

# **Decision Support System for Platform Selection in E-Commerce Using the OWH-TOPSIS Method**

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**Abstract**—Platforms in e-commerce are digital systems that allow online transactions to buy and sell products or services. E-commerce platforms also provide benefits for business actors because they are able to reach a wider market without geographical restrictions, while offering efficiency in business operations. The main problem in choosing a platform for e-commerce is often related to the sheer number of options available and the variety of criteria that must be considered. Criteria such as fees, platform popularity, transaction security, ease of use, features provided, as well as customer service support are important factors in determining the most suitable platform. The implementation of a decision support system to help select the optimal e-commerce platform by applying the OWH-TOPSIS method shows that this system can provide accurate and effective recommendations, so that it can be used as a reference for users in determining the e-commerce platform that suits their needs. The decision support system using the OWH-TOPSIS method provides an efficient and objective solution in the selection of e-commerce platforms. The results of the ranking of the best e-commerce platforms show that Platform D occupies the top position with the highest score value, which is 0.882. In second place is Platform E which obtained a score of 0.8599, followed by Platform A with a score of 0.8341.

**Keywords:** E-Commerce; Determining; Decision Support System; Platform; OWH-TOPSIS

## **1. INTRODUCTION**

A platform in e-commerce is a digital system that allows online transactions to buy and sell products or services. The platform provides infrastructure that facilitates interaction between sellers and buyers, including various features such as product search, payment, user reviews, and delivery services[1], [2]. E-commerce platforms also provide benefits for business actors because they are able to reach a wider market without geographical boundaries, as well as offering efficiency in business operations. Some examples of popular platforms in e-commerce are Amazon, eBay, and Shopee, each of which has advantages in ease of use, product variety, and customer service. Choosing the right platform is important for consumers and businesses because it can affect the shopping experience and business success in the digital era[3], [4]. The COVID-19 pandemic has prompted a huge surge in e-commerce usage. Social restrictions and physical store closures are driving consumers to shop online. E-commerce platforms such as Tokopedia, and Shopee recorded a drastic increase in transactions. One common problem is the mismatch between the products that customers receive and the descriptions on the platform. This often happens in the categories of clothing, electronics, and other items where details are crucial. Consumers often complain that the size, color, or specifications of the product do not match what is displayed. As a result, customers feel disappointed, lose trust, and tend to leave negative reviews. Customers are also more likely to request product returns or exchanges, which can increase operational costs and extend customer service time. Choosing a platform for e-commerce is often related to the many options available and the variety of criteria that must be considered. Criteria such as fees, platform popularity, transaction security, ease of use, features provided, as well as customer service support are important factors in determining the most suitable platform. Imbalances in the assessment of these criteria can lead to non-optimal decisions, so consumers and business actors can choose platforms that are less suitable for their needs. On the other hand, the complexity of analyzing and comparing different platforms makes the decision-making process more difficult, requiring a more objective and structured system.

A Decision Support System (DSS) in the selection of e-commerce platforms aims to assist users or businesses in choosing the best platform according to their specific needs. This DSS will collect and analyze various important criteria related to e-commerce, such as platform features, ease of use, costs, logistics performance, and customer service[5]–[7]. DSS combines data, analytical models, and evaluation techniques to make it easier to select the best alternative from several available options. In practice, DSS is widely applied in various fields, including business, health, education, and e-commerce. The system works by analyzing data from various relevant sources and criteria to provide recommendations based on objective methods. Methods that are

often used in SPK include TOPSIS, AHP, Weighted Product, and other weighting methods, which help determine the most rational and profitable decisions. DSS is particularly useful in conditions where decision-making factors are too complex or involve many variables, helping to reduce the risk of errors and improve the efficiency of the decision-making process[8]–[11]. The advantage of DSS is that by using the same algorithm for each case, DSS ensures that decisions are made consistently based on predetermined parameters, thereby reducing the risk of inconsistencies. One of the methods in DSS is the Objective Weighting Technique For Others Preference by Similarity to Ideal Solution.

Objective Weighting Technique For Others Preference by Similarity to Ideal Solution (OWH-TOPSIS) is a multi-criteria decision-making approach that combines objective weighting techniques and TOPSIS methods[12]. OWH-TOPSIS is designed to provide a more objective solution in determining the best preference by taking into account the linkages between various criteria quantitatively and directly compared to the ideal solution. The advantages of OWH-TOPSIS lie in the combination of objective weighting and the TOPSIS method that ensures more transparent and rational decisions. By using objective weighting techniques, OWH-TOPSIS reduces the potential for subjective preference in determining criterion weights, so that the results produced are fairer and accountable[13], [14]. In addition, this method is able to handle different types of criteria, both quantitative and qualitative, by calculating the distance of each alternative to the positive and negative ideal solution. The end result is more accurate, measurable, and data-driven decisions, making them suitable for application in a variety of multi-criteria decision-making contexts.

