) Mobile Ram Capacity Criteria

Table. 5. Ram Capacity (C1)

C1	Nilai
X = 256	1
X > 256MB <= 512MB	2
X > 512MB <= 1GB	3
X > 1GB <= 2GB	4
X > 2GB	5

2) Mobile Internal Memory Criteria

Table. 6. Internal Memory (C2)

C2	Nilai
<= 4 GB	1
> 4 GB <= 8 GB	2
> 8 GB <= 16 GB	3
> 16 GB <= 32 GB	4
> 32 GB	5

3) Mobile Camera Criteria

Table. 7. Camera Capacity (C3)

C3	Nilai
< 2 MP	1
> 2 MP <= 5 MP	2
> 5 MP <= 8 MP	3
> 8 MP <= 16 MP	4
< 16 MP	5

4) Mobile Processor Criteria

Table. 8. Processor (C4)

C4	Nilai
Dual-Core	1
Quad-Core	2
Hexa-Core	3
Octa-Core	4
Decal-Core	5

5) Mobile Screen Size Criteria

Table. 9. Screen Size (C5)

C5	Nilai
< = 2 inch	1
> 2 <= 3 Inch	2
> 3 <= 4 inch	3
> 4 <= 5 Inch	4
> 5 <= 6 inch	5

6) Mobile Price Criteria

Table. 10. Prices (C6)

C6	Nilai
> Rp.5000.000	1
> 3000.000 <= 5000.0000	2
> Rp. 2000.000 <= Rp.3000.000	3

> Rp.1000.000 <= Rp.2000.000	4
<= Rp.1000.000	5

7) Mobile Battery Criteria

Table. 11. Battery Criteria (C7)

C7	Nilai
<= 1000 mAh	1
> 1000 Mah <= 2000 Mah	2
>2000 Mah <= 3000Mah	3
> 3000 Mah <= 4000 Mah	4
>= 5000	5

Based on the weight priority level which refers to the weight priority in table 3, respondents give preference weight priority according to the level of importance based on needs as shown in the following table:

Table. 12. Giving priority levels of weight on criteria

Criteria	Priority Level	Weight
C1	Very important	8
C2	Important	7
C3	Important	7
C4	Quite important	5
C5	Not important enough	4
C6	Very important	8
C7	Not important enough	4

From the table above, normalization / repair of the weights is carried out first from the preference weight priorities chosen by respondents based on the priority level, namely = (8, 7, 7, 5, 4, 8, 4). The following is the normalization / improvement of weights carried out for each criterion:

$$w_j = \frac{w_j}{\Sigma w_j}$$

$$w_1 = \frac{8}{8+7+7+5+4+8+4} = \frac{8}{43} = 0,1860$$

$$w_2 = \frac{7}{8+7+7+5+4+8+4} = \frac{7}{43} = 0,1628$$

$$w_3 = \frac{7}{8+7+7+5+4+8+4} = \frac{7}{43} = 0,1628$$

$$w_4 = \frac{5}{8+7+7+5+4+8+4} = \frac{5}{43} = 0,1163$$

$$w_5 = \frac{4}{8+7+7+5+4+8+4} = \frac{4}{43} = 0,0930$$

$$w_6 = \frac{8}{8+7+7+5+4+8+4} = \frac{8}{43} = 0,1860$$

$$w_7 = \frac{4}{8+7+7+5+4+8+4} = \frac{4}{43} = 0,0930$$

After the normalization/improvement of weights stage is carried out, then determine the weight of each criterion based on the importance level of each alternative referring to the provisions of the importance level and weight of each criterion in Table 4 previously.

Table. 13. Assignment of weight value of each mobile alternative data

Alternatif	Criteria						
	C1	C2	C3	C4	C5	C6	C7
A1	2	1	2	1	3	3	2
A2	2	3	2	1	3	3	2
A3	5	4	4	2	4	1	3

Then the vector value (*S*) is calculated from the weight improvement above with the provisions for the criterion of exponential gain being positive (benefit), while the exponential cost criterion is negative (cost).

$$S_i = \Pi_{j=1}^{n} x_{ij}^{wj}$$

$$S_1 = (2^{0,18,60})(1^{0,1628})(2^{0,1628})(1^{0,1163})(3^{0,0930})(3^{-0,1860})(2^{0,0930}) = 1,2263$$

$$S_1 = (2^{0,18,60})(3^{0,1628})(2^{0,1628})(1^{0,1163})(3^{0,0930})(3^{-0,1860})(2^{0,0930}) = 1,4665$$

$$S_1 = (5^{0,18,60})(4^{0,1628})(4^{0,1628})(2^{0,1163})(4^{0,0930})(1^{-0,1860})(3^{0,0930}) = 2,8934$$

Then the vector value (V) is calculated as follows:

$$V_I = \frac{S_I}{\Sigma S_I}$$

$$V_1 = \frac{1,2263}{(1,2263+1,4665+1,8934)} = \frac{1,2263}{5,5862} = 0,2195$$

$$V_2 = \frac{1,4665}{(1,2263+1,4665+1,8934)} = \frac{1,4665}{5,5862} = 0,2625$$

$$V_3 = \frac{2,8934}{(1,2263+1,4665+1,8934)} = \frac{2,8934}{=0,51795}$$

The results obtained show that the largest value (max) is at the value = , so alternative A3 is the alternative chosen as the best recommendation option.

4. Conclusion

Based on the research conducted, it was concluded that the ranking of the highest vector value (V) would be an alternative for selecting a recommended mobile phone based on the criteria set according to the interests of the user. From the results of the analysis it was also found that the recommended mobile alternative fell on the A3 alternative, namely the Samsung Galaxy Note 5, even though the recommended alternative had a price criterion (C6) with a weight of 1 (very bad).

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