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Decision Support Systems to Determine Electronic Sales Products using The TOPSIS Method

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ABSTRACT

Products are everything that is traded. One of the tradable products is electronic products. One of the shops that sells electronic products in Medan is the Asia Electric Shop. The Asia Electric shop which sells electronic goods such as lamps, electrical appliances, furniture and so on. In fulfilling product stock in the store, order products that match the product category to be sold directly to the factory. This will cause a large stock of products in the warehouse. So that the Asian Electric Shop Owner has not been able to determine the exact electronics sales product. The owner must determine the right product sales and suitable for sale in the market, because the sale of products is part of company management and is also a very important factor that will directly affect the smooth running or confidence of the store in being successful. Therefore we need a "decision support system in determining electronic sales products using the Topsis method. So the author is the author of Decision Support Systems to Determine Seller Products using the Topsis method. The program used is Visual Basic 2010 and uses Microsoft SQL Server 2008 as its database. With this system, it is hoped that the Asia Electric Shop can easily determine the sales product.

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1. INTRODUCTION

Product sales are part of company management and also a very important factor that will directly affect the smoothness and success of the store in achieving its goals. Therefore we need a "decision support system in determining electronic sales products using the Topsis method.

One of the studies related to the Decision Support System (DSS) that has been developed using the Topsis Method includes research conducted by (Gunawan Wibisono1, et al, 2019), entitled Application of the Topsis Method in Determining the Best Lecturers. In this study, the lecturer data used by 20 people will be an alternative by using 5 criteria, the 5 criteria are the length of work factor (K1), achievement factor (K2), teaching factor (K3), research factor (K4), community service factor (K5).

The results of the calculation of the decision support system in determining the best lecturer using the TOPSIS method were obtained 6 highest ranks with different results for each. In this result, it is also found that the length of work does not have a big effect on the calculation of outstanding lecturers, but the research criteria have a very large effect on the calculation of outstanding lecturers even though the weight is smaller than the teaching criteria.

2. RESEARCH METHOD

At this stage, it will explain how to conduct research with details of analysis tools and materials, materials and a systematic sequence of research flows. So that it can be a guideline in solving problems that will be faced in Determining Electronic Sales Products Using the Topsis Method. The resulting system will be of good quality due to its gradual implementation. The stages of the waterfall method are as shown in the following figure:

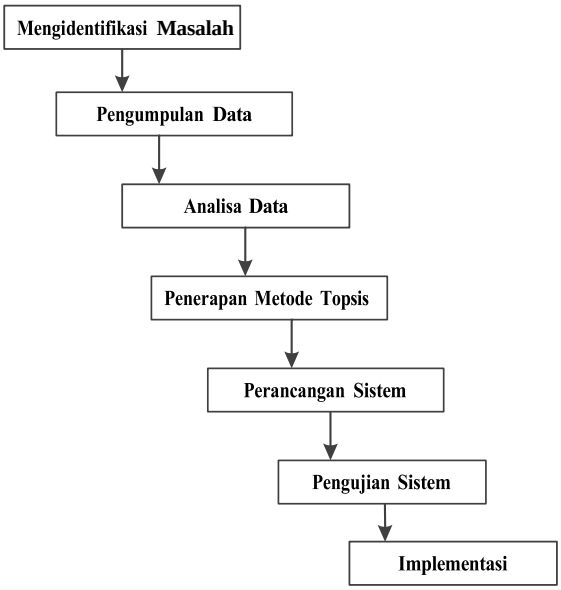

Figure 1. Research Framework

2.1. Decision Support System (DSS)

Decision Support System (DSS), in general, is defined as a system that is able to provide both problem-solving abilities and communication skills for semi-structured problems[1], [2]. In particular, DSS is defined as a system that supports the work of a manager or a group of managers in solving semi-structured problems by providing information or suggestions leading to certain decisions[3]–[6].

2.2. TOPSIS

TOPSIS is a multicriteria decision-making method or alternative choice which is an alternative that has the smallest distance from the positive ideal solution and the largest distance from the negative ideal solution from a geometric point of view using the Euclidean distance[7]–[9]. However, the alternative which has the smallest distance from the positive ideal solution, does not have to have the largest distance from the negative ideal solution[7], [10]–[12]. Therefore, TOPSIS considers both the distance to the positive ideal solution and the distance to the negative ideal solution simultaneously. a series of decision rules, with each division series, the members of the result set become similar to one another[13]–[16].

