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Selection of the Best E-Commerce Platform Based on User Ratings using a Combination Entropy and SAW Methods

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Abstract

Choosing the right e-commerce platform has a crucial role for consumers and business actors. For consumers, a reliable and user-friendly platform provides a safe, convenient, and efficient shopping experience. Considering various aspects of choosing the right e-commerce platform is a strategic investment that can provide long-term added value for all parties involved in the digital ecosystem. The purpose of this study is to identify and determine the best e-commerce platforms based on user experience and assessment with an objective and structured decision-making approach using a combination of Entropy and SAW methods. The results of the ranking of the best e-commerce platform selection determined through the combination of the Entropy and SAW methods, obtained that Shopee ranked first with the highest preference value of 0.9819, followed by Tokopedia in second place with a value of 0.973. Furthermore, Blibli is in third place with a score of 0.9401, followed by Lazada with a score of 0.9305, and the last is Bukalapak with a score of 0.9021. This research makes a significant contribution to multi-criteria decision-making by applying a combination of Entropy and SAW methods to evaluate and determine the best e-commerce platform based on user assessments. The results of this research can be used as a practical reference as a basis for strategic decision-making in choosing the e-commerce platform that best suits market needs.

Keywords: E-commerce Platform Selection; User Experience Assessment; Entropy Method; Simple Additive Weighting (SAW); Multi-Criteria Decision-Making (MCDM)

1. INTRODUCTION

Choosing the right e-commerce platform has a crucial role for both consumers and business actors[1]. For consumers, a reliable and user-friendly platform provides a safe, convenient, and efficient shopping experience. Features such as easy navigation, a reliable payment system, and responsive customer service will increase customer satisfaction and loyalty. Meanwhile, for business actors, choosing the right platform can support business growth through good product management features, logistics integration, and sales analytics that help strategic decision-making. Platforms that support promotion and search optimization also open up greater opportunities to reach a wider market. Choosing the right e-commerce platform is not only the foundation in building a healthy digital ecosystem, but also the key to success in competing in an increasingly competitive era of digital commerce[1]–[3]. For MSMEs, it is very important to increase competitiveness without having to spend large costs on technology infrastructure. On the consumer side, a platform that is transparent in product information, customer reviews, and return policies provides a sense of trust and reduces risk in online transactions. The security of personal data and transactions is also a major consideration that cannot be ignored. By considering these various aspects, it can be concluded that choosing the right e-commerce platform is a strategic investment that can provide long-term added value for all parties involved in the digital ecosystem.

The large selection of e-commerce platforms available in the market today poses its own challenges for consumers and business actors in determining the choice that best suits their needs. Each platform has different advantages and disadvantages, both in terms of features, fees, commission schemes, market reach, and technical support offered. In these conditions, the need for a decision support system (DSS) is very important. These systems can help in objectively analyzing various platform alternatives based on certain criteria, such as ease of use, security, operational costs, marketing features, and logistics integration. With DSS, the decision-making process becomes more structured, transparent, and based on relevant data, thus minimizing the risk of misselection and maximizing the potential for success in running a business or getting an optimal shopping experience. For business actors, the use of DSS can help in designing more effective digital strategies, including choosing a platform that is able to provide wider market exposure, ease of integration of payment systems, and flexibility in managing product catalogs. Meanwhile, for consumers, DSS can serve as a guide to choose a platform that offers the best price, fastest service, and adequate consumer protection. Thus, the presence of a decision support system not only helps simplify the selection process, but also becomes a strategic tool in dealing with the complexity and dynamics of the ever-evolving e-commerce ecosystem. Assessment based on user experience (user review) plays an important role in the decision-making process, both by consumers and business actors in choosing an e-commerce platform[4], [5]. Reviews from previous users give a real idea of the advantages and disadvantages of a platform that are not always visible from official information or promotions. Through the live experience shared, potential users can evaluate important aspects such as delivery speed, payment system reliability, customer service response, and the quality of the products offered by sellers on the platform. For business actors, user reviews can be very valuable evaluation and input in improving service quality and adjusting business strategies. In addition, a platform's reputation formed from the accumulation of positive reviews can also increase the trust of potential new customers. In the context

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of a decision support system, user review can be used as one of the criteria or qualitative indicators that are processed quantitatively to strengthen the accuracy and objectivity of the recommendation results. Thus, user experience-based assessments not only serve as an additional source of information, but also as an important benchmark in determining the right choices and avoiding risks in the e-commerce ecosystem.

The Entropy weighting method is one of the objective approaches in determining the level of importance or weight of each criterion in the multi-criteria decision-making process[6]–[9]. The basic principle of this method is to measure the degree of uncertainty or diversity of information contained in the data of a criterion. The greater the variation in the value of a criterion between alternatives, the more it is considered to have a greater influence and gain a higher weight. On the other hand, if the data on a criterion is uniform or unvaried, then the information provided is considered low and the weight becomes small. Thus, the Entropy method allows for the determination of the weight of criteria quantitatively, without interference from the subjectivity of the decision-maker. The main advantages of this method are its objectivity, transparency, and ability to be used flexibly with other methods in decision support systems[10]–[13]. The Entropy weighting method has a number of advantages that make it very effective in multi-criteria decision-making systems. One of its main advantages is its objective nature, since it does not require an opinion or intuition from the decision-maker, but rather relies entirely on data variations between alternatives. The weight of the criteria is determined based on how much information or uncertainty each criterion contains, so the greater the variation, the higher the weight given. Its systematic and transparent calculation process makes this method easy to trace and replicate with consistent results. This method is also very suitable for large amounts of quantitative data, as it is able to handle the complexity of the data without compromising the accuracy of the analysis results.

