The Assessment of Usability and Service Quality in E-Commerce Using the Integration of Analytical Hierarchy Process (AHP) and Technique for Order Performance by Similarity to Ideal Solution (TOPSIS)

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ABSTRACT

Manuscript type: Research paper
Research aims: This study aims to identify evaluation criteria for e-commerce platforms and determine the top-performing platform in the Indonesian marketplace.
Design/Methodology/Approach: The research employs a quantitative approach, utilising the Analytical Hierarchy Process (AHP) and the Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) model analysis. It involves analysing data from 100 respondents who are users of Shopee, Tokopedia, and Bukalapak e-commerce platforms.
Research findings: The findings suggest that the Usability criterion outperforms E-ServQual in terms of scores. Based on the AHP and TOPSIS techniques, Tokopedia, Shopee, and Bukalapak are ranked as the top three e-commerce platforms.
Theoretical contribution/Originality: This study contributes to understanding the importance of usability in evaluating e-commerce platforms and provides insights into customer preferences. It also demonstrates the sequential integration of AHP and TOPSIS techniques for evaluating multiple criteria.

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Practitioner/Policy implications: This study reveals that Satisfaction, Efficiency, and Learnability are crucial sub-criteria for customers when selecting an e-commerce platform. Improving these aspects can enhance consumer purchasing power and improve the overall user experience.
Research limitation/Implications: The limitation of the study is its geographic scope, as it was conducted solely in the Jakarta and Yogyakarta regions. Additionally, the research exclusively employs the AHP (Analytical Hierarchy Process) and TOPSIS (Technique for Order Performance by Similarity to Ideal Solution) methods.

Keywords: E-commerce, Service Quality, Customer Satisfaction, Analytical Hierarchy Process, Technique for Order Performance by Similarity to Ideal Solution
JEL Classification: D12, L81, M31

1. Introduction

The rapid growth of information and communication technology has had a significant impact on various aspects, including social, economic, political, and cultural dimensions, as well as changes in lifestyle, such as shifts in consumption habits and methods of buying and selling within communities. According to BPS Indonesia (2019), nowadays, people employ information and communication technologies to buy and sell products and services over the internet. This phenomenon is commonly referred to as electronic commerce (e-commerce). E-commerce is the process of buying and selling items, services, and information through the Internet. It involves transactions for purchasing and selling goods or services between two parties over the Internet, or the exchange and distribution of information between two parties within the same corporation using the Internet (Sarwono, 2012).

Based on a 2021 survey conducted by the Central Statistics Agency in Indonesia, using a sample of 3,504 Census Blocks across 101 regencies/cities in all provinces, it was found that 75.08% of respondents use e-commerce services to increase their company's sales. Based on this fact, it seems that offline sales have largely shifted to online sales through e-commerce. This suggests that e-commerce plays a significant role in Indonesian commerce. This shift can be attributed to various factors, including the simplicity of payment procedures, customer confidence, website quality, and more. When customer needs and satisfaction are met at a high standard, it fosters customer trust, making customer satisfaction a critical metric for establishing a sustainable business. E-commerce evaluates its quality based on the level of service and the convenience provided

to customers through website or application features (Nasrullah Setiawan, 2016).

According to iPrice's E-commerce Map of Indonesia study (Ahdiat, 2022), in the second quarter of 2021, Tokopedia recorded 147.79 million monthly site visits, surpassing Shopee's total of 126.997 million. Tokopedia has consistently led in website traffic since the fourth quarter of 2018. However, Shopee dominated both the App Store and PlayStore during this period. Nevertheless, Shopee's monthly online traffic is still lower than Tokopedia's 126.996 million.

According to a report by Bestari (2022), only Tokopedia and Shopee attract more than 100 million monthly visitors, distinguishing them from the top 10 e-commerce sites. Other e-commerce platforms receive an estimated monthly traffic of fewer than 30 million unique visitors. For example, Bukalapak has 29.49 million visits, Lazada has 27.67 million visitors, and Blibli ranks fifth with 18.44 million visits. Bhinneka, another e-commerce platform, follows Blibli with 6.99 million monthly web visitors. Orami and Ralali came next with 6.26 million and 5.12 million visitors, respectively. JD.id and Zalora occupy the ninth and tenth positions, with JD.id having 3.76 million visitors and Zalora with 3.37 million visitors (Bestari, 2022).