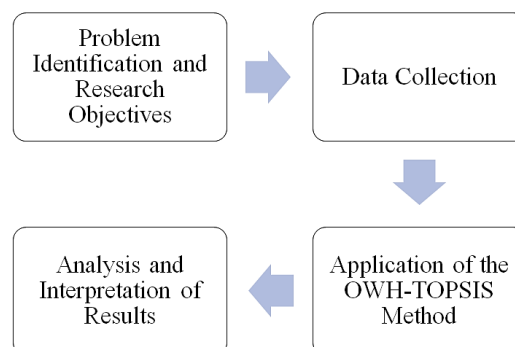
Research related to the selection of e-commerce was carried out by Anastasya (2023), the WP (Weighted Product) method produced a ranking to find out which e-Commerce is the best to minimize worries when shopping online with the largest value obtained by Shopee with a value of 0.498684[15]. Research conducted by Nugroho (2023) the AHP (Analytical Hierarchical Process) method provides the most appropriate and appropriate e-commerce recommendations based on the weight of the criteria produced[16]. Research conducted by Siregar (2024) the TOPSIS method is used in analyzing the selection of the best e-commerce with the highest results, Shopee (A1) is the best alternative with a score of 0.9564 as the best e-commerce[17]. Research related to the selection of e-commerce was carried out by Citra (2024) combining the entropy weighting and COPRAS methods in producing the best e-commerce assessment and ranking alternatives with the result of ranking 1 obtained Shoope e-commerce with a score of 100%[18]. The difference in the research carried out is in the method used, the OWH-TOPSIS method is a modified method from TOPSIS which is equipped with objective weight determination.

This research aims to provide a more objective and structured approach in determining the best e-commerce platform based on relevant criteria, making it easier for businesses and consumers to choose the platform that best suits their needs and provides a theoretical and practical foundation in the application of the OWH-TOPSIS method for the evaluation of e-commerce platforms, which can be used as a reference in advanced research in the field of multi-criteria decision-making.

## 2. RESEARCH METHODOLOGY

### 2.1 Research Stages

The research stage is a series of systematic steps carried out in the investigation process to discover, understand, or develop new knowledge[19]–[21]. These stages generally include problem identification, literature study, hypothesis formulation, data collection, data analysis, as well as drawing conclusions and reporting results[22]. Each stage has a crucial role in ensuring the validity and reliability of the findings. The benefits of implementing systematic research stages are increasing accuracy in understanding the phenomenon being studied, aiding in evidence-based decision-making, and allowing findings to be tested and further developed by other researchers[20], [23], [24]. This process also provides a solid foundation for future research, so that scientific contributions can continue to grow and be relevant. The stages of the research are carried out in Figure 1.



**Figure 1.** Research Stage

An explanation of each of the stages of research carried out in Figure 1 will be described below in detail, each stage is interrelated and forms a coherent research framework to achieve the desired results.

- a. **Problem Identification and Research Objectives:** In today's digital era, choosing the right e-commerce platform is a challenge for consumers and businesses. The sheer number of platform options available, each with different characteristics such as cost, features, security, and customer support, makes the selection process even more complex. The absence of objective tools to evaluate and compare these platforms can lead to suboptimal decisions, which has an impact on the shopping experience for consumers or business success for business actors. Therefore, the problem identification in this study focuses on the need for a decision support system that can help the platform selection process in a structured and data-driven manner. The purpose of this study is to develop a Decision Support System (DSS) using the Objective Weighting-TOPSIS (OWH-TOPSIS) method that can provide an objective evaluation of various e-commerce platforms. This system is expected to be able to help users in making better decisions by considering various relevant criteria. This research also aims to improve the accuracy of the platform selection process, thereby providing real benefits for consumers and business people in e-commerce.
- b. **Data Collection:** Data collection in this study is carried out to obtain relevant and accurate information related to the performance of various e-commerce platforms based on predetermined criteria. Data can be obtained from gathering information from publicly available industry reports, articles, or reviews of e-commerce platforms. This secondary data includes statistics, performance ratings, and user reviews from various trusted review sites.
- c. **Application of the OWH-TOPSIS Method:** The application of the Objective Weighting-TOPSIS (OWH-TOPSIS) method in this study aims to produce objective and accurate decisions in the selection of e-commerce platforms. The application of the OWH-TOPSIS method provides a more objective and systematic approach in the selection of e-commerce platforms, aiding better decision-making and being based on data that can be accurately measured.
- d. **Analysis and Interpretation of Results:** After the application of the OWH-TOPSIS method in this study, the next step is to analyze and interpret the results to understand the effectiveness of the decision support system that has been built. The overall analysis provides a comprehensive view of the performance of e-commerce platforms, as well as helping users make better decisions supported by objective data.

## 2.2 OWH-TOPSIS Method

The OWH-TOPSIS method is a multi-criteria decision-making technique from the development of the TOPSIS method. By using the OWH-TOPSIS method, decision-makers can conduct a more objective and systematic evaluation of various alternatives based on predetermined criteria, thus helping to make better and more informed decisions. One of the main advantages of OWH-TOPSIS is the use of objective weighting, which reduces the potential for personal opinions that may arise from subjective judgments which can improve the accuracy of decisions taken. The stages in the OWH-TOPSIS method are.

