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# Combination of the SAW and TOPSIS Method For Determining The Best Marketplace Recommendations

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# Combination of the SAW and TOPSIS Method For Determining The Best Marketplace Recommendations

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**Abstract**. A marketplace is a place where sellers can sell merchandise online without the need to create a website. From the many available marketplaces, it appears that consumers' desires in choosing a marketplace are different. Therefore a decision support system is needed to help resolve this problem. In this study, the author combines two methods, namely Simple Additive Weighting (SAW) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). The SAW method is used to find normalized matrix values, and the TOPSIS method to find normalized weighted matrices up to ranking. This is because the two methods are simple, easy to understand, efficient, and can measure the relative performance of decision alternatives in a simple mathematical form. The final result of this research is to determine the best alternative of a marketplace with criteria: application appearance, features, interactivity, transaction security, and customer service.

## 1. Introduction

Many e-commerce companies that offer convenience in shopping and selling through the internet [1]. Only by using a smartphone can we buy and get whatever items we want [2]. Based on the results of the APJII and Polling Indonesia survey the number of internet users in Indonesia in 2018 increased by 27.91 million (10.12%) to 171.18 million. [3]. This means that internet penetration in the country has increased to 64.8% of the total population of 264.16 million people [4]. This provides opportunities for prospective entrepreneurs, especially in the field of e-commerce to develop the business. From the many e-commerce users, it can be seen that e-commerce with the C2C model is the most widely used application by consumers in Indonesia [1]. C2C (Consumer To Consumer) model e-commerce provides a way for consumers to sell goods to other consumers. C2C involves exchanging information through internet forums that are of interest to certain special interest groups. Ten Shopping Apps in Indonesia such as 1. Shopee, 2. Tokopedia, 3. Olx, 4. Bukalapak, 5. Carousell, 6. Kaskus, 7.eBay, 8. Kudo, 9. Prelo, 10. Jualo. The data is grouped according to the C2C, B2C, B2B2C e-commerce business models that are most commonly uploaded by mobile apps users in Indonesia. The use of e-marketplaces is now very easy and users also benefit from using e-marketplace applications to transact, because now the e-marketplace application is multi-platform. The function of the e-marketplace is complete as integrated with non-cash payments [5]. The many criteria in choosing the best one can hamper the performance of the decision-maker, especially since each alternative has equal ability. Thus it is necessary to apply a particular analysis method that can help decision-makers choose an alternative to the proposed alternatives [6]. Research is more focused on what factors affect the marketplace with the limitation of the research problem focusing on the appearance of the application (user interface), features, interactivity, transaction security, and customer service. But it triggers the emergence of problems that make consumers confused in choosing a marketplace that is following their wishes [7]. The ranking will be an important consideration in selecting a marketplace [8] the most appropriate to be chosen as a means to shop and sell the best safely and following the content that has been offered by the marketplace.

## 2. Literature Research

Iriane, Ernawati, & Wisnubhadra [9] stated the problem from the results of the pre-research and interviews conducted by the author that the selection and recruitment process of lecturer recruitment is still done manually and the criteria assessed are still very few namely the selection of the GPA and Interview. This study combines the SAW method and the TOPSIS method to support the selection decision for lecturer acceptance. The final result of this study is to determine the best alternative from several alternatives, namely applicants (lecturers) who are eligible to pass the selection based on the following criteria: GPA (Grade Point Average), TPA (Academic Potential Test), TOEFL (Test of English as a Foreign Language), and Interview. The study was conducted by finding the normalized value of R for each attribute using the SAW method, then proceed with the TOPSIS method to find the solution or chosen.Abadi [10] raised the problem raised by the many events on the ground that education is still far from the standard of eligibility. This can be seen from the condition of the school facilities and infrastructure. However, the government is always trying to improve the standard of eligibility in teaching and learning programs in the form of financial assistance by both the central and regional governments. For this reason, a system that can help the selection process for receiving aid is needed. This study uses a decision support system that can give consideration to the recipient's priorities. This decision support system was implemented at the district level school, and the chosen district was the Banjar District in South Kalimantan Province. The decision-making system can take into account all the criteria that help, accelerate, and facilitate the determination of which schools are entitled to receive assistance.