The Simple Additive Weighting (SAW) method is one of the most popular and easy-to-implement multi-criteria decision-making methods[14]–[16]. This method is known as the weighted addition principle, where each alternative is assessed based on a number of criteria, and those values are added up after being multiplied by the weight of each criterion. The SAW method has major advantages in terms of simplicity, transparency, and efficiency. The uncomplicated calculation process allows users from a variety of backgrounds to understand and apply it easily. In addition, this method is flexible and can be used in a variety of fields. The SAW method provides a simple but powerful approach in assisting the decision-making process[17]–[20]. By considering all criteria in proportion to their weight, this method is highly effective in producing logical, measurable, and fair decisions. If used in conjunction with weighting methods such as RECA, the results obtained will be more objective and reliable.

Research on e-commerce selection was conducted by Saputra (2024) using the SAW method to provide recommendations for the most suitable e-commerce platforms for the community in the era of digitalization[21]. Research by Furi (2022) aims to be the best e-commerce recommendation using the SAW method, which complicates people's selection and determination of the best e-commerce[22]. Research by Sintaro (2023) applied the GRA method to provide the best e-commerce recommendations based on data obtained from the SimilarWeb website, based on the category of the most visited marketplace websites[23]. Research by Trisnawati (2022) applied the AHP method in selecting trusted online women's bag stores, which was appropriate based on the dimensions of online store satisfaction[24]. The gap in this research that sets it apart lies in the weighting method used; previous studies employed subjective weighting techniques, whereas this research utilizes objective weighting techniques based on data to produce criterion weights.

The purpose of this study is to identify and determine the best e-commerce platform based on user experience and assessment with an objective and structured decision-making approach using a combination of Entropy and SAW methods. With the combination of these two methods, the research aims to produce an evaluation system that not only considers user perceptions directly, but is also able to systematically process the assessment data in order to provide accurate recommendations. The contribution of this research lies in the application of a quantitative approach in helping consumers and business actors in choosing the e-commerce platform that best suits their needs. This research also provides methodological contributions through the integration of Entropy and SAW which is able to increase the objectivity of the weighting process and alternative selection.

2. RESEARCH METHODOLOGY

2.1 Research Stages

The research stage is a series of systematic steps taken to achieve research objectives methodologically and in a directed manner[25]–[27]. Each stage is structured to ensure that the data collection, analysis, and conclusion process is carried out validly, reliably, and logically.

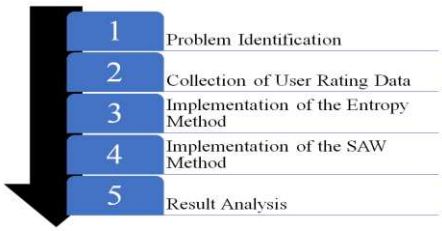

Figure 1. Research Stage

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In this study, the stages include problem identification, collection of user assessment data, weighting of criteria with the entropy method, calculation of alternative scores using the SAW method, and analysis of results. Figure 1 is the stage of research conducted.

The first stage of research from Figure 1 is the identification of problems which is the first step in this research which aims to recognize and formulate the main problems faced by users in choosing the best e-commerce platform. With the increasing choice of platforms such as Tokopedia, Shopee, Lazada, and Bukalapak, users often have difficulty determining which platform best suits their needs. This problem arises due to variations in service quality, differences in features, and a non-uniform user experience. Therefore, a systematic approach is needed that can help measure the performance of each platform objectively based on user assessments.

This stage involves the process of collecting data derived from reviews, surveys, or user assessments of various important aspects of using the e-commerce platform. The criteria used in this study include service speed, product price, transaction security, ease of use, product variety, and customer service quality. Data can be obtained from e-commerce platforms directly, online discussion forums, or through surveys distributed to active users. This assessment data is the basis for the alternative evaluation process using a multi-criteria decision-making method.

After the data is collected, the next step is to apply the Entropy Method, which is an objective method used to determine the weight or level of importance of each criterion based on the variation in information contained in the data. After the criteria weight is obtained through entropy, the next process is to evaluate and rank alternatives using the SAW method. In this method, the value of each alternative on each criterion is normalized, then multiplied by the weight of the relevant criteria. Next, the results are calculated to get the final score of each alternative. The highest-scoring alternative is considered the best e-commerce platform. SAW was chosen because of its ease of application and its ability to provide clear and measurable results.

The result analysis was carried out to interpret the final score of each e-commerce platform, as well as understand how the contribution of each criterion affects the ranking results. In this stage, the platform with the highest total value will be identified as the best alternative based on user ratings. In addition, an evaluation was also carried out on the role of dominant criteria, imbalances in assessments, and striking differences between alternatives. The results of this analysis provide important information not only for users who want to choose the best platform, but also for e-commerce platform developers to know the aspects that need improvement.

2.2 Entropy Method

The entropy method is one of the objective approaches used to determine the weight of each criterion in multicriteria decision-making. In contrast to subjective methods that rely on the opinions or perceptions of decision-makers, this method relies on actual information from existing assessment data, specifically the level of variation or uncertainty of the data in each criterion[28], [29]. With this method, an objective criterion weight is obtained, based on how much each criterion contributes in distinguishing alternatives.

