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Application Analysis Technique For Order Preference By Simillarity To Ideal Solution In the Electoral Power Energy Saving Light Bulbs For Home Appliances

Agustina Simangungsong

STMIK Pelita Nusantara Medan, Jln. Iskandar Muda No. 1, Medan, 20154, Indonesia

Email: agustina.simangunsong@gmail.com

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ABSTRACT

In the election of Light Bulbs these users are often confused with the choice of Light Bulbs are so many in the market, ranging in terms of brand, type, quality, prices continue to compete and with other advantages in the offer often leads to user confusion to get energy-saving Light Bulbs at an affordable price and with quality terbaik.Permasalahan do not stop there alone at the time of placement of the ball lamp in each room of the house too often mendapatakan problem. The problem is that often caused the discrepancy, it happens at the time of Bulb has been placed. Watt capacity existing on Light Bulbs often do not match the size of the room resulting in less than optimal lighting, watt capacity or large power consumption occasionally does not guarantee to be able to get information that bagus.Oleh because it takes a decision support system that can perform calculations for the value can help the user determine the desired Bulb properly and appropriately in accordance with needs. This decision support system implementing the method of technique for order preference by simillarity to ideal solution (TOPSIS), a method that can memeberikan and perangkingan weighting for each criteria. With the method technique for order preference by simillarity to ideal solution (TOPSIS), the author makes a system which is expected eventually to help make decisions in the selection of electrical Light Bulbs.

1. Introduction

Decision support systems in a point of view can also be explained as a means or tools for decision support. Is generally defined as a system that can provide problem-solving ability and the ability of communicating to semi-structured problems. Lights into one component that must be owned and paired in every house, in order to shed light on every each room of the house, from the living room, lounge room, porch, kitchen, lights over the kitchen learning and other rooms.

On election Light Bulbs these users are often confused with the choice Bulb that so many in the market, ranging in terms of brand, type, quality, prices continue to compete and with other advantages in the offer often leads to user confusion to get energy-saving Light Bulbs at an affordable price and with the best quality.

At the time of placement Bulb in each room of the house too often mendapatakan problem. The problem is that often caused the discrepancy, it happens at the time of Bulb has been placed. Watt capacity existing on Light Bulbs often do not match the size of the room resulting in less than optimal lighting, watt capacity or large power consumption occasionally does not guarantee to be able to get a good lighting.

Light Bulbs election as has been described above, the authors merasaperlu to make a decision support system to overcome the problem of election Bulb in the household with the method technique for

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order preference by simillarity to ideal solution, which is one method of multiple criteria decision making.

2. Theoretical basis

2.1. Fuzzy Multi Attribute Decision Making

Fuzzy Multiple Attribute Decision Making (FMADM) is a method used to find the optimal alternative of a number of alternatives to certain criteria. The essence of FMADM is determining the weight value for each attribute, followed by a ranking process that will select the alternative that has been given. In general, FMADM has a specific purpose which can be classified into two types, namely selecting alternatives with attributes (criteria) with the best characteristics, and classify alternatives based on specific roles.

There are several methods that can be used to solve the problem MADM, among others:

a. *Simple Additive Weighting Method* (SAW)
b. *weighted Product* (WP)
c. ELECTRE
d. *Technique for Order Preference by Similarity to Ideal Solution* (TOPSIS)
e. *Analytic Hierarchy Process* (AHP).

2.2. understanding TOPSIS

TOPSIS based on the concept that the best alternative was selected or not only has the shortest distance from the positive ideal solution, but it also has the longest distance from the negative ideal solution from a geometrical point by using the Euclidean distance to determine the relative proximity of an alternative to the optimal solution. Positive ideal solution is defined as the sum of all the best attainable value for each attribute, while the negative-ideal solution comprised of all the worst value achieved for each attribute.

TOPSIS into account both the distance of the positive ideal solution and the distance to the negative ideal solution by taking the relative proximity to the positive ideal solution. Based on the comparison of the relative distance, alternative priority order can be achieved. This method is widely used in some models of MADM to solve problems in a practical decision making ..

Here are the stages in implementing the TOPSIS method:

a. Make a decision matrix that is normalized
b. Make a decision matrix that is normalized weighted
c. Creating an ideal solution matrix of positive and negative ideal solution matrix
d. Determine the distance between the value of each alternative with a matrix of positive ideal solution and negative ideal solution matrix.
e. Determining the value of preference for each alternative
   1) Decision Matrix D refers to the m alternatives that will be evaluated based on the criteria defined.
   2) By declaring the performance of alternative calculations for the i-th to j-th attribute.x_{ij}

Here are the steps TOPSIS method works:

a. Build normalized decision matrix.

