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Articles

Analysis and Design of Decision Support System Information Systems in Choosing the Best Supplier Using the TOPSIS Method at PT. Bintang Putra Mandiri

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A B S T R A C T

Analysis and design of a decision support system aims to deal with problems in selecting the best supplier which is a problem at PT. Independent male star. PT. Bintang Putra Mandiri is a company engaged in the subsidized housing contractor and developer. With the existing problems, we need a system that can help companies to help determine the best supplier. Then produced a system that can help companies by using the TOPSIS method. TOPSIS uses the principle that the chosen alternative must have the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution from a geometric point of view using the Euclidean distance to determine the relative proximity of an alternative to the optimal solution. As a result, PT. Bintang Putra Mandiri can determine the best supplier precisely. And the TOPSIS method is able to support supplier selection decisions by ranking

INTRODUCTION

Technology and information systems have become daily food in human life. Very rapid development has a very important role in the progress of business or daily life. In our lives many problems that encourage us to make the best decisions to solve problems. This is also the case with companies that make decisions every day. With that decision support requires information technology, due to changes in the era of companies competing to be the foremost, which requires companies to move quickly in making decisions. With reference to the solutions provided by the TOPSIS method (Technique For Order Preference by Similiarty to Ideal Solution).

I. LITERATURES REVIEW

In Journal [1] Evaluation of lecturers' performance in teaching using the TOPSIS method can provide a more precise level of accuracy.

In Journal [2] Based on the results of the study it can be concluded that there are 2 healthy home conditions and 8 unhealthy home conditions; The TOPSIS method can be applied to determine the priority of an unhealthy home which results in the second alternative on behalf of (Sutardi) with a preference value (1) expressed as a top priority for the condition of an unhealthy home; The results of the system calculation have been validated with manual calculations and the same results are obtained, and it can be said that the system that has applied the TOPSIS method to determine the priority of unhealthy houses has been going well and accordingly.

In Journal [3] Can Solve the Problems of Obese People. Where in this decision making. Use the TOPSIS method which will help the alternative selection process

TOPSIS

The Technical Method for Preference Ordering based on Similarity with Ideal Solutions (TOPSIS) is one of the multi-criteria decision making methods first introduced by Yoon and Hwang (1981). TOPSIS uses the principle that the chosen alternative must have the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution from a geometric point of view using the Euclidean distance to determine the relative proximity of an alternative to the optimal solution. The positive ideal solution is defined as the worst achieved for each attribute. TOPSIS considers both the distance to a positive ideal solution and the distance to a negative ideal solution by taking a closeness relative to a positive ideal solution. [4]

Decision Support System

"Decision Support System (SPK) is a computer-based interactive application that combines data and mathematical models to help the decision making process in handling a problem." [5]

Supplier

"Suppliers are part of the supply chain that affects the survival of a company. Quality, flexibility, product diversity, fast response, and competition in the global environment are important for companies to obtain customer satisfaction. "[6]

II. METHODS

Technique For Order Performance by Similarity to Ideal Solution

Steps in TOPSIS:

1. Determine the normalized decision matrix

$$rij = \frac{Xij}{\sqrt{\sum_{j=1}^{J} X_{ij}^2}}, j = 1,2,3 \dots, J; i = 1,2,3, \dots, n$$

Information:
Xij is the value of real data
Rij is an element of a normalized decision matrix.

2. Determine the normal weight Vij value based on the value of the Rij multiplication matrix with Wij.

$$Vij = Wj * rij$$

Information :
Wj is the weighting of the criteria
Vij is an element of a weighted, numeralized decision matrix.

3. Determine Positive Ideal Value Solution (PIS) and Negative Ideal Value Solution (NIS)

$$A^* = \{V1^*, V2^*, \dots.., Vn^*\}$$

$$A^- = \{V1^-, V2^-, \dots.., Vn^-\}$$

4. Calculating the Distance Value of each alternative based on the value of the PIS and NIS.

$$d_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^2}, j = 1,2,\dots,J$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2}, j = 1,2,\dots,J$$

Information :
Vj + is a positive ideal solution matrix
Vj- is the ideal negative solution matrix

5. Calculating the closest value (Closeness Coefficient) based on the ideal value of each alternative

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-}, i = 1,2,\dots..,j.$$

Information :
a greater ci value indicates alternative priority.

III. RESULT

The criteria used are as follows: Appropriate Goods, Price, Delivery Time, Service, Quality.