The initial stage in the entropy method is to form a decision matrix, which is to compile assessment data from each alternative to a number of criteria. This data can come from surveys, user reviews, or other relevant sources.

$$X = \begin{bmatrix} x_{11} & \cdots & x_{n1} \\ \vdots & \ddots & \vdots \\ x_{1m} & \cdots & x_{nm} \end{bmatrix} \quad (1)$$

Each value in the decision matrix is then normalized so that it can be compared proportionally. Normalization is carried out using the formula:

$$k_{ij} = \frac{x_{ij}}{\sum_{j=1}^{n} x_{ij}} \quad (2)$$

Entropy is used to find out how much variation the value of each alternative is to a particular criterion. If a criterion has a uniform value (minimal variation), then the entropy value will be high, indicating that the criterion has low or less relevant information in the decision-making process. The entropy value for each criterion is calculated by the formula:

$$E_j = -\frac{1}{\ln m} \sum_{i=1}^{n} k_{ij} \ln(k_{ij}) \quad (3)$$

Degree of Divergence indicates the degree of variation or difference in data on a criterion. This value is used to assess how much information each criterion contains in distinguishing alternatives from each other. The Degree of Divergence value for each criterion is calculated by the formula:

$$D_j = 1 - E_j \quad (4)$$

The weight of criteria is a measure of the level of relative importance of each criterion in decision-making. In the entropy method, the weight is calculated objectively, based on the information and data variations provided by each criterion. The weighted value for each criterion is calculated by the formula:

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$$w_j = \frac{D_j}{\sum_{j=1}^{n} D_j} \quad (5)$$

The purpose of this stage is to objectively calculate the weight of the criteria based on how much each criterion contributes in distinguishing alternatives. Thus, criteria that have greater value variation will gain higher weight because they are considered more influential in the decision-making process.

2.3 SAW Method

The SAW method is one of the most popular methods in DSS that is used to solve multi-criteria or multi-attribute problems. This method is also known as the weighted addition method, because its main principle is to add up all the weights of the criteria value of each alternative to get the total value. The advantage of SAW is the high level of transparency in decision-making, as each stage of the process can be clearly tracked and explained[30], [31]. This makes SAW an ideal method for objective decision-making, especially when data is available and the weight of criteria has been well determined.
Making a decision matrix that displays the value or score of each alternative to each criterion using equation (1), the next stage of calculating the normalization value aims to equalize the scale of the data, so that the comparison between the criteria becomes fair. The formula for normalization values is.

$$r_{ij} \begin{cases} \frac{x_{ij}}{\max x_{ij}} ; if\ j\ is\ the\ benefit\ atributte \\ \frac{min\ x_{ij}}{x_{ij}} ; if\ j\ is\ the\ cost\ atributte \end{cases} \quad (6)$$

Each value of the normalization result is multiplied by the weight of each criterion. The result of this calculation will generate the final preference value of each alternative using the formula.

$$V_i = \sum_{j=1}^{n} w_j . r_{ij} \quad (7)$$

After going through the assessment and calculation process with the SAW method, each alternative will obtain a final score (preference score) that reflects how good the alternative is based on the overall criteria that have been determined. The final value is obtained from the sum of the multiplication between the normalization value and the weight of each criterion. The highest-rated alternative is considered the best alternative because it shows the most superior performance overall. This process helps decision-makers to objectively and structurally choose the alternative that best suits the goals or needs that have been set.

3. RESULT AND DISCUSSION

Selecting the best e-commerce platform based on user ratings using a combination of Entropy and SAW methods is a structured and objective approach in decision-making. In this approach, the Entropy method is used to objectively determine the weight of each criterion by measuring the degree of uncertainty or variation of the user's assessment data. The weight generated reflects the importance of each criterion based on real data, not subjective opinions. Furthermore, the SAW method is applied to calculate the final score of each platform by normalizing the performance value and multiplying it by the weight that has been obtained. The platform with the highest final score is considered the best choice, so the decisions taken are transparent, data-driven, and in accordance with user preferences.
By combining these two methods, the evaluation process becomes more accurate and fair, as it takes into account the variability of the data mathematically and assesses the performance of alternatives thoroughly based on the relevant weights. In addition, this approach also minimizes subjective bias in the assessment process, which is often a weakness in traditional decision-making. The end result is an e-commerce platform recommendation that not only excels in one aspect, but has consistent and balanced performance across a variety of important criteria. This approach is very beneficial for individuals, business actors, and organizations who want to choose the most suitable e-commerce platform to support business activities optimally.

3.1 Problem Identification

In the increasingly growing digital era, the use of e-commerce platforms has become an important part of buying and selling activities, both by individuals and business actors. The large selection of e-commerce platforms such as Tokopedia, Shopee, Bukalapak, Lazada, and others, makes users face difficulties in determining which platform best suits their needs. The main problem faced is how to choose the best e-commerce platform based on various aspects of service, such as the quality of the interface display, the speed of delivery, the security of transactions, the variety of products, and the response of customer service. Given that each user has a different experience, a systematic and objective approach is needed that can process user assessment data thoroughly to provide accurate and accountable recommendations. Therefore, a decision support system is needed that is able to integrate scientific methods in the process of selecting the best e-commerce platform.