3. RESULTS AND DISCUSSION

The system to be built is to determine electronic sales products using the Topsis method. The system will accept input (data input) criteria and product name as an alternative. Then it will be processed by applying the Technique For Others Reference by Similarity to Ideal Solution (TOPSIS) and producing a ranking output (output data) of all the criteria for each alternative.

a. Criteria

Table 1. Code and Criteria Conditions

No	Criteria Code	Criteria Terms	Criteria weights
1	C1	Harga	5
2	C2	Merek	4
3	C3	Kualitas	4
4	C4	Desain	3

5	C5	Kemasan	2

b. Subcriteria

Table 2. Price Sub-criteria

Level of Importance	Value	Limitation		
		Kipas Angin	Lampu 20 Watt	Setrikaan
Very expensive	1	>=400.000	>=50.000	>=400.000
Expensive	2	>=300.000	>=40.000	>=300.000
Cheap enough	3	>=200.00	>=30.000	>=200.00
Cheap	4	>=100.000	>=20.000	>=100.000
Very cheap	5	<100.000	<20.000	<100.000

Table 3. Brand Subcriteria

Tingkat Kepentingan	Nilai
Sangat Baik	5
Baik	4
Cukup Baik	3
Kurang Baik	2
Sangat Kurang Baik	1

Table 4. Sub-Criteria for Product Quality

Tingkat Kepentingan	Nilai
Sangat Baik	5
Baik	4
Cukup Baik	3
Kurang Baik	2
Sangat Kurang Baik	1

Table 5. Sub-Criteria for Product Design

Tingkat Kepentingan	Nilai
Sangat Baik	5
Baik	4
Cukup Baik	3
Kurang Baik	2
Sangat Kurang Baik	1

Table 6. Product Packaging Sub-criteria

Tingkat Kepentingan	Nilai
Sangat Baik	5
Baik	4
Cukup Baik	3
Kurang Baik	2
Sangat Kurang Baik	1

3.1. Analysis Method Technique For Others Reference by Similarity to Ideal Solution (TOPSIS)

Analysis Method Technique For Others Reference by Similarity to Ideal Solution (TOPSIS) Decision support system to determine electronic sales products using the Topsis method.

1. The Asia Electric Shop will determine the electronics sales products. The data can be seen from the table below:

Table 7. Electronics sales product data

Nama produk	Harga	Merek	Kualitas Produk	Desain Produk	Kemasan Produk

Kipas angin 1	500.000	Arashi	Baik	Baik	Baik
Kipas angin 2	240.000	Yunda	Baik	Baik	Baik
Kipas angin 3	180.000	Meiko	Cukup baik	Cukup baik	Cukup Baik

2. There are 3 product names that will be alternatives, namely:
   A1 = Fan 1,
   A2 = Fan 2,
   A3 = Fan 3,
3. There are 5 criteria used as a reference in making decisions, namely:
   C1 = Price
   C2 = Product Brand
   C3 = Product Quality
   C4 = Product Design
   C5 = Product Packaging
4. Decision makers give preference weights as:
   W = (5,4,4,3,2)
5. Score each alternative in each criterion:

Table 8. Alternative value on each criterion

Nama produk	Harga	Merek	Kualitas Produk	Desain Produk	Kemasan Produk
A1	1	4	4	4	4
A2	3	3	4	4	4
A3	4	2	3	3	3

6. Normalized matrix, R :

$|X_1| = \sqrt{1^2 + 3^2 + 4^2} = 5{,}099$

$R_{11} = \frac{1}{5{,}099} = 0{,}196$

$R_{21} = \frac{3}{5{,}099} = 0{,}588$

$R_{31} = \frac{4}{5{,}099} = 0{,}784$

$|X_2| = \sqrt{4^2 + 3^2 + 2^2} = 5{,}385$

$R_{12} = \frac{4}{5{,}385} = 0{,}743$

$R_{22} = \frac{3}{5{,}385} = 0{,}557$

$R_{32} = \frac{2}{5{,}385} = 0{,}371$

$|X_3| = \sqrt{4^2 + 4^2 + 3^2} = 6{,}403$

$R_{13} = \frac{4}{6{,}403} = 0{,}625$

$R_{23} = \frac{4}{6{,}403} = 0{,}625$

$R_{33} = \frac{3}{6{,}403} = 0{,}469$

$|X_4| = \sqrt{4^2 + 4^2 + 3^2} = 6{,}403$

$R_{14} = \frac{4}{6{,}403} = 0{,}625$

$R_{24} = \frac{4}{6{,}403} = 0{,}625$

$R_{34} = \frac{3}{0{,}6403} = 0{,}469$

$|X_5| = \sqrt{4^2 + 4^2 + 3^2} = 6{,}403$

$R_{15} = \frac{4}{6{,}403} = 0{,}625$

$R_{25} = \frac{4}{6{,}403} = 0{,}625$

$R_{35} = \frac{3}{6,403} = 0,469$

$$R = \begin{bmatrix} 0,196 & 0,743 & 0,6250,625 & 0,625 \\ 0,588 & 0,557 & 0,6250,625 & 0,625 \\ 0,784 & 0,371 & 0,4690,469 & 0,469 \end{bmatrix}$$

