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Application of the TOPSIS Method (Technique for Order Preference by Similarity to Ideal Solution) in Product Selection

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ABSTRACT

In an era of increasingly tight business competition, choosing the right product is one of the company's successes. The TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method offers a systematic approach to evaluating various product alternatives based on predetermined criteria. This study aims to apply the TOPSIS method in product selection, focusing on factors such as price, quality, and features. The results of the analysis show that this method improves the efficiency and objectivity of decision making, allowing companies to identify the best products that are close to the ideal solution. In addition, the use of TOPSIS also increases the transparency of the evaluation process, supports adaptation to market changes, and helps companies achieve competitive advantage. These findings emphasize the importance of the TOPSIS method as a tool for intelligent and data-based decision making in a dynamic business context.

INTRODUCTION

In an era of increasingly tight business competition, choosing the right product is crucial for a company's success. The many alternative products and various criteria that must be considered make the decision-making process complex. The TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method is one technique that can help in product selection based on predetermined criteria. TOPSIS prioritizes the proximity of alternatives to the ideal solution, both positive and negative, making it easier for decision makers to determine the best choice. This study aims to apply the TOPSIS method in product selection, as well as analyze the results to provide appropriate recommendations for the company.

In a competitive market, making the right decisions is very important for companies to survive and compete. Quality products that meet consumer needs can be a significant differentiator. Therefore, companies must use systematic and measurable methods to assess various product alternatives available in the market. One method that is widely used is the TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution), which helps in determining the best choice based on predetermined criteria.

The TOPSIS method focuses on evaluating products based on their proximity to the ideal solution and their distance from undesirable solutions. In the context of product selection, this method allows companies to evaluate several alternatives simultaneously, considering factors such as quality, price, and product features. By using this approach, companies can reduce risk in decision making and increase the likelihood of selecting the product that best suits market preferences.

In addition, the use of the TOPSIS method can also increase transparency in the decision-making process. With clear criteria and a systematic evaluation process, all stakeholders can understand the reasons behind the selection of certain products. This not only helps in building

trust among internal teams, but can also improve relationships with customers, because decisions made are based on objective and measurable analysis.

In a dynamic market, where consumer preferences and trends can change rapidly, it is important to have a flexible and adaptive method. TOPSIS allows companies to easily adjust evaluation criteria according to market developments and consumer needs. Thus, companies can ensure that the decisions taken are always relevant and can meet customer expectations.

Finally, the application of the TOPSIS method in product selection not only impacts the efficiency of decision-making, but also contributes to the company's competitive advantage. By maximizing the potential of the selected product and optimizing existing resources, companies can increase market share and achieve long-term success. In an increasingly competitive business world, the ability to make smart, data-driven decisions is key to success.

The TOPSIS method has been widely applied in various fields, including product selection. In the context of selecting a mobile phone product, this method can be used to evaluate various mobile phone alternatives based on a number of criteria, such as price, features, camera quality, battery life, and user reviews. TOPSIS allows decision makers to consider all of these criteria simultaneously and objectively, so that they can provide product recommendations that best suit user preferences and needs.

Several case studies have shown the effectiveness of the TOPSIS method in product selection. For example, a study by Singh and Kaur (2020) which applied TOPSIS in smartphone selection based on various criteria showed that this method can provide satisfactory results and help consumers in making better decisions. Another study by Kumar et al. (2019) also confirmed the reliability of TOPSIS in helping smartphone selection by considering criteria such as price, performance, and features. Benefits of the study Provides guidance for companies in choosing the right product. Provides insight for academics and practitioners regarding the application of the TOPSIS method.

METHOD

TOPSIS ((Technique for Order Preference by Similarity to Ideal Solution)

In designing a decision support system there are many methods used, one of the methods used is Multiple Attribute Decision Making (MADM). MADM is a method for finding the best alternative with existing criteria. MADM has many solution methods, one of the methods that can be used is the TOPSIS method.

The TOPSIS method is a method used to solve problems in many decisions. TOPSIS itself is used using the optimal concept not only the shortest distance from the positive ideal solution, but also the farthest distance from the negative ideal solution.

Typically, the process steps in TOPSIS are as follows:

a) Create a normalized and weighted decision matrix.
b) Determine a positive ideal solution matrix and a negative ideal solution matrix.
c) Determine the distance to the values in the alternatives with the positive ideal solution matrix and the negative ideal solution matrix.
d) Determine the preference value for each alternative.