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3.2 Collection of User Rating Data

The collection of user assessment data is an important stage in the process of selecting the best e-commerce platform, as this data is the basis for subsequent evaluation and calculation. Data is obtained from various sources, such as user reviews on e-commerce sites, survey results, or questionnaires distributed to respondents who have used several e-commerce platforms. The assessment was carried out against a number of criteria that were considered important, such as the appearance of the user interface, product variety, speed and accuracy of delivery, transaction security, and quality of customer service. Each criterion is assessed using a specific scale, which reflects the level of user satisfaction with each aspect of the service. The collected data is then compiled in the form of a decision matrix, where each row represents an alternative (e-commerce platform) and each column represents a criterion. This stage ensures that the information that will be used in the next analysis method truly reflects the perception and experience of the user in a real and relevant way. Table 1 is the result of data collection based on user reviews that have been conducted and collected.

Table 1. E-commerce valuation data

Platform E-Commerce	K1	K2	K3	K4	K5
Tokopedia	4.5	4.7	4.6	4.2	4.3
Shopee	4.6	4.8	4.4	4.5	4.2
Bukalapak	4.2	4.3	4.1	4.1	4.1
Lazada	4.3	4.5	4.2	4.3	4.1
Blibli	4.4	4.4	4.3	4.1	4.4

User rating data on e-commerce platforms is collected in table 1 based on five main criteria, namely user interface (K1), product variety (K2), transaction security (K3), delivery speed (K4), and customer service (K5). The assessment was carried out on five popular e-commerce platforms in Indonesia, namely Tokopedia, Shopee, Bukalapak, Lazada, and Blibli. Each platform is rated on a scale of 1 to 5 by a number of users based on their experience using the service. This information is then used as a basis for weight calculation with the Entropy method and the final assessment using the SAW method to determine the best e-commerce platform objectively and measurably.

3.3 Implementation of the Entropy Method

The Entropy method is one of the objective approaches in determining the weight of criteria based on diversity or variation of data. In the context of decision-making, the weight of criteria is very important because it shows how much influence a criterion has on the final outcome. The application of the Entropy method aims to avoid subjectivity in the weight determination process, by utilizing the actual assessment data that has been collected. In general, this method works by analyzing how scattered the values are on each criterion. Criteria that have varying or non-uniform assessment values are considered more informative, as they contribute more to distinguishing alternatives from each other. On the other hand, criteria that tend to be the same between alternatives are considered less informative and will be given less weight. Thus, the Entropy method generates weights that represent the natural level of importance of the criteria from the data, without interference with the decision-makers' subjective opinions. This method is particularly useful in data-driven decision-making based on multicriteria evaluation.

The initial stage in the entropy method is to form a decision matrix, namely compiling assessment data for each alternative against a number of criteria using equation (1) based on the assessment data in table 1.

$$X=\begin{bmatrix} x_{11} & x_{21} & x_{31} & x_{41} & x_{51} \\ x_{12} & x_{22} & x_{32} & x_{42} & x_{52} \\ x_{13} & x_{23} & x_{33} & x_{43} & x_{53} \\ x_{14} & x_{24} & x_{34} & x_{44} & x_{54} \\ x_{15} & x_{25} & x_{35} & x_{45} & x_{55} \end{bmatrix} \Rightarrow X=\begin{bmatrix} 4.5 & 4.7 & 4.6 & 4.2 & 4.3 \\ 4.6 & 4.8 & 4.4 & 4.5 & 4.2 \\ 4.2 & 4.3 & 4.1 & 4.1 & 4.1 \\ 4.3 & 4.5 & 4.2 & 4.3 & 4.1 \\ 4.4 & 4.4 & 4.3 & 4.1 & 4.4 \end{bmatrix}$$

Each value in the decision matrix is then normalized so that it can be compared proportionally. Normalization is calculated out using equation (2).

$$k_{11}=\frac{x_{11}}{\sum_{j=1}^{n} x_{11,15}}=\frac{4.5}{4.5+4.6+4.2+4.3+4.4}=\frac{4.5}{22}=0.2045$$

Table 2 is the result of the overall calculation of the normalization value of the matrix using the entropy method using the same equation for each alternative of the existing criteria.

Table 2. Results of normalization of the entropy method

Platform E-Commerce	K1	K2	K3	K4	K5
Tokopedia	0.2045	0.2070	0.2130	0.1991	0.2048
Shopee	0.2091	0.2115	0.2037	0.2133	0.2000
Bukalapak	0.1909	0.1894	0.1898	0.1896	0.1952
Lazada	0.1955	0.1982	0.1944	0.2038	0.1905
Blibli	0.2000	0.1938	0.1991	0.1943	0.2095

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Entropy is used to find out how much variation the value of each alternative is to a particular criterion, the entropy value for each criterion is calculated out using equation (3).

$$E_1 = -\frac{1}{\ln 5}\sum_{i=1}^{n} k_{11,15} \ln(k_{11,15}) = -0.6213 * (-1.6089) = 0.9997$$

$$E_2 = -\frac{1}{\ln 5}\sum_{i=1}^{n} k_{21,25} \ln(k_{21,25}) = -0.6213 * (-1.6086) = 0.9995$$

$$E_1 = -\frac{1}{\ln 5}\sum_{i=1}^{n} k_{11,15} \ln(k_{11,15}) = -0.6213 * (-1.6086) = 0.9995$$

$$E_1 = -\frac{1}{\ln 5}\sum_{i=1}^{n} k_{11,15} \ln(k_{11,15}) = -0.6213 * (-1.6086) = 0.9995$$

$$E_1 = -\frac{1}{\ln 5}\sum_{i=1}^{n} k_{11,15} \ln(k_{11,15}) = -0.6213 * (-1.6088) = 0.9996$$