From a business perspective, this research can serve as a valuable resource, especially for individuals and organisations involved in e-commerce aiming to establish new criteria to enhance their e-commerce operations. Therefore, this study aims to address the following questions:

1. What are the key requirements for e-commerce platforms that incorporate the AHP and TOPSIS techniques?
2. Which subcriteria should be given priority for e-commerce marketplaces using the AHP and TOPSIS methods?
3. What aspects of e-commerce should marketplaces employing the AHP and TOPSIS methods focus on the most?

In alignment with the research questions mentioned earlier, the author has defined three research objectives for this study:

1. To establish the appropriate criteria for prioritising e-commerce marketplaces by employing the AHP and TOPSIS methods.
2. To pinpoint the relevant sub-criteria for prioritising e-commerce marketplaces using the AHP and TOPSIS methods.

3. To identify the e-commerce platforms that merit prioritisation within the marketplace through the application of the AHP and TOPSIS methods.

This research aimed to assess e-commerce using a combination of AHP (Analytical Hierarchy Process) and TOPSIS (Technique for Order Performance by Similarity to Ideal Solution). Integrating AHP and TOPSIS leverages the strengths of AHP in structuring assessments and considering customer preferences, along with the quantitative analysis capabilities of TOPSIS. This approach provides a comprehensive and robust evaluation of e-commerce platforms, making it a valuable methodology for decision-making in this context.

2. Theoretical Framework

With the help of the Internet and its rapid global reach, many businesses are strengthening their competitive edge by connecting with customers through e-commerce. Currently, e-commerce is among the most popular methods of buying products. E-commerce websites offer customers a wide range of services, and as time goes on and competition heats up, service providers are competing to deliver the best possible service to ensure customer satisfaction.

The research conducted by the authors for this study aims to identify the criteria used for evaluating e-commerce. The goal is to determine which factors have the most significant impact on the success of an e-commerce venture. This effort seeks to find the e-commerce platform that best meets these requirements and serves as a benchmark for other e-commerce businesses to follow.

Previous research by Wismar (2018), Ran Li (2020), Hana (2021), and Rakhmat (2019) has utilised e-servqual variables such as efficiency, fulfillment, privacy, system availability, responsiveness, compensation, and contact to assess a website's ability to provide effective and efficient shopping, purchasing, and product or service delivery facilities for consumers. This research also includes additional usability characteristics.

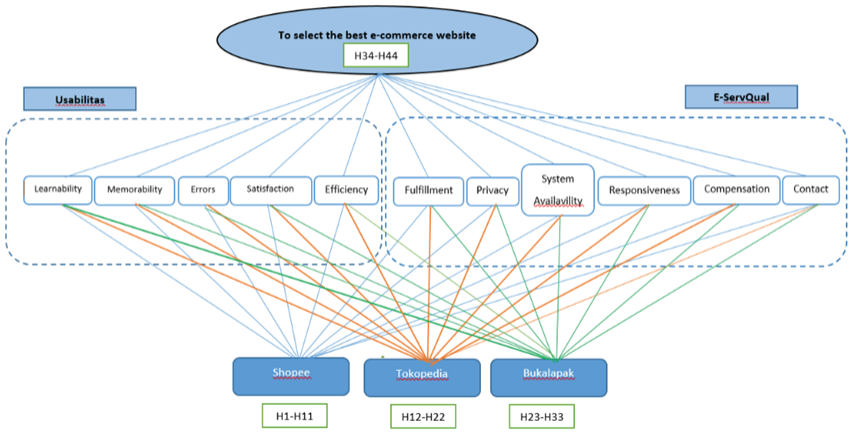
On the other hand, previous studies by Akinbowale (2019), Ryan (2017), Norizan (2010), and Feby (2017) have emphasised usability as a measure of the quality of the user experience when interacting with items or e-commerce website systems managed by users. To evaluate the viability of an e-commerce website, it is essential to research both its capacity to provide services and the quality of the user experience.