7. Weighted normalized matrix, Y:

$$R = \begin{bmatrix} 0,196 & 0,743 & 0,6250,625 & 0,625 \\ 0,588 & 0,557 & 0,6250,625 & 0,625 \\ 0,784 & 0,371 & 0,4690,469 & 0,469 \end{bmatrix} X\ (5,4,4,3,2)$$

$$Y = \begin{bmatrix} 0,98 & 2,972 & 2,5 & 1,875 & 1,25 \\ 2,94 & 2,228 & 2,5 & 1,875 & 1,25 \\ 3,92 & 1.484 & 1,8761,407 & 0,938 \end{bmatrix}$$

8. Positive Ideal Solution (A+):

$$y_1^+ = \max\{0.981;2,94;3,92\} = 3,92$$
$$y_2^+ = \max\{2,972;2,228;1,484\} = 2,972$$
$$y_3^+ = \max\{2,5;2,5;1,876\} = 2,5$$
$$y_4^+ = \max\{1,875;1,875;1,407\} = 1,875$$
$$y_5^+ = \max\{1,25;1,25;0,938\} = 1,25$$
$$A^+ = \{3,92;2,972;2,45;1,875;1,25\}$$

9. Negative Ideal Solution (A-):

$$y_1^- = \min\{0,98;2,944;3,92\} = 0,98$$
$$y_2^- = \min\{2,972;2,228;1,484\} = 1,484$$
$$y_3^- = \min\{2,499;2,499;1,874\} = 1,874$$
$$y_4^- = \min\{1,875;1,875;1,407\} = 1,407$$
$$y_5^+ = \min\{1,25;1,25;0,938\} = 0,938$$
$$A^- = \{0,98;1,484;1,874;1,407;0,938\}$$

10. The distance between the weighted values of each alternative to the positive ideal solution:
    $D_1^+ = (0,98-3,92)^2 + (2,972-2,972)^2 + (2,5-2,5)^2 + (1,875-1,875)^2 + (1,25-1,25)^2 = 8,644$
    $D_2^+ = (2,94-3,92)^2 + (2,228-2,972)^2 + (2,5-2,5)^2 + (1,875-1,875)^2 + (1,25-1,25)^2 = 1,514$
    $D_3^+ = (3,92-3,92)^2 + (1,484-2,972)^2 + (1,876-2,5)^2 + (1,407-1,875)^2 + (0,938-1,25)^2 = 2,92$
11. The distance between the weighted value of each alternative to the negative ideal solution:
    $D_1^- = (0,98-0,98)^2 + (2,972-1,484)^2 + (2,5-1,876)^2 + (1,875-1,405)^2 + (1,25-0,938)^2 = 2,92$
    $D_2^- = (0,98-0,98)^2 + (2,972-1,484)^2 + (2,5-1,876)^2 + (1,875-1,405)^2 + (1,25-0,938)^2 = 5,2$
    $D_3^- = (0,98-0,98)^2 + (2,972-1,484)^2 + (2,5-1,876)^2 + (1,875-1,405)^2 + (1,25-0,938)^2 = 8,643$
12. The proximity of each alternative to the ideal solution is calculated as follows:

$$V_1 = \frac{2,92}{2,92+8,66} = 0,25$$
$$V_2 = \frac{5,1}{5,1+1,514} = 0,768$$
$$V_3 = \frac{8,643}{8,643+2,92} = 0,748$$

13. From this V value, it can be seen that V2 has the largest value, so it can be concluded that the second alternative would be preferred.

4. CONCLUSION

Based on research conducted in determining sales products at Asian Electric Stores, the criteria used are 5 criteria for price, brand, quality, design, and packaging. The alternatives used are 3. Alternatives V1, V2, and V3. Of the three alternatives that have the highest value is the V2 alternative, namely the Yunda fan with a value of 0.771. So V2 is the most important recommendation for sales products at the Asia Electric Shop. By using a decision support system with the topsis method, it can make it easier to determine sales products.

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