Table 1 Rating Weight

Weight	Right Item
1	Very Inaccurate
2	Not exactly
3	Right enough
4	Right
5	Very precise

The table above is a ranking assessment for each criterion

Table 2 Analysis results

Supplier	Price	Right Item	delivery time	Quality	Service
PT.SMW	5	5	5	4	4
PT.SBL	4	4	5	4	4
Bos Baja	2	4	4	4	4
Trimulia Kencana Baja	3	4	4	4	3

The criteria are assessed from the assessment weight table.

Tabel 3 Normalization

Supplier	Price	Right Item	delivery time	Quality	Service
PT.SMW	0,680413817	0,585205736	0,552153763	0,5	0,529812943
PT.SBL	0,544331054	0,468164589	0,552153763	0,5	0,529812943
Bos Baja	0,272165527	0,468164589	0,441726104	0,5	0,529812943
Trimulia Kencana Baja	0,408248829	0,468164589	0,441726104	0,5	0,397359707

Squaring each element of the matrix for example for PT.SMW which has a value of 5 squared to be 5 ^ 5 = 25. The total row is obtained by adding up each row on each criterion. For example the total column Price 25 + 16 + 4 + 9 = 54. And to get the normalization value is 5 divided by the square root of 54 the result is 0.680413817

Table 4 Weighted Normalization

Supplier	Price	Right Item	delivery time	Quality	Service
PT.SMW	3,402069087	1,755617208	2,208630521	2,5	1,059625886
PT.SBL	2,72165527	1,404493766	2,208630521	2,5	1,059625886
Bos Baja	1,360827635	1,404493766	1,766904417	2,5	1,059625886
Trimulia Kencana Baja	2,041241452	1,404493766	1,766904417	2,5	0,794719414

Settlement: Price obtained from calculation [0.680413817 * 5] = 3.402069087

Table 5 The Ideal Solution Matrix

	Price	Right Item	delivery time	Quality	Service
positive	3,402069087	1,755617208	2,208630521	2,5	1,059625886
Negative	1,360827635	1,404493766	1,766904417	2,5	0,794719414

The ideal solution matrix is obtained based on weighted normalization. The positive ideal solution is to take the maximum value from weighted normalization. Instead the negative ideal solution is taken the minimum value of weighted normalization.

Table 6 Ideal Positive Distance Solution

Supplier	Price	Right Item	delivery time	Quality	Service	Price
PT. SMW	0	0	0	0	0	**0**
PT. SBL	0,462962963	0,12328767 1	0	0	0	**0,765670056**
Bos Baja	4,166666667	0,12328767 1	0,19512195 1	0	0	**2,11779987**
Trimulia Kencana Baja	1,851851852	0,12328767 1	0,19512195 1	0	0,070175439	**1,49680891**

Weighted normalization minus the positive ideal solution matrix then rank 2 3.402069087-3.402069087 ^ 2 = 0. And so on if it's past the total then at the root

Table 7 Ideal Negative Distance Solution

Supplier	Price	Right Item	delivery time	Quality	Service	Price
PT. SMW	4,166666667	0,12328767 1	0,19512195 1	0	0,070175439	**2,13430357**
PT. SBL	1,851851852	0	0,19512195 1	0	0,070175439	**1,455042694**
Bos Baja	0	0	0	0	0,070175439	**0,264906471**
Trimulia Kencana Baja	0,462962963	0	0	0	0	**0,680413817**

Weighted normalization minus the negative solution matrix and then rank 2.3.402069087-1.360827635 ^ 2 = 4.166666667. And so on if it's been in total then in the root.

Table 8 Preference

Supplier	Positive	Negative	Preference	Rank
PT.SMW	0	2,13430357	1	**1**
PT.SBL	0,765670056	1,455042694	0,655214275	**2**
Bos Baja	2,11779987	0,264906471	0,111178817	**4**
Trimulia Kencana Baja	1,496808911	0,680413817	0,312514567	**3**

Preference is obtained from the division of negative ideals divided by the sum of positive and negative ideals. Based on the formula above, the following example is calculated: 2.13430357 / (0 + 2.13430357) = 1

The best alternative there which has the biggest preference is PT. SMW with preference value 1. This is the example of the decision support system for the TOPSIS Method

IV. DISCUSSION

According to calculations using the TOPSIS method the results obtained are ranked among the alternatives. First rank is PT.SMW, second rank is PT.SBL, Third rank is Trimulia Kencana Baja, Last Raking is Bos Baja.

V. CONCLUSION

1. With the assessment of companies, they are getting bolder in choosing suppliers.
2. By using a decision support system / application system to minimize errors in supplier selection.
3. The TOPSIS method is able to support supplier selection decisions by ranking.

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