Decision matrix is a form used in decision support systems to present the data needed in the evaluation or comparison process. The values in the matrix indicate how well each alternative meets each criterion. The decision matrix in OWH-TOPSIS is created using the following equation.

$$X = \begin{bmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

$x_{ij}$  represents the elements in the  $i$ -th row and the  $j$ -th column in the matrix. The  $m$  line (from  $x_{11}$  to  $x_{m1}$ ) represents an alternative or a different entity. Column  $n$  (from  $x_{in}$  to  $x_{mn}$ ) represents the criteria used to evaluate alternatives.

Matrix normalization is the process of converting the values in a decision matrix into a uniform scale or range and to facilitate comparison and evaluation. The goal is for each criterion to have a balanced contribution to the decision-making process and avoid dominance from criteria that have a larger value range. The normalization of the decision matrix in OWH-TOPSIS is made using the following equation.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^m x_{ij}^2}} \quad (2)$$

The  $r_{ij}$  value is the normalization value of the  $x_{ij}$  element, which is the performance of the  $i$ -th alternative to the  $j$ -th criterion after the normalization process. The  $x_{ij}$  value is the original value of the  $i$ -th alternative element to the  $j$ -th criterion before normalization. The value of  $\sum_{j=1}^m x_{ij}^2$  is the sum of the squares of all  $x_{ij}$  values for the  $j$ -th criterion (sum the squared values for all alternatives to that criterion).

The average value of the normalization matrix is the average value of all elements in the matrix after the normalization process has been carried out. It provides an overview of the relative mean values of the alternatives in the matrix after normalization. The average value of the normalization matrix in OWH-TOPSIS is made using the following equation.

$$N_i = \frac{1}{m} \sum_{j=1}^n r_{ij} \tag{3}$$

The  $N_i$  value is the average value of the  $i$ -th alternative after normalization, which represents the overall performance of the alternative against all criteria. The value of  $m$  is the total sum of the alternatives. The  $r_{ij}$  value is the  $i$ -th alternative normalization value to the  $j$ -th criterion. is the number of criteria used in the evaluation.

Variation is a measure of how much the values in a matrix spread out or vary from their average value. A high variation indicates that the values in the matrix are widely spread, while a low variation indicates that the values are relatively close to the mean. The average value of the normalization matrix in OWH-TOPSIS is made using the following equation.

$$\phi_j = \sum_{i=1}^n [r_{ij} - N_i]^2 \tag{4}$$

The  $\phi_j$  value is the variance value or deviation for the  $j$ -th criterion, measuring how far the performance of the alternative against this criterion deviates from the overall average value. The value of criterion variation has several important roles in data analysis and decision-making, the value of criterion variation indicates that the values are relatively uniform and consistent, while high variation indicates that there is a significant difference between values. The value of the variation of the criteria in OWH-TOPSIS is calculated using the following equation.

$$\Omega_j = 1 - \phi_j \tag{5}$$

The  $\Omega_j$  value is the consistency value of the  $j$ th criterion, which indicates how well the alternative performs against that criterion relative to the average.

Criterion weights are the values assigned to each criterion in a decision support system to reflect the importance of those criteria in the evaluation and decision-making process. This weight is used to assess and compare alternatives or options based on relevant criteria. The weight of the criteria in OWH-TOPSIS is calculated using the following equation.

$$w_j = \frac{\Omega_j}{\sum_{j=1}^n \Omega_j} \tag{6}$$

The  $w_j$  value is the weight of the  $j$ th criterion, which indicates how important the criterion is compared to other criteria based on its consistency or stability. Weight multiplication is a method used in decision support systems to combine criterion weights with alternative values in a normalization matrix. It is often applied in various multi-criteria decision-making (MCDM) methods to calculate the final score of each alternative based on the criteria that have been given weight. The multiplication of weights in OWH-TOPSIS is calculated using the following equation.

$$Y_{ij} = w_j * r_{ij} \tag{7}$$

The value of  $Y_{ij}$  is the weighted value of the  $i$ -th alternative to the  $j$ -th criterion, which shows the contribution of the  $i$ -th alternative to the  $j$ th criterion after considering the weight of the  $w$  criterion. The ideal positive solution value is the alternative that has the best value for each criterion, while the ideal negative solution value is the alternative that has the worst value for each criterion. The values of the ideal positive and ideal negative solutions in OWH-TOPSIS are calculated using the following equation.

$$y_j^+ = \begin{cases} \max y_{ij}; & \text{if } j \text{ benefit criteria} \\ \min y_{ij}; & \text{if } j \text{ cost criteria} \end{cases} \tag{8}$$

$$y_j^- = \begin{cases} \min y_{ij}; & \text{if } j \text{ benefit criteria} \\ \max y_{ij}; & \text{if } j \text{ cost criteria} \end{cases}$$

The ideal solution value is positive if criterion  $j$  is benefit criteria, then  $y_j^+$  is the maximum value  $y_{ij}$  for that criterion. If criterion  $j$  is a cost criterion, then  $y_j^+$  is the minimum value  $y_{ij}$  for that criterion. The ideal solution value is negative if criterion  $j$  is a benefit criterion, then  $y_j^-$  is the minimum value  $y_{ij}$  for that criterion. If criterion  $j$  is a cost criterion, then  $y_j^-$  is the maximum value  $y_{ij}$  for that criterion.