This research aimed to evaluate e-commerce by combining the

AHP (Analytical Hierarchy Process) and TOPSIS (Technique for Order Performance by Similarity to Ideal Solution) methodologies. Both methods were chosen for specific reasons. AHP is a decision support model that uses a functional hierarchy and customer input to assess e-commerce services. The final ranking of e-commerce platforms is then determined using the TOPSIS methodology.

The variables used in this study have been organised conceptually within a framework. This research model is depicted in Figure 1.

Figure 1: Research Model



3. Research Methodology

3.1 Types of Research

Every research study has distinct objectives and purposes. Research, based on its objectives, can be categorised into three types: exploratory, descriptive, and hypothesis testing (conclusive). In this research, a descriptive quantitative approach is employed with a cause-and-effect (causality research) perspective.

According to Indrawati (2015), quantitative research is a method aimed at accurately measuring behaviour, knowledge, opinions, or attitudes. Quantitative methods are widely utilised in various studies because they are well-suited for testing models or hypotheses. A causal approach is a research method used to examine the impact of one or more independent variables on a dependent variable.

In the process of designing research, formulating questions, and developing hypotheses, we utilise variables from a theoretical

framework. These variables include aspects related to usability, such as learnability, memorability, errors, and satisfaction. Additionally, we draw from the E-ServQual model, which includes efficiency, fulfillment, system availability, privacy, responsiveness, compensation, and contact, as found in various literature sources.

Every research has specific objectives and functions. Research objectives can be grouped into three categories: exploratory, descriptive, and causal hypothesis testing. In this research, it leans more towards hypothesis testing, which is conclusive or causal in nature. Conclusive research is conducted to determine and explain whether the relationships between variables observed in previous research also apply to other objects or fields.

To address all the research questions, we collect the required data through field surveys conducted using questionnaires. Following data collection, we proceed to analyse and describe the research issues through data analysis, statistical calculations, and data interpretation.

3.2 Operational Variables

The operationalisation of variables is the process of breaking down the variables in a research study into their smallest components, allowing for the classification of their measurements and facilitating the acquisition of the necessary data for assessing the research problem (Indrawati, 2015:124). According to Bougie (2010), operationalisation of variables is a process carried out to reduce the abstractness of a concept of a variable, making it measurable in a tangible form.

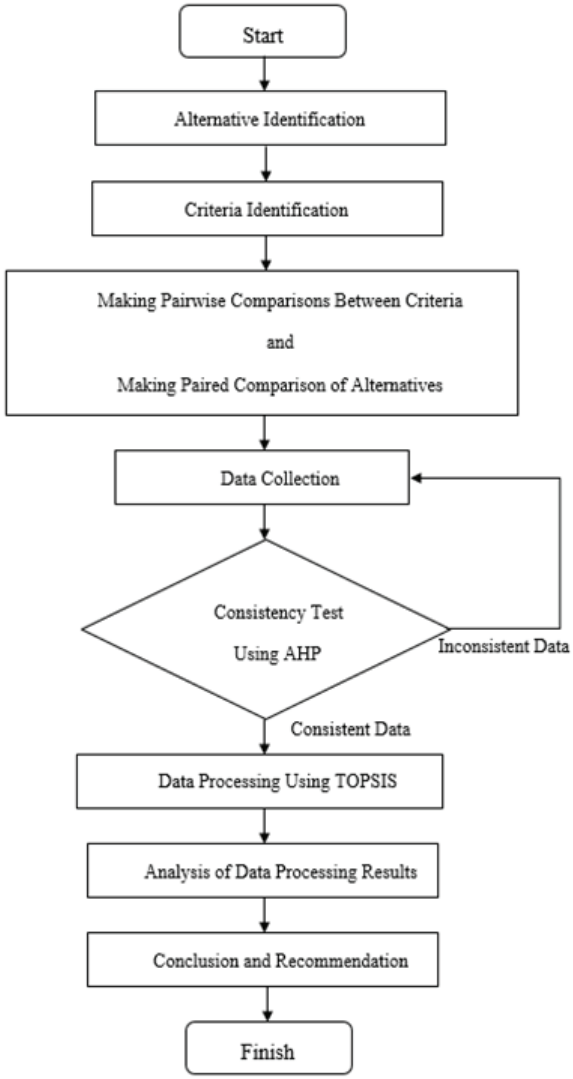
In this planning of a research study, problem formulation, and hypothesis development, a theoretical framework regarding the variables in service usability (C1), including learnability (SC11), efficiency (SC12), memorability (SC13), errors (SC14), and satisfaction (SC15), is used. Additionally, variables within the

E-ServQual (C2), including fulfillment (SC21), system availability (SC22), privacy (SC23), responsiveness (SC24), compensation (SC25), and contact (SC26), are employed. In addition, in this research, there will be three e-commerce platforms that we will test, some of which are Shopee (A1), Tokopedia (A2), and Bukalapak (A3).