Degree of divergence indicates the degree of variation or difference in data on a criterion. The Degree of Divergence value for each criterion is calculated by the using equation (4).

$$D_1 = 1 - E_1 = 1 - 0.9997 = 0.0003$$

$$D_2 = 1 - E_2 = 1 - 0.9995 = 0.0005$$

$$D_3 = 1 - E_3 = 1 - 0.9995 = 0.0005$$

$$D_4 = 1 - E_4 = 1 - 0.9995 = 0.0005$$

$$D_5 = 1 - E_5 = 1 - 0.9996 = 0.0004$$

The weight of criteria is a measure of the level of relative importance of each criterion in decision-making. The weighted value for each criterion is calculated by the using equation (5).

$$w_1 = \frac{D_1}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0003}{0.0003 + 0.0005 + 0.0005 + 0.0005 + 0.0004} = \frac{0.0003}{0.0022} = 0.1364$$

$$w_2 = \frac{D_2}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0005}{0.0003 + 0.0005 + 0.0005 + 0.0005 + 0.0004} = \frac{0.0005}{0.0022} = 0.2273$$

$$w_3 = \frac{D_3}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0005}{0.0003 + 0.0005 + 0.0005 + 0.0005 + 0.0004} = \frac{0.0005}{0.0022} = 0.2273$$

$$w_4 = \frac{D_4}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0005}{0.0003 + 0.0005 + 0.0005 + 0.0005 + 0.0004} = \frac{0.0005}{0.0022} = 0.2273$$

$$w_5 = \frac{D_5}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0004}{0.0003 + 0.0005 + 0.0005 + 0.0005 + 0.0004} = \frac{0.0004}{0.0022} = 0.1818$$

Based on the calculations using the Entropy method, objective weights were obtained for each criterion that reflected the level of contribution or importance in the decision-making process. Criteria with high assessment variations between alternatives have greater weight because they are considered to provide more significant information in distinguishing the quality of e-commerce platforms. The weights obtained through the Entropy method are objective and will be used in the final calculation stage of the SAW method to determine the best e-commerce platform in a comprehensive and fair manner.

3.4 Implementation of the SAW Method

The implementation of the SAW method is a decision-making process that is carried out by summing the performance values of each alternative against all criteria that have been given certain weight. This method is known for its simplicity in calculation and its ability to provide easy-to-understand results. The process begins by compiling a decision matrix, then normalizing the data so that all values are on a comparable scale. After that, the normalization values are multiplied

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by the weight of each criterion, which is obtained objectively through the Entropy method. The results of the multiplication are then added up to get the final score of each alternative. The highest-scoring alternative is considered to be the most optimal or best. The SAW method provides a systematic and measurable approach to integrate various criteria in one comprehensive calculation, making it very suitable for use in decision support systems for alternative selection, evaluation, and ranking.

The calculation of normalization values aims to equalize the scale of the data, so that the comparison between the criteria becomes fair. The results of the calculation for the normalization value using equation (6).

$$r_{11} = \frac{x_{11}}{\max x_{11,16}} = \frac{4.5}{4.6} = 0.9783$$

Table 3 is the result of the overall calculation of the normalization value of the matrix using the saw method using the same equation for each alternative of the existing criteria.

Table 3. Results of normalization of the SAW method

Platform E-Commerce	K1	K2	K3	K4	K5
Tokopedia	0.9783	0.9792	1.0000	0.9333	0.9773
Shopee	1.0000	1.0000	0.9565	1.0000	0.9545
Bukalapak	0.9130	0.8958	0.8913	0.8889	0.9318
Lazada	0.9348	0.9375	0.9130	0.9556	0.9091
Blibli	0.9565	0.9167	0.9348	0.9111	1.0000

Each value of the normalization result is multiplied by the weight of each criterion. The result of this calculation will generate the final preference value of each alternative using using equation (7).

$$V_1 = \sum_{j=1}^{n} w_{1,5}.r_{11,51}$$

$$V_1 = (w_1 * r_{11}) + (w_2 * r_{21}) + (w_3 * r_{31}) + (w_4 * r_{41}) + (w_5 * r_{51})$$

$$V_1 = (0.1364 * 0.9783) + (0.2273 * 0.9792) + (0.2273 * 1.0000) + (0.2273 * 0.9333) + (0.1818 * 0.9773)$$

$$V_1 = 0.1334 + 0.2225 + 0.2273 + 0.2121 + 0.1777$$

$$V_1 = 0.9730$$

$$V_2 = \sum_{j=1}^{n} w_{1,5}.r_{12,52}$$

$$V_2 = (w_1 * r_{12}) + (w_2 * r_{22}) + (w_3 * r_{32}) + (w_4 * r_{42}) + (w_5 * r_{52})$$

$$V_2 = (0.1364 * 1.0000) + (0.2273 * 1.0000) + (0.2273 * 0.9565) + (0.2273 * 1.0000) + (0.1818 * 0.9545)$$

$$V_2 = 0.1364 + 0.2273 + 0.2174 + 0.2273 + 0.1736$$

$$V_2 = 0.9819$$

$$V_3 = \sum_{j=1}^{n} w_{1,5}.r_{13,53}$$

$$V_3 = (w_1 * r_{13}) + (w_2 * r_{23}) + (w_3 * r_{33}) + (w_4 * r_{43}) + (w_5 * r_{53})$$