TOPSIS Method Steps

1. Creating a normalized decision matrix from the results of normalizing the decision matrix R using the Euclidean method is as follows:

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_i^m X_{ij}^2}} \quad \ldots\ldots\ldots$$

Where:$r\ i\ j$ = result of normalization of decision matrix R
i = 1,2,3,...m;
j = 1,2,3,...n;

2. Construct a weighted normalized decision matrix.
   The weights are W=(W1,W2,...,Wn), then the weights of the matrix V are normalized as follows:

$$V = \begin{bmatrix} w_{11}r_{11} & \cdots & w_{1n}r_{1n} \\ \vdots & \ddots & \vdots \\ w_{m1}r_{m1} & \cdots & w_{nm}r_{nm} \end{bmatrix}$$

3. Looking for ideal positive solutions and ideal negative solutions The positive ideal solution is represented by ? + and the negative ideal solution is represented by ? −, as follows: Determining the ideal solutions (+) and (-):

$$A^+ = \left\{\left(max_{v_{ij}}\right)\left(min_{v_{ij}}\middle| j \in J\right), i = 1,2,3,\ldots m\right\} = \{v_1^+, v_2^+, v_m^+\}$$

$$A^- = \left\{\left(max_{v_{ij}}\right)\left(min_{v_{ij}}\middle| j \in J\right), i = 1,2,3,\ldots m\right\} = \{v_1^-, v_2^-, v_m^-\}$$

   Where :
   Vij in matrix v, first row and jth column
   j = { j=1,2,3,...n and –j is connected by benefit criteria}
   j = { j=1,2,3,...n and –j are connected by cost criteria}
4. Calculating separation
   *Separation measure*This is a measure of the substitute distance between the positive ideal solution and the negative ideal solution. The mathematical calculation is as follows:
   Separation calculation for positive idea solution:

$$S_i^+ = \sqrt{\sum_{j=1}^{n}\left(v_{ij} - v_j^+\right)^2}, \text{ dengan-i} = 1, 2,3,\ldots\text{m}$$

   Where :
   j = { j=1,2,3,...n and – j is with benefit criteria}
   j = { j=1,2,3,...n and – j is the cost criterion}
   Separation calculation for Negative ideal solution:

$$S_i^- = \sqrt{\sum_{j=1}^{n}\left(v_{ij} - v_j^-\right)^2}, \text{ dengan-i} = 1,2,3,\ldots\text{n}$$

   Where :
   j = { j=1,2,3,...n and – j is with benefit criteria}
   j = { j=1,2,3,...n and – j is the cost criterion}
5. Calculate the relative distance to the ideal solutionrelative distance from alternatives*A* +with ideal solution*A* - made with:

$$C_i = \frac{S_i^-}{S_i^- + S_i^+}, \text{ dengan} 0 < C_i^+ < 1 \text{ dan-i} = 1,2,3,\ldots\text{m}$$

6. Ranking alternatives
   Alternatives must be in sequence $C\,i\ *$.Therefore, the best choice must be from the distance that shortest from the positive ideal solution and furthest from the negative ideal solution [4]

RESULTS AND DISCUSSION

The application of the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method in product selection has shown significant results in increasing the efficiency and effectiveness of decision making. This method works by comparing alternatives based on a number of predetermined criteria. In this study, we analyzed several products with criteria such as price, quality, and popularity. As a result, the product with the highest value in the TOPSIS calculation is the one that best meets the established criteria.

During the analysis process, the first step is to determine the weight for each criterion. This weight reflects the importance of each criterion in the context of product selection. For example, if quality is considered more important than price, then the weight of quality will be greater. The

use of the AHP (Analytic Hierarchy Process) method to determine the weight can increase objectivity and accuracy in the assessment. The calculation results show that the product with the highest weight is at the top, indicating that this method can prioritize alternatives effectively.

Once the weights are determined, the next step is to calculate the distance from each alternative to the positive and negative ideal solutions. This process involves normalizing the data to ensure that all criteria can be compared consistently. From the results of normalization, we get the preference value for each product. In this case, product A is in the top position with the highest preference value, while products B and C follow behind it. This shows that product A is the choice closest to the ideal solution.

One of the main advantages of the TOPSIS method is its ability to handle multidimensional data. By considering several criteria simultaneously, this method can provide a more comprehensive picture of the available alternatives. In addition, this method also helps in identifying trade-offs between different criteria. For example, although product B has a lower price, its quality is not as good as product A, which reflects the importance of holistic assessment in product selection.

Overall, the application of the TOPSIS method in product selection provides clear benefits in the decision-making process. This method not only simplifies the analysis of alternatives, but also produces more rational and data-based decisions. With reliable results, companies or individuals can make better choices, which in turn can improve customer satisfaction and market effectiveness. Further research can be done to test the application of this method in various industry sectors, as well as develop more complex models to cover more criteria and alternatives.

CONCLUSION

The application of the TOPSIS method in product selection is an effective tool to improve the efficiency and objectivity of decision-making amidst tight business competition. With the ability to consider multiple criteria simultaneously, TOPSIS helps companies identify the best products based on their proximity to the ideal solution. In addition, this method not only increases transparency in the evaluation process, but also allows companies to adapt quickly to market changes. Thus, the application of TOPSIS not only improves the product decisions taken, but also supports the company's competitive advantage and sustainability in the long term.

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