The distance value of the positive ideal solution and the distance of the negative ideal solution are the values of each alternative compared to the ideal solution (positive and negative) to determine its ranking. The distance from the positive ideal solution and the distance from the negative ideal solution are used to evaluate and sort the alternatives. The value of the distance between the ideal positive and ideal negative solutions in OWH-TOPSIS is calculated using the following equation.

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_i^+ - y_{ij})^2} \tag{9}$$

$$D_i^- = \sqrt{\sum_{j=1}^n (y_{ij} - y_i^-)^2} \tag{10}$$

The value of  $D_i^+$  distance from the i-th alternative to the positive ideal solution, and the value of  $D_i^-$  distance from the i-th alternative to the negative ideal solution. The preference value for each alternative is calculated based on its relative distance from the positive ideal solution and the negative ideal solution. This preference value shows how well the alternative compares to the ideal and worst solution. The value of alternative preference in OWH-TOPSIS is calculated using the following equation.

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \tag{11}$$

The  $V_i$  value is the value of the preference index or the preference value of the ith alternative. The OWH-TOPSIS method offers a more objective approach in multi-criteria decision-making. By utilizing objective weighting and systematic ranking techniques, this method improves accuracy, transparency, and quality of decisions while remaining simple and easy to implement.

### 3. RESULT AND DISCUSSION

The decision support system for platform selection in E-Commerce using the OWH-TOPSIS method is designed to provide a systematic and data-driven solution in this decision-making process. By integrating the OWH-TOPSIS method, the system is able to analyze various alternative e-commerce platforms based on relevant criteria, such as cost, security, ease of use, and customer support. This approach not only improves objectivity and accuracy in judgment, but also assists users in making better and more informational decisions. Through this system, users can find the platform that best suits their business needs and goals, thus supporting the growth and sustainability of the business in the competitive world of e-commerce.

#### 3.1 Data Collection

In this study, data collection was carried out by involving 25 respondents consisting of e-commerce business owners, customers, and other digital platform users. Respondents were asked to provide their perceptions of the important criteria for choosing an e-commerce platform, including cost, security, ease of use, and customer support. The data collection method is carried out through online surveys that contain closed-ended and open-ended questions to gain deeper insights. Each respondent was asked to rate each criterion on a scale of 1 to 10, as well as provide comments or suggestions regarding their experience using different e-commerce platforms. The data collected from these surveys is then analyzed to identify emerging trends and preferences among respondents, providing a clearer picture of users' expectations and needs in choosing the optimal e-commerce platform. Through this approach, it is hoped that research can produce relevant and applicable recommendations for e-commerce business owners in choosing the platform that best suits their needs. The results of data collection are shown in Table 1.

**Table 1.** Data Collection

E-Commerce Name	Cost	Security	Ease of Use	Customer Support
Platform A	7	9	9	8
Platform B	8	8	7	7
Platform C	6	9	5	6
Platform D	7	8	8	9
Platform E	8	7	9	7

The results of the data collection table 1 is the result of a survey of respondents who were also asked about their previous experience with various platforms, as well as the challenges they faced in the process of selecting and using the platform. This research not only relies on quantitative assessments of predetermined criteria, but also involves a qualitative perspective that can provide a deeper context to the data obtained. Each respondent gives a score for each criterion using a pre-agreed scoring scale, for example a scale from 1 to 10. After all the assessment data is collected, the average of the scores given by all respondents is calculated for each criterion. This average is then used as the final value of each criterion. By using this method, the values obtained reflect the general perception from various points of view, so that the final result becomes more representative and objective. It also ensures that variations in user preferences or needs towards e-commerce platforms can be well reflected in the evaluation and decision-making process. The results of this data collection are expected to identify the key factors that contribute to the decision to select an e-commerce platform, as well as provide valuable insights for the development of a Decision Support System that is more effective and responsive to user needs. Thus, this research aims to make a significant contribution in understanding the dynamics of e-commerce platform selection and improving the overall user experience.

### 3.2 Implementation of the OWH-TOPSIS Method

The implementation of the OWH-TOPSIS method provides a structured and objective approach to assist decision-making in the selection of e-commerce platforms. By considering various criteria and using data-driven analysis, the study provides clear guidance for business owners and users in choosing the most suitable platform for their needs. The implementation of the OWH-TOPSIS method in the selection of e-commerce platforms is a comprehensive and structured approach. By involving various criteria, taking into account the weights of criteria objectively, and using data-driven analysis, organizations can make better, more informational decisions. In addition, this approach allows organizations to adapt quickly to changes in the e-commerce market, as well as better meet the needs of users. With systematic measures and continuous evaluation, it is expected to improve the performance and effectiveness of the chosen platform, as well as provide a better experience for all stakeholders.