$$V_3 = (0.1364 * 0.9130) + (0.2273 * 0.8958) + (0.2273 * 0.8913) + (0.2273 * 0.8889) + (0.1818 * 0.9318)$$

$$V_3 = 0.1245 + 0.2036 + 0.2026 + 0.2020 + 0.1694$$

$$V_3 = 0.9021$$

$$V_4 = \sum_{j=1}^{n} w_{1,5}.r_{14,54}$$

$$V_4 = (w_1 * r_{14}) + (w_2 * r_{24}) + (w_3 * r_{34}) + (w_4 * r_{44}) + (w_5 * r_{54})$$

$$V_4 = (0.1364 * 0.9348) + (0.2273 * 0.9375) + (0.2273 * 0.9130) + (0.2273 * 0.9556) + (0.1818 * 0.9091)$$

$$V_4 = 0.1275 + 0.2131 + 0.2075 + 0.2172 + 0.1653$$

$$V_4 = 0.9305$$

$$V_5 = \sum_{j=1}^{n} w_{1,5}.r_{15,55}$$

$$V_5 = (w_1 * r_{15}) + (w_2 * r_{25}) + (w_3 * r_{35}) + (w_4 * r_{45}) + (w_5 * r_{55})$$

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$$V_5 = (0.1364 * 0.9565) + (0.2273 * 0.9167) + (0.2273 * 0.9348) + (0.2273 * 0.9111) + (0.1818 * 1.0000)$$

$$V_5 = 0.1304 + 0.2083 + 0.2125 + 0.2071 + 0.1818$$

$$V_5 = 0.9401$$

The end result of the SAW method is the total preference value for each alternative, which is obtained from the sum of the criteria weights multiplied by the normalization value of each alternative in each criterion. This value shows the level of feasibility or performance of each alternative based on all the criteria assessed.

3.5 Result Analysis

Analysis of the ranking results using a combination of the entropy weighting and SAW methods showed that each alternative was evaluated based on the total preference value calculated from the sum of the normalization values of the criteria that had been multiplied by the respective weights of the entropy method. The alternative with the highest final score is considered the best choice because it has the most optimal overall performance against all the criteria considered. These results provide an objective picture of the ranking of each alternative, allowing decision-makers to choose the option that best suits their goals or needs based on measurable quantitative data. In addition, the combination of the entropy and SAW weighting methods also makes it easier to compare various alternatives transparently and systematically. Figure 2 is the result of ranking using a combination of entropy and SAW weighting methods.

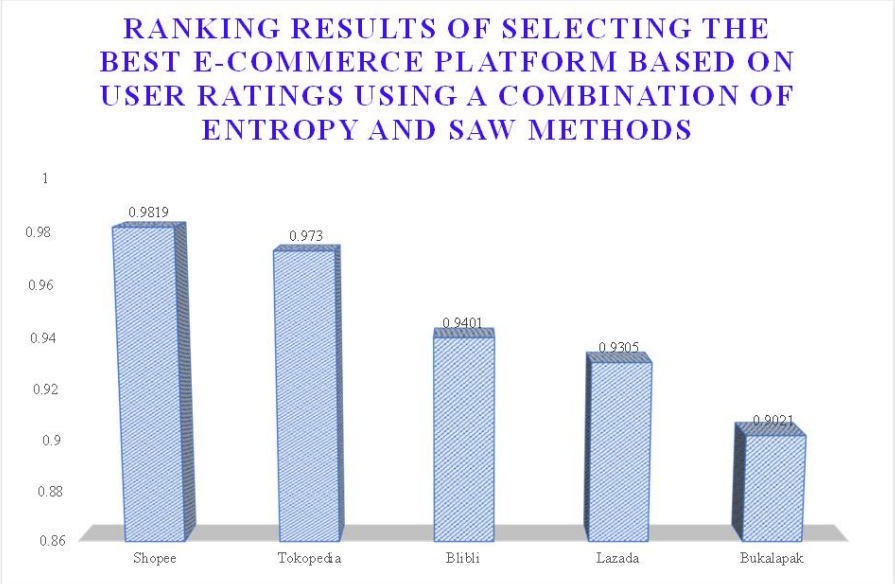

Figure 2. Alternative Ranking Results

The results of the ranking of the best e-commerce platform selection determined through the combination of the Entropy and SAW methods in figure 2, found that Shopee ranks first with the highest preference value of 0.9819, followed by Tokopedia in second place with a value of 0.973. Furthermore, Blibli is in third place with a score of 0.9401, followed by Lazada with a score of 0.9305, and the last is Bukalapak with a score of 0.9021. These results reflect that Shopee as a whole is the most superior in meeting the criteria determined based on user ratings, while Bukalapak received the lowest rating in this comparison. Entropy and SAW's combined approach provides an objective and systematic assessment, making it easier to identify the e-commerce platform that users are most likely to choose.

This research makes a significant contribution to multi-criteria decision-making by applying a combination of Entropy and SAW methods to evaluate and determine the best e-commerce platform based on user assessments. This approach not only increases objectivity in determining the weight of each criterion through the Entropy method, but also simplifies the process of calculating alternative final values using the SAW method. Thus, the results of this research can be used as a practical reference for consumers, business actors, and platform developers in understanding user preferences quantitatively and systematically, as well as as as a basis for strategic decision-making in choosing the best e-commerce platform according to the needs of the market.