Windarto [11] stated the number of businesses with the same type makes an entrepreneur must have the right strategies in increasing customer purchasing power and reaping profits. This strategy also increases trade competition with fellow entrepreneurs. One strategy that can be applied is to choose one customer to be the main customer. These main customers are given attractive rewards from the entrepreneur. This reward can divert customers to remain subscribed to an entrepreneur who has the strategy as explained, with the provision that the entrepreneur must also maintain the quality of the products produced. In this case, there are difficulties in determining the main customers where the number of customers is approximately 250 customers with orders ranging from 50 customers/day. This study compares the SAW and TOPSIS methods to find out whether or not the results provided by the two methods are the same, as well as analyzing the comparison of the two methods in the case of a decision support system for customer rewards.

## 3. Methods and Materials

In this study the combination of the SAW method with the TOPSIS method in which data processing consists of assigning variable codes is done with the SAW method to find normalized matrix values, then proceed with the TOPSIS method to look for normalized weighted matrices until ranking.

### 3.1. Research Instruments

The research instrument used for this study was a questionnaire or questionnaire, which served as an instrument or data collection tool that contained several questions or questions that had to be answered or responded by respondents. The questionnaire that was made in this study was closed, the closed questionnaire was a questionnaire that was presented in such a way that the respondent was only asked to choose one of the answers following his characteristics. Besides, the authors also use Microsoft Excel which is useful to help with calculation and data processing.

### 3.2. Population

The population in the study was 100 respondents consisting of men and women who are users of marketplace services with an age range of 15-50 years.

### 3.3. Research Samples

In this study, the technique used in sampling is a simple random sampling technique or method, meaning that this sample is selected from randomly available population elements, where each member of the population has the same right to be sampled. In this study, because the population is unknown, the samples taken were 100 respondents.

### 3.4. Data Analysis Method

To achieve the objectives in the selection of this marketplace, data analysis methods are needed, the data analysis methods that the authors use in this study are the Simple Additive Weight (SAW) method and the

Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) [12]. SAW method to find normalized matrix values then proceeds with the TOPSIS method to find normalized weighted matrices until ranking. Of the many marketplace services, the authors take four marketplace services as examples for the application of the SAW and TOPSIS methods. Table 1 there are four alternative marketplaces, namely:

Table 1 Alternatives

| Alternative | Information |
|---|---|
| A1 | Shopee |
| A2 | Tokopedia |
| A3 | Bukalapak |
| A4 | OLX |

The determination of these criteria will be used as a reference in decision making. After completing the criteria determination, there will be a weight value for each criterion. Where the weighting is measured based on the most important criteria in the marketplace selection decision process. For weighting criteria can be seen in Table 2 below:

Table 2. Weighting Criteria

| Criteria | Information | Range % | Weight (W) |
|---|---|---|---|
| C1 | App Display | 25% | 0,25 |
| C2 | Feature | 20% | 0,2 |
| C3 | Interactivity | 15% | 0,15 |
| C4 | Transaction Security | 25% | 0,25 |
| C5 | Customer service | 15% | 0,15 |

Table 2 above explains the assessment criteria as a reference for valuing marketplace selection decisions.

## 4. Result and Discussion

### 4.1. Determine Alternative Data and Criteria
Questionnaire data of 100 respondents and calculate the overall results of the questionnaire from each respondent to get alternative data. Alternative data results will be presented as follows:

Table 3. Weight Criteria

| Alternative | Criteria | | | | |
|---|---|---|---|---|---|
| | C1 | C2 | C3 | C4 | C5 |
| Shopee | 3,66 | 3,68 | 3,57 | 3,96 | 3,66 |
| Tokopedia | 3,83 | 3,63 | 3,86 | 3,72 | 3,88 |
| Bukalapak | 3,8 | 3,75 | 3,74 | 3,75 | 3,57 |
| OLX | 3,48 | 3,59 | 3,76 | 3,81 | 3,54 |