Decision matrix is a form used in decision support systems to present the data needed in the evaluation or comparison process. The decision matrix in OWH-TOPSIS is made using equation (1) based on the table of data collection results.

$$X = \begin{bmatrix} 7 & 9 & 9 & 8 \\ 8 & 8 & 7 & 7 \\ 6 & 9 & 5 & 6 \\ 7 & 8 & 8 & 9 \\ 8 & 7 & 9 & 7 \end{bmatrix}$$

Matrix normalization is the process of converting the values in a decision matrix into a uniform scale or range and to facilitate comparison and evaluation. The normalization of the decision matrix in OWH-TOPSIS is made using equation (2).

$$r_{11} = \frac{x_{11}}{\sqrt{\sum_{j=1}^n x_{1j,15}}} = \frac{7}{\sqrt{7+8+6+7+8}} = \frac{7}{\sqrt{36}} = \frac{7}{6} = 1.1667$$

The overall results of the calculation of the matrix normalization value for all existing alternatives from the criteria used in the best e-commerce assessment are shown in Table 2.

**Table 2.** The calculation of the matrix normalization value

E-Commerce Name	Cost	Security	Ease of Use	Customer Support
Platform A	1.1667	1.4056	1.460	1.315
Platform B	1.3333	1.249	1.1355	1.1508
Platform C	1.0000	1.4056	0.8111	0.9864
Platform D	1.1667	1.2494	1.2978	1.4796
Platform E	1.3333	1.093	1.460	1.1508

The average value of the normalization matrix is the average value of all elements in the matrix after the normalization process has been carried out. The average value of the normalization matrix in OWH-TOPSIS is made using equation (3).

$$N_1 = \frac{1}{5} \sum_{j=1}^n r_{1j,15} = \frac{1}{5} * (6) = 0.2 * (6) = 1.2$$

$$N_2 = \frac{1}{5} \sum_{j=1}^n r_{2j,25} = \frac{1}{5} * (6.4031) = 0.2 * (6.4031) = 1.2806$$

$$N_3 = \frac{1}{5} \sum_{j=1}^n r_{3j,35} = \frac{1}{5} * (6.1644) = 0.2 * (6.1644) = 1.2329$$

$$N_4 = \frac{1}{5} \sum_{j=1}^n r_{4j,45} = \frac{1}{5} * (6.0828) = 0.2 * (6.0828) = 1.2166$$

The value of variation is a measure of how much the values in a matrix spread out or vary from their average value. The value of variation in OWH-TOPSIS is made using equation (4).

$$\phi_1 = \sum_{j=1}^n [r_{1j,15} - N_1]^2 = 0.0778$$

$$\phi_2 = \sum_{j=1}^n [r_{2j,25} - N_2]^2 = 0.0683$$

$$\phi_3 = \sum_{j=1}^n [r_{3j,35} - N_3]^2 = 0.2947$$

$$\phi_4 = \sum_{j=1}^n [r_{4j,45} - N_4]^2 = 0.1405$$

The final value of the criterion variation has several important roles in data analysis and decision-making, the value of the criterion variation indicates that the values are relatively uniform and consistent. The final value of the variation of the criteria in OWH-TOPSIS is calculated using the following equation.

$$\Omega_1 = 1 - \phi_1 = 1 - 0.0778 = 0.9222$$

$$\Omega_2 = 1 - \phi_2 = 1 - 0.0683 = 0.9317$$

$$\Omega_3 = 1 - \phi_3 = 1 - 0.2947 = 0.7053$$

$$\Omega_4 = 1 - \phi_4 = 1 - 0.1405 = 0.8595$$

Criterion weights are the values assigned to each criterion in a decision support system to reflect the importance of those criteria in the evaluation and decision-making process. The weight of the criteria in OWH-TOPSIS is calculated using equation (6).

$$w_1 = \frac{\Omega_1}{\sum_{j=1}^n \Omega_{1,4}} = \frac{0.9222}{0.9222+0.9317+0.7053+0.8595} = \frac{0.9222}{3.4187} = 0.2698$$

$$w_2 = \frac{\Omega_2}{\sum_{j=1}^n \Omega_{1,4}} = \frac{0.9317}{0.9222+0.9317+0.7053+0.8595} = \frac{0.9317}{3.4187} = 0.2725$$

$$w_3 = \frac{\Omega_3}{\sum_{j=1}^n \Omega_{1,4}} = \frac{0.7053}{0.9222+0.9317+0.7053+0.8595} = \frac{0.7053}{3.4187} = 0.2063$$

$$w_4 = \frac{\Omega_4}{\sum_{j=1}^n \Omega_{1,4}} = \frac{0.8595}{0.9222+0.9317+0.7053+0.8595} = \frac{0.8595}{3.4187} = 0.2514$$

Weight multiplication is a method used in decision support systems to combine criterion weights with alternative values in a normalization matrix. The multiplication of weights in OWH-TOPSIS is calculated using equation (7).

$$Y_{11} = w_1 * r_{11} = 0.2698 * 1.1667 = 0.3147$$

The overall results of the weight multiplication calculation for all available alternatives based on the criteria used in the best e-commerce assessment are shown in Table 3.