4. CONCLUSION

The purpose of this study is to identify and determine the best e-commerce platform based on user experience and assessment with an objective and structured decision-making approach using a combination of Entropy and SAW methods. provide accurate recommendations. The results of the ranking of the best e-commerce platform selection determined through the combination of the Entropy and SAW methods, obtained that Shopee ranked first with the highest preference value of 0.9819, followed by Tokopedia in second place with a value of 0.973. Furthermore, Blibli is in third

place with a score of 0.9401, followed by Lazada with a score of 0.9305, and the last is Bukalapak with a score of 0.9021. These results reflect that Shopee as a whole is the most superior in meeting the criteria determined based on user ratings, while Bukalapak received the lowest rating in this comparison. This research makes a significant contribution to multi-criteria decision-making by applying a combination of Entropy and SAW methods to evaluate and determine the best e-commerce platform based on user assessments. The results of this study can be used as a practical reference for consumers, business actors, and platform developers in understanding user preferences quantitatively and systematically, as well as as a basis for strategic decision-making in choosing the e-commerce platform that best suits market needs.

REFERENCES

[1] S. L. Weng, H. L. Weng, F. L. Pei, S. H. Jaaman, and L. B. Swee, "Multi-Criteria Decision Making for the Selection of E-Commerce Platforms using AHP-TOPSIS Model," *J. Adv. Res. Appl. Sci. Eng. Technol.*, pp. 120–136, 2024, doi: https://doi.org/10.37934/araset.60.1.120136.

[2] Z. Zhu, Y. Bai, W. Dai, D. Liu, and Y. Hu, "Quality of e-commerce agricultural products and the safety of the ecological environment of the origin based on 5G Internet of Things technology," *Environ. Technol. Innov.*, vol. 22, p. 101462, 2021, doi: https://doi.org/10.1016/j.eti.2021.101462.

[3] P. Permata, "Pemilihan Aplikasi E-Commerce untuk Pengembangan Bisnis Virtual Menggunakan Metode VIKOR dan Rank Sum," *Chain J. Comput. Technol. Comput. Eng. Informatics*, vol. 2, no. 4 SE-Articles, pp. 150–160, Oct. 2024, doi: 10.58602/chain.v2i4.148.

[4] X. Liang, P. Liu, and Z. Wang, "HOTEL SELECTION UTILIZING ONLINE REVIEWS: A NOVEL DECISION SUPPORT MODEL BASED ON SENTIMENT ANALYSIS AND DL-VIKOR METHOD," *Technol. Econ. Dev. Econ.*, vol. 25, no. 6, pp. 1139–1161, Jul. 2019, doi: 10.3846/tede.2019.10766.

[5] S. I. N. Suwandi, X. W. Seloatmodjo, A. Situmorang, and N. A. Rakhmawati, "Analisis privasi data pengguna contact tracing application pengendalian COVID-19 di Indonesia berdasarkan PERPRES RI No. 95 tahun 2018 tentang sistem pemerintahan berbasis elektronik," *Teknol. J. Ilm. Sist. Inf.*, vol. 11, no. 1, pp. 46–58, 2021, doi: 10.26594/teknologi.v11i1.2174.

[6] D. T. Do, "Assessing the Impact of Criterion Weights on the Ranking of the Top Ten Universities in Vietnam," *Eng. Technol. Appl. Sci. Res.*, vol. 14, no. 4 SE-, pp. 14899–14903, Aug. 2024, doi: 10.48084/etasr.7607.

[7] A. Karim, "Implementation of the Multi-Objective Optimization Method on the Basic of Ratio Analysis (MOORA) and Entropy Weighting in New Employee Recruitment," *J. Inf. Syst. Res.*, vol. 5, no. 2 SE-Articles, Jan. 2024, doi: 10.47065/josh.v5i2.4859.

[8] Y. Shi, Q. Peng, and J. Zhang, "An objective weighting method of function requirements for product design using information entropy," *Comput. Aided. Des. Appl.*, vol. 17, no. 5, pp. 966–978, 2020, doi: 10.14733/cadaps.2020.966-978.

[9] Aditia Yudhistira, Setiawansyah, Temi Ardiansah, Sufiatul Maryana, Yuli Yadin, and Risma Oktaviani, "Development of Multi-Attribute Utility Theory Methods in Dynamic Decision Models Using Change-Data Driven," *Evergreen*, vol. 11, no. 4, pp. 3279–3289, Dec. 2024, doi: 10.5109/7326962.

[10] Q. Song, Z. Wang, and T. Wu, "Risk analysis and assessment of water resource carrying capacity based on weighted gray model with improved entropy weighting method in the central plains region of China," *Ecol. Indic.*, vol. 160, p. 111907, Mar. 2024, doi: 10.1016/j.ecolind.2024.111907.

[11] J. Tao, X.-H. Sun, Y. Cao, and M.-H. Ling, "Evaluation of water quality and its driving forces in the Shaying River Basin with the grey relational analysis based on combination weighting," *Environ. Sci. Pollut. Res.*, vol. 29, no. 12, pp. 18103–18115, 2022, doi: 10.1007/s11356-021-16939-z.

[12] M. P. Libório, R. Karagiannis, A. M. A. Diniz, P. I. Ekel, D. A. G. Vieira, and L. C. Ribeiro, "The Use of Information Entropy and Expert Opinion in Maximizing the Discriminating Power of Composite Indicators," *Entropy*, vol. 26, no. 2, p. 143, Feb. 2024, doi: 10.3390/e26020143.

[13] N. Shen, H. You, J. Li, and H. Qian, "Utilizing the Entropy Weighting Method to Determine Objective Weights in Robot Trajectory Optimization," in *2024 6th International Conference on Communications, Information System and Computer Engineering (CISCE)*, May 2024, pp. 251–255. doi: 10.1109/CISCE62493.2024.10653410.