TOPSIS require performance ratings of each alternative on each criterion are normalized, namely:$A_i C_j$

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}};$$

$dengan i = 1,2,3, \dots, m; dan j = 1,2,3, \dots, n$

Where :
rij = normalized matrix [i] [j]
x ij = a decision matrix [i] [j]

b. Positive ideal solution A + A- negative ideal solution can be determined based on the normalized weight rating

$$y_{ij} = w_i r_{ij} \; ; dengan i = 1,2,3, \dots, m; dan j = 1,2,3, \dots, n$$

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c. Positive ideal solution is calculated by: (A^{+})

$$A^{+} = (Y_1^{+}, Y_2^{+}, Y_3^{+}, \ldots, Y_n^{+})$$

with:

$$y_j^{+} = \begin{cases} \max\limits_{i} \; y_{ij} \,; & jikajadalahatributkeuntungan \\ \min\limits_{i} \; y_{ij} \,; & jikajadalahatributbiaya \end{cases}$$

d. Negative ideal solution is calculated by: (A^{-})

$$A^{-} = (Y_1^{-}, Y_2^{-}, Y_3^{-}, \ldots, Y_n^{-})$$

with:

$$y_j^{-} = \begin{cases} \min\limits_{i} \; y_{ij} \,; & jikajadalahatributkeuntungan \\ \max\limits_{i} \; y_{ij} \,; & jikajadalahatributbiaya \end{cases}$$

e. Determine the distance between alternate positive ideal solution and negative ideal solution. A_i
f. Distance alternative with positive ideal solution: A_i

$$D_i^{+} = \sqrt{\sum_{j=1}^{n} \left(y_{ij} - y_i^{+}\right)^2} \,; i = 1,2,3, \ldots, m.$$

Where :
Di = Distance alternative with positive ideal solution: A_i
yi = positive ideal solution [i]
yij = normalized weighted matrix [i] [j]
g. Distance alternative to the negative ideal solution: A_i

$$D_i^{-} = \sqrt{\sum_{j=1}^{n} \left(y_{ij} - y_i^{-}\right)^2} \,; i = 1,2,3, \ldots, m$$

Where :
Di = Distance alternative to the negative ideal solution: A_i
yi = negative ideal solution [i]
yij = normalized weighted matrix [i] [j]

h. Determining the value of preference for each alternative.
Preference value for each alternative is given as follows: V_i

$$V = \frac{D_i^{-}}{D_i^{-} + D_i^{+}} \,; i = 1,2,3, \ldots m$$

Where:
Vi = proximity of each alternative against the ideal solution
Di- = Distance alternative to the negative ideal solution [i] A_i
At + = Distance alternative with positive ideal solution [i] A_i

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The larger value indicates that the preferred alternative. Alternatives are ranked based on the distance to the positive ideal solution and negative ideal solution. The best alternative is the shortest with a positive ideal solution and negative ideal solution farthest. ((Sri Kusumadewi 2006, 87-89).$V_i A_i$

3. Analysis

3.1. Analysis Method Technique For Order Preference by Similarity to Ideal Solution (TOPSIS).

Methods Technique For Order Preference by Similarity to Ideal Solution (TOPSIS) is one method of solving Fuzzy Multiple Attribute Decision Making (FMADM), then the problem solving assessment of the election of the electric light bulb using methods Technique For Order Preference by Similarity to Ideal Solution (TOPSIS), which in this case will provide recommendations electric light bulb with assessment criteria and predetermined weights. The criteria and weights needed to do the calculations in the method Technique For Order Preference by Similarity to Ideal Solution (TOPSIS), so it will get the best alternative. Alternative question in this case is a light bulb that has the highest value of the sum of all the criteria and the weights have been determined.

Table 1.
Alternative electric light bulb with space 4m2

No.	Alternative	Criteria				
		C1	C2	C3	C4	C5
1	A1	Rp.19.000	5watt	4m2	8,000 hours	12 months
2	A2	Rp. 26,000	5watt	4m2	10,000 hours	18 Months
3	A3	Rp. 18,000	7watt	4m2	8,800 hours	24 Months
4	A4	Rp. 16,500	5watt	4m2	6,000 hours	6 months

Based on the criteria of each alternative on each criteria that have been determined, then the translation of the weight of each criterion that has been converted with fuzzy numbers.