3.3 Research Flow

Data is collected by observing and surveying respondents who have used e-commerce platforms like Tokopedia, Shopee, and Bukalapak. This process follows the research sequence outlined in Figure 2, entitled Research Flow.

Figure 2: Research Flow



The combination of the Analytical Hierarchy Process (AHP) and the Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) plays a crucial role in making well-informed and optimal decisions. This collaborative approach leverages the unique strengths of each method, creating a more comprehensive decision-making framework.

AHP is instrumental in determining the relative importance of various factors in the decision context, such as price, quality,

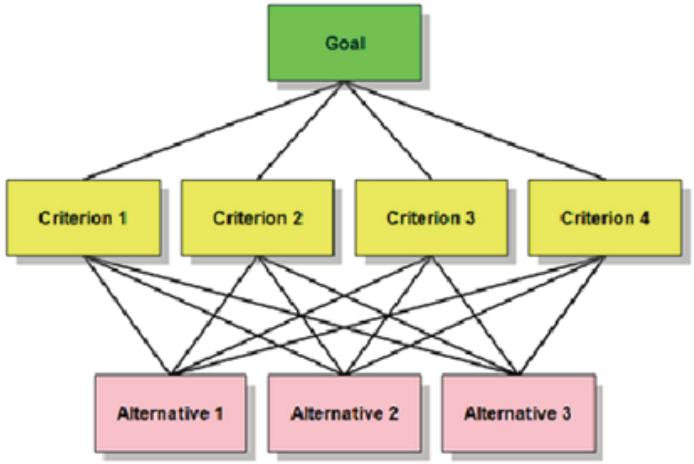
or speed, through pairwise comparisons. It assigns meaningful weights to each criterion, allowing decision-makers to understand the significance of each factor. Once the criteria's importance is established, TOPSIS comes into play by ranking the available alternatives based on their performance in relation to these criteria. It quantitatively assesses how well each alternative aligns with the defined criteria, facilitating a systematic comparison of options.

The synergy between AHP and TOPSIS results in a robust decision-making process. AHP sets the rules by determining the criteria's importance, effectively guiding the decision-making framework. TOPSIS then applies mathematical rigour to rank the alternatives, providing a clear hierarchy of options based on the weighted criteria.

3.4 Analytical Hierarchy Process (AHP)

Once the existing problem is defined, a decomposition process is initiated, which entails breaking down the overall issue into its constituent parts. To achieve precise results, this decomposition continues until further breakdown is no longer feasible. This process leads to the creation of multiple levels of the problem. Consequently, this analytical process is referred to as a hierarchy. You can observe the hierarchical structure of AHP in Figure 3 (Saaty, 2013).

Figure 3: General Hierarchy Structure of AHP



The AHP approach can assist in decision-making by following the stages outlined below (Saaty, 2013):

a. Identify objectives, criteria, sub-criteria, and alternative options based on current issues.
b. Construct a hierarchical tree that represents the various criteria, sub-criteria, and current choice options.
c. Create a pairwise comparison matrix named matrix A (Pairwise Comparison). The numbers in the i-th row and j-th column (Ai, j) represent the Relative Importance. In this matrix, Ai is compared to Aj. A 1 to 9 scale is typically used to express preferences for a range of issues. The scale values and their qualitative interpretations, according to the Saaty comparison scale, are displayed in Table 1 Comparison Rating Scale.