[14] A. Diana and M. A. P. Kurniawan, "Decision Support System For Selection Of Internet Service Provider (ISP) With Analytical Hierarchy Process (AHP) And Simple Additive Weighting (SAW) Methods," *SYSTEMATICS*, vol. 4, no. 2, pp. 421–439, 2022, doi: 10.35706/sys.v4i2.6875.

[15] A. F. O. Pasaribu, "Decision Support System for Best Supplier Selection Using Simple Additive Weighting and Rank Sum Weighting," *Chain J. Comput. Technol. Comput. Eng. Informatics*, vol. 1, no. 3, pp. 106–112, 2023.

[16] C. Z. Radulescu and M. Radulescu, "A Hybrid Group Multi-Criteria Approach Based on SAW, TOPSIS, VIKOR, and COPRAS Methods for Complex IoT Selection Problems," *Electronics*, vol. 13, no. 4, p. 789, Feb. 2024, doi: 10.3390/electronics13040789.

[17] M. Arief, A. Triayudi, and I. D. Sholihati, "Comparison of the simple additive weighting saw method and multi-objective optimization by ratio analysis MOORA," in *IOP Conference Series: Materials Science and Engineering*, 2021, vol. 1088, no. 1, p. 12017.

[18] E. Rahmayana, "Penerapan Metode Simple Additive Weighting (SAW) dan Rank Order Centroid Dalam Analisis Kinerja Pegawai Honorer," *Resolusi Rekayasa Tek. Inform. dan Inf.*, vol. 4, no. 5, pp. 494–501, 2024.

[19] D. Pibriana, "Penggunaan Metode Simple Additive Weighting (SAW) dalam Pengambilan Keputusan Rekrutmen Karyawan Pada PT. ABC," *Techno. Com*, vol. 19, no. 1, pp. 45–55, 2020.

[20] E. F. Wati, "Penerapan Metode Simple Additive Weighting (SAW) Dalam Menentukan Lokasi Usaha," *J-SAKTI (Jurnal Sains Komput. dan Inform.*, vol. 5, no. 1, pp. 241–245, 2021, doi: 10.30645/j-sakti.v5i1.316.

[21] M. O. Saputra and A. S. Purnomo, "Rekomendasi Platform E-commerce Terbaik Menggunakan Metode (SAW)," *J. Tek. Inform. dan Sist. Inf. ISSN*, vol. 2407, p. 4322, 2024, doi: 10.35957/jatisi.v11i3.8055.

[22] R. E. Furi and D. N. Sulistyowati, "Implementasi Metode Saw Pada Sistem Penunjang Keputuasan Pemilihan E-Commerce Terbaik Di Masa Pandemi Covid-19," *Bianglala Inform.*, vol. 10, no. 2, pp. 124–128, Sep. 2022, doi: 10.31294/bi.v10i2.13186.

[23] 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.

[24] H. Trisnawati, V. Veranita, and S. Tarigan, "PENERAPAN METODE AHP UNTUK PEMILIHAN TOKO ONLINE TAS WANITA PADA PLATFORM SHOPEE," *J. Sist. Inf. dan Inform.*, vol. 5, no. 2 SE-Articles, Aug. 2022, doi: 10.47080/simika.v5i2.2005.
[25] B. Ezell, C. J. Lynch, and P. T. Hester, "Methods for Weighting Decisions to Assist Modelers and Decision Analysts: A Review of Ratio Assignment and Approximate Techniques," *Applied Sciences*, vol. 11, no. 21. 2021. doi: 10.3390/app112110397.
[26] B. Yagmahan and H. Yılmaz, "An integrated ranking approach based on group multi-criteria decision making and sensitivity analysis to evaluate charging stations under sustainability," *Environ. Dev. Sustain.*, vol. 25, no. 1, pp. 96–121, 2023, doi: 10.1007/s10668-021-02044-1.
[27] M. Bitarafan, K. A. Hosseini, and S. H. Zolfani, "Identification and assessment of man-made threats to cities using integrated Grey BWM- Grey MARCOS method," *Decis. Mak. Appl. Manag. Eng.*, vol. 6, no. 2, pp. 581–599, Oct. 2023, doi: 10.31181/dmame622023747.
[28] S. Zhang, X. Yu, H. Mao, H. Yao, and P. Li, "Evaluating Expressway Safety Based on Fuzzy Comprehensive Evaluation with AHP–Entropy Method: A Case Study of Jinliwen Expressway in Zhejiang Province, China," *Systems*, vol. 11, no. 10. 2023. doi: 10.3390/systems11100496.
[29] H. Su, Q. Niu, and Z. Yang, "Optimal Power Flow Using Improved Cross-Entropy Method," *Energies*, vol. 16, no. 14. 2023. doi: 10.3390/en16145466.
[30] T. Van Dua, "Combination of design of experiments and simple additive weighting methods: a new method for rapid multi-criteria decision making," *EUREKA Phys. Eng.*, no. 1 SE-Engineering, pp. 120–133, Jan. 2023, doi: 10.21303/2461-4262.2023.002733.
[31] K. Aliyeva, A. Aliyeva, R. Aliyev, and M. Özdeşer, "Application of Fuzzy Simple Additive Weighting Method in Group Decision-Making for Capital Investment," *Axioms*, vol. 12, no. 8. 2023. doi: 10.3390/axioms12080797.