1. Price
   Price is the criteria used for the assessment of each alternative bulbs are taken into consideration, the assessment which has been determined is converted into fuzzy numbers in the table below:

Table 2.
conversion Price

Criteria	Fuzzy numbers	Weight
C1 <= 18,500	Very High (ST)	1
C1> = 19000-23000	Height (T)	0.75
C1> = 24000-30000	Enough (C)	0.5
C1> = 31000-40000	Low (R)	0.25
C1> 40,000	Very Low (RS)	0

2. Power Consumption
   Power consumption is the criteria used for assessing how much is absorbed power consumption light bulbs is usually expressed by Watt into consideration alternative. Rate predetermined converted into fuzzy numbers as the following table:

Table 3.
Conversion Power Consumption

Criteria	Fuzzy numbers	Weight
C2 <= 5watt	Very High (ST)	1
C2> = 7watt - 14watt	Height (T)	0.75
C2> = 15watt - 18watt	Enough (C)	0.5
C2> = 20watt - 23watt	Low (R)	0.25
C2> 23watt	Very Low (SR)	0

3. Room Size
   Assessment criteria specify the size of the room that is converted into fuzzy numbers in the table below:

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Table 4.
Conversion Room Size

Criteria	Fuzzy numbers	Weight
C3 <4m2	Very Low (SR)	0
C3> = 4m2 - 6M2	Low (R)	0.25
C3> = 7M2 - 10m2	Enough (C)	0.5
C3> = 11M2 - 15m2	Height (T)	0.75
C3> = 16m2	Very High (ST)	1

4. Age Wear
assessment criteria specified lifespan converted into fuzzy numbers in the table below:

Table 5.
Conversion Age Wear

Criteria	Fuzzy numbers	Weight
C4 <5,000 hours	Very Low (SR)	0
C4> = 6000-8000 hours	Low (R)	0.25
C4> = 8500-8800 hours	Enough (C)	0.5
C4> = 8900-9900 hours	Height (T)	0.75
C4> = 10,000 hours	Very High (ST)	1

5. Guarantee
Rate warranty predetermined converted into fuzzy numbers in the table below:

Table 6.
conversions Warranty

Criteria	Fuzzy numbers	Weight
C5 <6 months	Very Low (SR)	0
C5> = 6 months -11 months	Low (R)	0.25
C5> = 12 months -18 months	Enough (C)	0.5
C5> = 19 months - 23 months	Height (T)	0.75
C5> = 24 months	Very High (ST)	1

After all the translation of the weight of each criterion has been converted with fuzzy numbers. The next step is to create a table ranking matches the data appraisal criteria based on a predetermined weight rating for each room and take measures to get the desired result. Below are tables ranking matches and perhitunganya:

Table 7.
Table Ranking Matches room

No.	Alternative	Criteria				
		C1	C2	C3	C4	C5
1	A1	0.75	1	0.25	0.25	0.5
2	A2	0.5	1	0.25	1	0.5
3	A3	1	0.75	0.25	0.5	1
4	A4	1	1	0.25	0.25	0.25

Furthermore, Decision Matrix Form Normalization

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}};$$

$$X_1 = \sqrt{0{,}75\ ^2 + 0{,}5^2 + 1^2 + 1^2}$$
$$= \sqrt{0{,}5625 + 0{,}25 + 1 + 1}$$
$$= \sqrt{2{,}8125}$$
$$= 1.6770509$$

R1.1 = = = 4472136$\frac{x_{1.1}}{x_{\ 1}}$ $\frac{0{,}75}{1{,}6770509}$ 0,

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r1.2 = = = 2981424$\frac{x_{1.2}}{x_1}\frac{0,5}{1,6770509}$ 0,

r1.3 = = =$\frac{x_{1.3}}{x_1}\frac{1}{1,6770509}$0,5962848

r1.4 = = =$\frac{x_{1.4}}{x_1}\frac{1}{1,6770509}$0,5962848

Table 8.
Preference value for each alternative

Alternative	preference Values
A1	0,3790308
A2	0.4754463
A3	0,6234870
A4	0,5282364

Alternative ranked based on the value of the preference possessed by each alternative, from the table above preference value can be formed perangkingannya as follows:

Table 9.
Results on Ranking based on the value of the preference

Rank	Alternative	preference Values
1	A3	0,6234871
2	A4	0,5282364
3	A2	0,4754463
4	A1	0,3790308

4. Conclusion

Based on the results of research and discussion, we can conclude that the research that has been done it can be determined what is the criteria and what is the alternative in the selection of electric light bulbs to households. Technique for order preference by simillarity to ideal solution (TOPSIS) can give a good result in the issue decisions election electric light bulb which consists of several alternative bulb. Based on the criteria that have been taken into consideration.

Decision support systems for the electric light bulb election this household, can make it easier for consumers to choose electric light bulb was good and in accordance with needs.

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