**Table 3.** The overall results of the weight multiplication calculation

E-Commerce Name	Cost	Security	Ease of Use	Customer Support
Platform A	0.3147	0.3831	0.3012	0.3306
Platform B	0.3597	0.3405	0.2343	0.2893
Platform C	0.2698	0.3831	0.1673	0.2480
Platform D	0.3147	0.3405	0.2677	0.3720
Platform E	0.3597	0.2979	0.3012	0.2893

The ideal positive solution value is the alternative that has the best value for each criterion, while the ideal negative solution value is the alternative that has the worst value for each criterion. The values of the ideal positive and ideal negative solutions in OWH-TOPSIS are calculated using equation (8) shown in Table 4.

**Table 3.** Hasil Nilai Solusi Ideal Penilaian Kinerja Supplier Toserba Terbaik

	Cost	Security	Ease of Use	Customer Support
$y_j^+$	0.3597	0.2979	0.3012	0.3720
$y_j^-$	0.2698	0.3831	0.1673	0.2480

The distance value of the positive ideal solution and the distance of the negative ideal solution are the values of each alternative compared to the ideal solution (positive and negative) to determine its ranking. The value of the ideal positive and ideal negative solution distance in OWH-TOPSIS is calculated using equations (9) and (10).

$$D_1^+ = \sqrt{((y_1^+ - y_{11})^2) + ((y_2^+ - y_{21})^2) + ((y_3^+ - y_{31})^2) + ((y_4^+ - y_{41})^2)}$$

$$D_1^+ = \sqrt{((0.3597 - 0.3147)^2) + ((0.2979 - 0.3831)^2) + ((0.3012 - 0.3012)^2) + ((0.3720 - 0.3306)^2)}$$

$$D_1^+ = \sqrt{0.01098} = 0.10477$$

$$D_1^- = \sqrt{((y_{11} - y_1^-)^2) + ((y_{21} - y_2^-)^2) + ((y_{31} - y_3^-)^2) + ((y_{41} - y_4^-)^2)}$$

$$D_1^- = \sqrt{((0.3147 - 0.2698)^2) + ((0.3831 - 0.3831)^2) + ((0.3012 - 0.1673)^2) + ((0.3306 - 0.2480)^2)}$$

$$D_1^- = \sqrt{0.27736} = 0.52665$$

The overall results of the calculation of the distance value of the positive ideal solution and the distance of the existing negative ideal solution based on the criteria used in the assessment of the best supplier are shown in Table 4.

**Table 4.** The Best E-Commerce Assessment Ideal Solution Distance Score Results

E-Commerce Name	$D_i^+$	$D_i^-$
Platform A	0.10477	0.52665
Platform B	0.11456	0.54201
Platform C	0.22051	0.47535
Platform D	0.07038	0.52606
Platform E	0.08266	0.50728

The preference value for each alternative is calculated based on its relative distance from the positive ideal solution and the negative ideal solution. The value of alternative preferences in OWH-TOPSIS is calculated using equation (11).

$$V_1 = \frac{D_1^-}{D_1^- + D_1^+} = \frac{0.10477}{0.10477 + 0.52665} = \frac{0.10477}{0.6314} = 0.8341$$

The overall results of the calculation of the preference value for each existing alternative from the criteria used in the best supplier assessment are shown in Table 5.

**Table 5.** The overall results of the calculation of the preference value

E-Commerce Name	$V_i$
Platform A	0.8341
Platform B	0.8255
Platform C	0.6831
Platform D	0.8820
Platform E	0.8599

The end result of the OWH-TOPSIS method for e-commerce assessment is usually a ranking of each e-commerce based on how close they are to the positive ideal solution and how far away from the negative ideal solution. The results of the ranking of the best e-commerce assessment using the OWH-TOPSIS method show that this method evaluates each supplier based on their distance from the positive and negative ideal solutions, taking into account the weight of objectively determined criteria. The supplier with the highest score is considered to meet the criteria the most. The ranking results of the best e-commerce ratings are shown in Figure 2.



**Figure 2.** Best E-Commerce Ranking Results

The ranking results of the best e-commerce platform shown in figure 2 show that Platform D occupies the top position with the highest score value, which is 0.882. In second place is Platform E, which obtained a score of 0.8599, followed by Platform A with a score of 0.8341. Platform B occupies the fourth position with a score of 0.8255, while Platform C is in the last position with the lowest score, which is 0.6831. Overall, Platform D showed the most superior performance among the five platforms evaluated.