Table 1: Comparison Rating Scale

Intensity of Importance	Information
1	Both elements are equally important
3	One element is slightly more important than the other
5	One element is more important than the other
7	One element is definitely more absolutely important than the other
9	One element is absolutely important than the other
2,4,6,8	Values between two neighbouring judgment values

When conducting comparisons, it's important to note that an element is given a value of 1 when compared to itself. If element I (Ai) has a certain value when compared to element j (Aj), then Aj has the reciprocal value when compared to element I (Ai).

Here are the steps involved in the AHP process:

a. Establish the Eigenvector to create a ranking of the pairwise matrix based on its importance.
b. Calculate the Eigenvector for each alternative from the Pairwise matrix to rank the alternatives. The same procedure is used to rank the criteria.
c. Compute the Pairwise Comparisons matrix for each option.
d. Determine the Eigenvector value of each alternative.
e. Determine an Alternative Level by multiplying the Eigenvector value of each alternative by the Eigenvector value of the criteria. This results in the ranking of alternatives.

f. Test Logical Consistency to ensure that all components are logically and consistently assessed based on a logical criterion.

The weight matrix resulting from pairwise comparisons should contain both cardinal and ordinal relationships. These relationships can be illustrated as follows (Saaty, 2013):

> Cardinal relationship: aij * ajk = aik
> Ordinal relationship: If Ai > Aj, and Aj > Ak, then Ai > Ak. This relationship can be deduced from both multiplicative preferences and their inverses.

Deviations from consistency can occur, making the matrix not entirely constant. These deviations result from inconsistent preferences. To assess the consistency of the evaluation or its logical consistency, several steps are necessary to calculate the inconsistency ratio and determine if the assessment findings align consistently. Here are the steps for calculating logical consistency (Saaty, 2013).

a. Determine the weighted vector (weighted sum vector)

   This is accomplished by multiplying the first row of the priority matrix by the first column of the comparison matrix, followed by the second row of the priority matrix by the second column of the comparison matrix, the third row of the priority matrix by the third column of the comparison matrix, etc. The product of each row's or column's multiplication results is then computed.

b. Calculating the vector consistency (VC)

   Next, each element of the VJT is divided by each element of the priority matrix.

c. Calculating Lambda and Consistency Index
   Lambda (λ) is average value of the vector consistency.

d. Calculating the Consistency Index (CI)

$$\mathrm{CI} = \frac{\lambda - n}{n - 1} \tag{2.1}$$

With n being the number of factors being compared.

e. Ratio of Consistency (RC)

Consistency ratio is a consistency index divided by Random Index (RI). For more information, see the following formula.

$$\mathrm{RC} = \frac{\mathrm{CI}}{\mathrm{RI}} \tag{2.2}$$

The Random Index is directly proportional to the number of compared alternatives or systems. The Random Index is shown below in Table 2.

Table 2: Random Index Value

Matrix Size	RI value
1,2	0,00
3	0,58
4	0,90
5	1,12
6	1,24
7	1,32
8	1,41
9	1,45
10	1,49
11	1,51

For the AHP method, the acceptable inconsistency rate is down by 10%. So if the RC value is ≤ 0.1 (10%), then the result of the preferential comparison is consistent and vice versa if RC is > 0,1 (10%), then the findings of the comparison of preferences are contradictory. If it is inconsistent, a reevaluation is conducted.

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

The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) involves selecting an option that not only has the smallest distance from the positive ideal solution but also the largest distance from the negative ideal solution (Hwang, 1981). This approach is

widely used in various Multi-Attribute Decision Making (MADM) models to address real-world decision challenges (Hwang, 1993), (Liang, 1999), (Yeh, 2000). It is favoured because the concept is fundamental and easy to grasp, the calculations are efficient, and the performance of choice alternatives can be measured in a straightforward mathematical manner.

In general, the TOPSIS technique consists of the following phases (Kusumadewi, 2006):

a. Create a decision matrix that is normalised.
b. Establish a weighted normalised decision matrix..
c. Determine the positive ideal solution matrix as well as the negative ideal solution matrix.
d. Calculate the distance between the values of each alternative using the positive ideal solution matrix and the negative ideal solution matrix.
e. Determine the value of preference for each option.