### 4.2. Use of the SAW Method

#### 4.2.1. Normalizing Decision Matrix (X)
Before normalizing, a criterion of attributes consisting of Benefit and Cost is grouped. In this study only uses the Benefit attribute. The calculation results for each criterion are as follows:

a.  Calculation of Application Display Criteria, with the results: $r\_11 = 0.955613577$; $r\_21 = 3.83 / 3.83 = 1$; $r\_31 = 0.992167102$; $r\_41 = 0.908616188$

b.  Calculation of Feature Criteria, with the results: $r\_12 = 0.981333333$; $r\_22 = 0.968$; $r\_32 = 1$; $r\_42 = 0.957333333$

c.  Calculation of Interactivity Criteria, with the results: $r\_13 = 0.924870466$; $r\_23 = 3.86 / 3.86 = 1$; $r\_33 = 0.968911917$; $r\_43 = 0.974093264$

d.  Calculation of Transaction Security Criteria, with the result: $r\_14 = 1$; $r\_24 = 0.939393939$; $r\_34 = 0.946969697$; $r\_44 = 0.962121212$

e.  Calculation of Customer Service Criteria, with the results: $r\_15 = 0.943298969$; $r\_25 = 1$; $r\_35 = 0.920103093$; $r\_45 = 0.912371134$

*4.2.2. Making a Normalized Matrix (R)*

$$R = \begin{bmatrix} 0,955613577 & 0,981333333 & 0,924870466 & 1 & 0,943298969 \\ 1 & 0,968 & 1 & 0,939393939 & 1 \\ 0,992167102 & 1 & 0,968911917 & 0,946969697 & 0,920103093 \\ 0,908616188 & 0,957333333 & 0,974093264 & 0,962121212 & 0,912371134 \end{bmatrix}$$

After the results of the normalized matrix R, then the Y-weighted matrix will be obtained by using the TOPSIS method

*4.3.  Use of the TOPSIS Method*

*4.3.1. Calculating the Weighted Normalized Matrix*
    The next step, the authors carry out the weighted normalization that has been known the weight of the criteria taken from the SAW calculation as table 5 below:

Table 5 Criteria Weight Weights

| Criteria | Information | Range % | Bobot (W) |
|---|---|---|---|
| C1 | App Display | 25% | 0,25 |
| C2 | Feature | 20% | 0,2 |
| C3 | Interactivity | 15% | 0,15 |
| C4 | Transaction Security | 25% | 0,25 |
| C5 | Customer service | 15% | 0,15 |

After we know the weight of the next criteria is weighted normalization. The following results are weighted normalization as below:

Table 6 Weighted Normalization Matrix

| Alternative | C1 | C2 | C3 | C4 | C5 |
|---|---|---|---|---|---|
| Shopee | 0,238903394 | 0,196266667 | 0,13873057 | 0,25 | 0,141494845 |
| Tokopedia | 0,25 | 0,1936 | 0,15 | 0,234848485 | 0,15 |
| Bukalapak | 0,248041775 | 0,2 | 0,145336788 | 0,236742424 | 0,138015464 |
| OLX | 0,227154047 | 0,191466667 | 0,14611399 | 0,240530303 | 0,13685567 |

*4.3.2. Determine the Positive Ideal Solution and the Negative Ideal Solution*
    After weighting normalization, the next step the author can determine the positive ideal solution and the negative ideal solution.