## 4. CONCLUSION

Platforms in e-commerce are digital systems that allow online transactions to buy and sell products or services. Choosing the right platform is important for consumers and businesses because it can affect the shopping experience and business success in the digital era. The implementation of a decision support system to help choose the optimal e-commerce platform by applying the OWH-TOPSIS method shows that this system can provide accurate and effective recommendations, so that it can be used as a reference for users in determining the e-commerce platform that suits their needs. The decision support system using the OWH-TOPSIS method provides an efficient and objective solution in the selection of e-commerce platforms. By combining the weighting method based on criterion ranking (OWH) and alternative preference analysis (TOPSIS), the system also minimizes subjectivity in decision-making, resulting in more valid and reliable recommendations in real practice. The results of the ranking of the best e-commerce platforms show that Platform D occupies the top position with the highest score value, which is 0.882. In second place is Platform E which obtained a score of 0.8599, followed by Platform A with a score of 0.8341. Platform B is in fourth place with a score of 0.8255, while Platform C is in the last position with the lowest score, which is 0.6831. Overall, Platform D showed the most superior performance among the five platforms evaluated.

## REFERENCES

- [1] J. Wang and Y. Zhang, "Using cloud computing platform of 6G IoT in e-commerce personalized recommendation," *Int. J. Syst. Assur. Eng. Manag.*, vol. 12, no. 4, pp. 654–666, Aug. 2021, doi: 10.1007/s13198-021-01059-1.
- [2] K. G. Al-Moghrabi and A. M. Al-Ghonmein, "Harnessing the power of blockchain technology to support decision-making in e-commerce processes," *IAES Int. J. Artif. Intell.*, vol. 13, no. 2, p. 1380, Jun. 2024, doi: 10.11591/ijai.v13.i2.pp1380-1387.
- [3] J. Wang, "Impact of mobile payment on e-commerce operations in different business scenarios under cloud computing environment," *Int. J. Syst. Assur. Eng. Manag.*, vol. 12, no. 4, pp. 776–789, Aug. 2021, doi: 10.1007/s13198-021-01100-3.
- [4] S. Sintaro, "Penerapan Metode Grey Relational Analysis (GRA) Dalam Pemilihan E-Commerce," *J. Inf. Technol. Softw. Eng. Comput. Sci.*, vol. 1, no. 4, pp. 166–173, 2023, doi: 10.58602/itsecs.v1i4.75.
- [5] D. Tešić, M. Radovanović, D. Božanić, D. Pamucar, A. Milić, and A. Puška, "Modification of the DIBR and MABAC Methods by Applying Rough Numbers and Its Application in Making Decisions," *Information*, vol. 13, no. 8, p. 353, Jul. 2022, doi: 10.3390/info13080353.
- [6] P. Palupiningsih and S. Setiawansyah, "Best Sales Selection Using a Combination of Reciprocal Rank Weighting Method and Multi-Attribute Utility Theory," *J. Comput. Informatics Res.*, vol. 3, no. 3, pp. 242–250, Jul. 2024, doi: 10.47065/comforch.v3i3.1496.
- [7] A. Sani, S. Aisyah, M. Rachmawati, P. Dian, and N. Wiliani, "Analysis Of Decision Support Systems for Candidate Selection Scholarship Recipients Using TOPSIS Method," in *Proceedings of the 2nd International Conference on Law, Social Science, Economics, and Education, ICLSSEE 2022, 16 April 2022, Semarang, Indonesia, 2022*.
- [8] M. W. Arshad, D. Darwis, H. Sulistiani, R. R. Suryono, Y. Rahmanto, and D. A. Megawaty, "Combination of Weighted Product Method and Entropy Weighting in the Best Warehouse Employee Recommendation," *KLIK Kaji. Ilm. Inform. dan Komput.*, vol. 5, no. 1, pp. 193–202, 2024, doi: 10.30865/klik.v5i1.2095.
- [9] M. W. Arshad, S. Sintaro, Y. Rahmanto, A. Wantoro, and S. Setiawansyah, "Optimization of Alternative Assessment with Modified MOORA Method: Case Study of Contract Employee Selection," *KLIK Kaji. Ilm. Inform. dan Komput.*, vol. 4, no. 6, pp. 3099–3107, 2024, doi: 10.30865/klik.v4i6.1891.
- [10] A. R. Mishra, P. Rani, F. Cavallaro, I. M. Hezam, and J. Lakshmi, "An Integrated Intuitionistic Fuzzy Closeness Coefficient-Based OCRA Method for Sustainable Urban Transportation Options Selection," *Axioms*, vol. 12, no. 2, p. 144, Jan. 2023, doi: 10.3390/axioms12020144.
- [11] M. Mesran, M. Kom, J. H. Lubis, and I. F. Rahmad, "Penerapan Metode Multi-Objective Optimization on the Basic of Ratio Analysis (MOORA) dalam Keputusan Penerimaan Siswa Baru," *Bull. Informatics Data Sci.*, vol. 1, no. 2, pp. 73–80, 2022.
- [12] H. Sulistiani, S. Setiawansyah, A. F. O. Pasaribu, P. Palupiningsih, K. Anwar, and V. H. Saputra, "New TOPSIS: Modification of the TOPSIS Method for Objective Determination of Weighting," *Int. J. Intell. Eng. Syst.*, vol. 17, no. 5, pp. 991–1003, Oct. 2024, doi: 10.22266/ijies2024.1031.74.
- [13] T. ÖZTAŞ and G. Z. ÖZTAŞ, "Innovation Performance Analysis of G20 Countries: A Novel Integrated LOPCOW-MAIRCA MCDM Approach Including the COVID-19 Period," *Veriml. Derg.*, pp. 1–20, Jan. 2024, doi: 10.51551/verimlilik.1320794.
- [14] M. Keshavarz-Ghorabae, M. Amiri, E. K. Zavadskas, Z. Turskis, and J. Antucheviciene, "Determination of Objective Weights Using a New Method Based on the Removal Effects of Criteria (MEREC)," *Symmetry (Basel)*, vol. 13, no. 4, p. 525, Mar. 2021, doi: 10.3390/sym13040525.
- [15] D. Anastasya, S. Fahri, S. Situmorang, and D. Y. Niska, "Implementasi Metode Weighted Product dalam