TOPSIS requires a performance rating of each alternative A_i on each normalised C j criterion, namely:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}; \text{ with i = 1.2, ..., m; and j = 1, 2, ..., n.} \quad (2.3)$$

The positive ideal solution A^+ and the negative ideal solution A- can be determined based on the normalised weight rating (y_{ij}) as:

$$y\ ij = w\ i\ r_{ij}; \text{ where i = 1, 2, ..., m; and j = 1, 2, ..., n.} \quad (2.4)$$

$$A^+ = () ; (2.5) y_1^+, y_2^+, \dots, y_n^+ \quad (2.5)$$

$$A^- = () ; (2.6) y_1^-, y_2^-, \dots, y_n^- \quad (2.6)$$

With

$$y_j^+ = \begin{cases} \max_i y_{ij}; & \text{if j is the benefit attribute} \\ \min_i y_{ij}; & \text{if j is the cost attribute} \end{cases} \quad (2.7)$$

$$y_j^- = \begin{cases} \min_i y_{ij}; \text{ if j is the benefit attribute} \\ \max_i y_{ij}; \text{ if j is the cost attribute} \end{cases} \quad (2.8)$$

The distance between the alternative A_i and the positive ideal solution is formulated as follows:

$$D_i^+ = \sqrt{\sum_{j=1}^{n}\left(y_i^+ - y_{ij}\right)^2}\ ; i = 1, 2, ..., m. \quad (2.9)$$

The distance between the alternative A_i and the negative ideal solution is formulated as follows:

$$D_i^- = \sqrt{\sum_{j=1}^{n}\left(y_{ij} - y_i^-\right)^2}\ ; i = 1, 2, ..., m. \quad (2.10)$$

The value preference for each alternative (V_i) is given as follows:

$$V_i = \frac{D_i^-}{D_i^- + D_i^+}\ ; i = 1, 2, ..., m. \quad (2.11) \quad (2.11)$$

The largest value$_{of}$ Vi indicates that the alternative A_i is preferred.

4. Research Results

4.1 AHP Criteria Weight

The following results are acquired because of the data processing that has been carried out:

Table 3: Criteria Weight Calculation Results

No	Information	Code	Weight Value	Ranking
1	Usability (Ease of Use)	C1	0.53747	1
2	E-ServQual (System Quality)	C2	0.46253	2

Based on the results as shown in Table 3 above, it can be explained that the Usability criterion (Ease of Use) has a weight value of 0.53747, ranking first. This indicates that the Usability criterion (Ease of Use) plays a crucial role in evaluating e-commerce. Following that is the E-ServQual (System Quality) criterion with a weight

value of 0.46253, ranking second. It holds the second position after the Usability criterion (Ease of Use). This means that respondents prioritise the Usability criterion (Ease of Use) followed by E-ServQual (System Quality) criterion over other criteria.

4.2 AHP Sub-Criteria Weight – Ease of Use

This section reflects the data based on the Usability or Ease of Use sub-criterion. Table 4 shows the results obtained based on the processing of data that has been performed:

Table 4: Usability Sub-Criterion Weight Calculation Results (Ease of Use)

No	Information	Code	Weight Code	Ranking
1	Learnability	SC11	0.20354	3
2	Efficiency	SC12	0.20444	2
3	Memorability	SC13	0.17175	4
4	Errors	SC14	0.20312	5
5	Satisfaction	SC15	0.21716	1

On the basis of the following data processing outcomes, table 5 shows the results of the sub-criteria e-servqual weight calculation.

Table 5: Results of Sub-Criteria E-ServQual Weight Calculation (Quality of system)

No	Information	Code	Weight Code	Ranking
1	Fulfillment	SC21	0.15673	6
2	System Availability	SC22	0.17591	2
3	Privacy	SC23	0.16265	3
4	Responsiveness	SC24	0.15951	5
5	Compensation	SC25	0.16235	4
6	Contact	SC26	0.18285	1

4.2.1 Learnability Sub-Criteria Weight (SC11)

Based on the received processing results, the weight codes for the learnability sub-criteria for each e-commerce platform can be shown in table 6:

Table 6: Results of Alternative Value Calculation reviewed from Sub-Criteria *Learnability* (SC11)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.34797	2
2	Tokopedia	A2	0.46113	1
3	Bukalapak	A3	0.19090	3