Table 7 Matrix of Positive Ideal Solutions ($A^+$)

| Positive Solution | C1 | C2 | C3 | C4 | C5 |
|---|---|---|---|---|---|
| ($A^+$) | 0,25 | 0,2 | 0,15 | 0,25 | 0,15 |

The results of the negative ideal solution are as follows:

Table 8 Matrix of Negative Ideal Solutions ($A^-$)

| Negative Solution | C1 | C2 | C3 | C4 | C5 |
|---|---|---|---|---|---|
| ($A^-$) | 0,227154047 | 0,191466667 | 0,13873057 | 0,234848485 | 0,13685567 |

*4.3.3. Determine the Weighted Distance of Each Alternative to the Positive Ideal Solution (A ^ +) and the Negative Ideal Solution (**$A^-$**)*
    The next step is determining the distance between the positive and negative ideal solutions. The results of the calculation of a positive ideal distance then the following table are formed:

Table 9 Positive Distance Solution Ideal Solution

| | $D^+$ |
|---|---|
| Shopee | 0,018341487 |
| Tokopedia | 0,016447748 |
| Bukalapak | 0,018573438 |
| OLX | 0,02953481 |

The next step determines the distance value of the negative ideal solution. Calculation of the negative ideal distance then formed the following table:

Table 10. Distance Results of Ideal Negative Solutions

| | $D^-$ |
|---|---|
| Shopee | 0,020302156 |
| Tokopedia | 0,028744776 |
| Bukalapak | 0,023615444 |
| OLX | 0,009316541 |

*4.3.4. Determine the Preference Value for each Alternative*
   To determine the preference value for each alternative, generate a value: V1 = 0.525368578; V2 = 0.636051574; V3 = 0.5597515; V4 = 0.239799676. The total preference value is 1,960974978

*4.3.5. Determine the Percentage Value of Each Alternative*
   To determine the percentage value in each alternative, so the results obtained from the calculation of the percentage value to determine the ranking of the marketplace such as tables and graphs below:

Table 11. Preference Value for Each Alternative

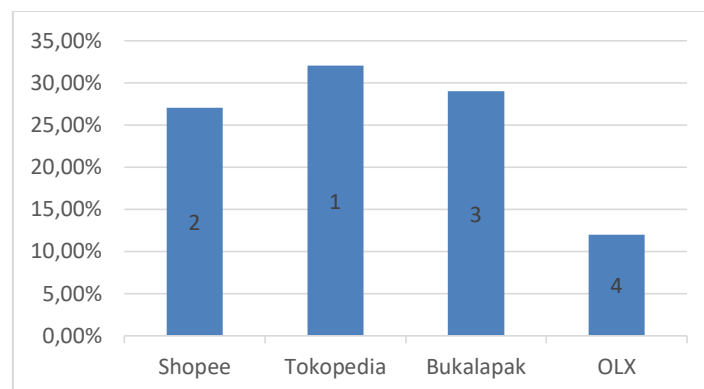| Alternatives | Alternative name | Preference Value | Persentase | Ranking |
|---|---|---|---|---|
| A1 | Shopee | 0,525368578 | 27% | 3 |
| A2 | Tokopedia | 0,636051574 | 32% | 1 |
| A3 | Bukalapak | 0,55975515 | 29% | 2 |
| A4 | OLX | 0,239799676 | 12% | 4 |



Figure 1. Ranking Chart

Graph 1 results above note that the selection of the best marketplace recommendations with ranking 1 is obtained by alternative Tokopedia with a preference value of 0.636051574 and a percentage of 32%. Rank 2 is obtained by Bukalapak alternative with a preference value of 0.55975515 and a percentage of 29%. Rank 3 is obtained by Shopee alternatives with a preference value of 0.525368578 and a percentage of 27%. And the last ranking is obtained by OLX alternatives with a preference value of 0.239799676 and a percentage of 12%.

## 5. Conclusion

Questionnaire data that has been processed shows that the more attractive marketplace falls on the alternative Tokopedia. Tokopedia Alternative get rank 1 with preference value 0.636051574 and percentage 32%, rank 2 is obtained by Bukalapak alternative with preference value 0.55975515 and percentage 29%, rank 3 is obtained by Shopee alternative with preference value 0.525368578 and percentage 27%, and the last rank is obtained by OLX alternatives. The combination of SAW and TOPSIS methods can be used for decision making in determining the best marketplace recommendations. By combining these two methods it can be said that this method is quite efficient and more accurate in its calculations.

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