- Menentukan E-Commerce Terbaik,” *Infomatek*, vol. 25, no. 1, pp. 55–60, Jun. 2023, doi: 10.23969/infomatek.v25i1.7699.
- [16] A. Tri Nugroho, K. Kusrini, and H. Al Fatta, “PERANGKINGAN DALAM PENENTUAN E-COMMERCE TERBAIK DENGAN METODE ANALYTICAL HIERARCHICAL PROCESS,” *J. PERANGKAT LUNAK*, vol. 5, no. 3, pp. 379–384, Oct. 2023, doi: 10.32520/jupel.v5i3.2798.
- [17] F. A. Siregar, A. F. Siregar, and E. W. N. Setiadi, “Sistem Pendukung Keputusan Menentukan E-Commerce Terbaik Menggunakan Metode Topsis,” *Kesatria J. Penerapan Sist. Inf. (Komputer dan Manajemen)*, vol. 5, no. 3, pp. 935–947, 2024, doi: 10.30645/kesatria.v5i3.419.
- [18] P. Citra, H. B. Santoso, and I. W. Sriyasa, “Sistem Pendukung Keputusan Pemilihan E-Commerce Menggunakan Pembobotan Entropy dan COPRAS,” *J. Ilm. Inform. dan Ilmu Komput.*, vol. 3, no. 1, pp. 36–45, 2024, doi: 10.58602/jima-ilkom.v3i1.25.
- [19] E. Pranita, J. P. Sembiring, A. Jayadi, N. U. Putri, A. Jaenul, and A. M. Fathurahman, “Melinjo Chip Dryer Monitoring System Using Fuzzy Logic Method,” in *2023 International Conference on Networking, Electrical Engineering, Computer Science, and Technology (IConNECT)*, Aug. 2023, pp. 98–102. doi: 10.1109/IConNECT56593.2023.10327339.
- [20] J. H. Lubis, M. Mesran, and C. A. Siregar, “The Decision Support System for Cashier Recruitment Implements the Multi-Attribute Utility Theory Method,” *Build. Informatics, Technol. Sci.*, vol. 6, no. 1, pp. 257–264, 2024.
- [21] M. N. D. Satria, S. Setiawansyah, and M. Mesran, “Combination of CRITIC Weighting Method and Multi-Attribute Utility Theory in Network Vendor Selection,” *Build. Informatics, Technol. Sci.*, vol. 6, no. 1, pp. 188–197, 2024, doi: 10.47065/bits.v6i1.5342.
- [22] A. D. Amanda, F. N. Arieni, and A. P. Windarto, “Penerapan Metode Multi Objective Optimization on The Basic of Ratio Analysis (MOORA) pada Pemilihan Masker Organik Wajah Berdasarkan Kriteria,” *J. Sist. Komput. dan Inform.*, vol. 2, no. 3, p. 289, May 2021, doi: 10.30865/json.v2i3.3011.
- [23] T. E. Teddy, Muhammad Luthfi Akbar, Nola Dita Puspa, and Mesran, “Penerapan Metode MOORA dan Pembobotan ROC Dalam Pemilihan Alat KB,” *J. Comput. Informatics Res.*, vol. 2, no. 2, pp. 37–43, Mar. 2023, doi: 10.47065/comforch.v2i2.524.
- [24] R. Aldisa, F. Nugroho, M. Mesran, S. A. Sinaga, and K. Sussolaikah, “Sistem Pendukung Keputusan Menentukan Sales Terbaik Menerapkan Metode Simple Additive Weighting (SAW),” *J. Inf. Syst. Res.*, vol. 3, no. 4 SE-Articles, Jul. 2022, doi: 10.47065/josh.v3i4.1955.