4.2.2 Efficiency Sub-Criteria Weight (SC12)

Based on the received processing results, the weight codes for the efficiency sub-criteria for each e-commerce platform can be shown in table 7:

Table 7: Results of Alternative Value Calculation reviewed from Sub-Criteria *Efficiency* (SC12)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.35610	2
2	Tokopedia	A2	0.46970	1
3	Bukalapak	A3	0.17420	3

4.2.3 Memorability Sub-Criteria Weight (SC13)

Based on the received processing results, the weight codes for the memorability sub-criteria for each e-commerce platform can be shown in table 8:

Table 8: Results of Alternative Value Calculation reviewed from Sub-Criteria *Memorability* (SC13)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.35354	2
2	Tokopedia	A2	0.48162	1
3	Bukalapak	A3	0.16484	3

4.2.4 Errors Sub-Criteria Weight (SC14)

Based on the received processing results, the weight codes for the errors sub-criteria for each e-commerce platform can be shown in table 9:

Table 9: Results of Alternative Value Calculation reviewed from Sub-Criteria *Errors* (SC14)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.32480	1
2	Tokopedia	A2	0.32724	2
3	Bukalapak	A3	0.34795	3

4.2.5 Satisfaction Sub-Criteria Weight (SC15)

Based on the received processing results, the weight codes for the satisfaction sub-criteria for each e-commerce platform can be shown in table 10:

Table 10: Results of Alternative Value Calculation reviewed from Sub-Criteria *Satisfaction* (SC15)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.34666	2
2	Tokopedia	A2	0.47032	1
3	Bukalapak	A3	0.18302	3

4.3 AHP Sub-Criteria Weight – System Quality

This section reflects the data based on the E-ServQual or System Quality sub-criterion.

4.3.1 Fulfillment Sub-Criteria Weight (SC21)

Based on the received processing results, the weight codes for the fulfillment sub-criteria for each e-commerce platform can be shown in table 11:

Table 11: Results of Alternative Value Calculation reviewed from Sub Criteria *Fulfillment* (SC21)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.35531	2
2	Tokopedia	A2	0.46560	1
3	Bukalapak	A3	0.17909	3

4.3.2 System Availability Sub-Criteria Weight (SC22)

Based on the received processing results, the weight codes for the availability sub-criteria for each e-commerce platform can be shown in table 12:

Table 12: Results of Alternative Value Calculation reviewed from Sub-Criteria *System Availability* (SC22)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.34989	2
2	Tokopedia	A2	0.47108	1
3	Bukalapak	A3	0.17903	3

4.3.3 Privacy Sub Criteria Weight (SC23)

Based on the received processing results, the weight codes for the privacy sub-criteria for each e-commerce platform can be shown in table 13:

Table 13: Results of Alternative Value Calculation reviewed from Sub Criteria *Privacy* (SC23)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.35883	2
2	Tokopedia	A2	0.46526	1
3	Bukalapak	A3	0.17591	3

4.3.4 Responsiveness Sub Criteria Weight (SC24)

Based on the received processing results, the weight codes for the responsiveness sub-criteria for each e-commerce platform can be shown in table 14:

Table 14: Results of Alternative Value Calculation reviewed from Sub Criteria *Responsiveness* (SC24)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.35996	2
2	Tokopedia	A2	0.46977	1
3	Bukalapak	A3	0.17027	3

4.3.5 Compensation Sub Criteria Weight (SC25)

Based on the received processing results, the weight codes for the compensation sub-criteria for each e-commerce platform can be shown in table 15:

Table 15: Results of Alternative Value Calculation reviewed from Sub Criteria *Compensation* (SC25)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.35399	2
2	Tokopedia	A2	0.47426	1
3	Bukalapak	A3	0.17175	3

4.3.6 Contact Sub Criteria Weight (SC26)

Based on the received processing results, the weight codes for the contact sub-criteria for each e-commerce platform can be shown in table 16:

Table 16: Results of Alternative Value Calculation reviewed from Sub Criteria *Contact* (SC26)

No	Information	Code	Weight Code	Ranking
1	Shopee	A1	0.32168	3
2	Tokopedia	A2	0.35120	1
3	Bukalapak	A3	0.32712	2

4.3.7 The final calculation AHP-TOPSIS

Based on the data processing results, the final ranking weight for each e-commerce platform is as shown in table 17:

Table 17: Final Results of Calculations AHP-TOPSIS

Alternatif	D+	D-	V	Percentage	Ranking
Shopee	0.04309	0.04143	0.49017	32.838%	2
Tokopedia	0.00030	0.08433	0.99644	66.754%	1
Bukalapak	0.08432	0.00052	0.00610	0.408%	3
TOTAL			1.49271	100%	

Based on the calculations above, the results indicate that the values of each alternative based on the highest score are as follows: Tokopedia has a score of 0.99644 or 66.754%. Next is Shopee with a score of 0.49017 or 32.838%. The last is Bukalapak has a score of 0.00610 or 0.408%.

5. Conclusion and Suggestion

5.1 Conclusion

Based on the data processing and analysis conducted in the previous part, the following conclusions can be drawn:

1. The criteria deserving prioritisation for the e-commerce marketplace, using the integration of the AHP and TOPSIS methods, are Usability (Ease of Use) with a weight value of 0.53747, and E-ServQual (System Quality) with a weight value of 0.46253. This indicates that customers prioritise the user-friendliness of an e-commerce platform over the quality of the system it offers.
2. Sub-criteria should also be prioritised for the e-commerce market using the integration of the AHP and TOPSIS methods. When sorted from the highest to the lowest final criterion weight value, the top three sub-criteria are Satisfaction with a weight value of 0.21716, Efficiency with 0.20444, and Learnability with 0.20354. Errors have a weight value of 0.20312, Contact at 0.18286, System Availability at 0.17592, Memorability at 0.17176, Privacy at 0.16265, Compensation at 0.16235, Responsiveness at 0.15951, and Fulfillment at 0.15673. Notably, the top three sub-criteria, namely Satisfaction, Efficiency, and Learnability, all belong to the usability criterion group, emphasising the importance of user-friendliness in e-commerce.
3. Based on the integration of the AHP and TOPSIS methods, Tokopedia is qualified as the most suitable e-commerce platform with a score of 66.754%, followed by Shopee with a score of 32.838%, and then Bukalapak with a score of 0.409%. Tokopedia outperforms in 10 sub-criteria, including Learnability, Efficiency, Memorability, Satisfaction, Fulfillment, System Availability, Privacy, Responsiveness, Compensation, and Contact, compared to Shopee and Bukalapak. On the other hand, Shopee excels in 1 sub-criterion, which is Errors, when compared to Tokopedia and Bukalapak. It's worth noting that Bukalapak does not exhibit superior sub-criteria compared to Tokopedia and Shopee.

5.2 Suggestions

After conducting data processing, analysing the processed data, and drawing conclusions, the researchers have identified feedback and recommendations that can be taken into consideration by companies involved in the e-commerce business process aimed at improving the quality of services:

5.2.1 For Companies

From the results of this research, it is evident that satisfaction, efficiency, and learnability are the top three priorities for customers when choosing an e-commerce platform. If we delve deeper, all three of these criteria fall under the sub-criterion of usability. This implies that the user experience perceived by e-commerce users, particularly the ease with which users can learn the features offered by an e-commerce platform, the perceived speed of utilizing features, and the level of satisfaction in conducting online shopping, should be enhanced by e-commerce companies.

The following are recommendations that can be provided to each of the e-commerce platforms that were the subjects of this research:

A. Tokopedia

Tokopedia stands as the top choice among respondents when selecting the best e-commerce platform, based on several sub-criteria including Learnability, Efficiency, Memorability, Satisfaction, Fulfillment, System Availability, Privacy, Responsiveness, Compensation, and Contact. This serves as a reference point for e-commerce companies in providing excellent service to e-commerce customers in the criteria of Usability (ease of use) and E-servqual. However, in the sub-criteria of errors, Tokopedia received a score lower than Shopee. Therefore, Tokopedia should address issues related to bugs in its website and application software to minimize error-related problems such as functional errors, performance defects, usability defects, compatibility errors, and other issues caused by application bugs commonly experienced by e-commerce users. By resolving these error-related issues, Tokopedia can excel in all criteria in this research.

B. Shopee

Shopee holds the second position in this research. Shopee ranks first in the sub-criteria of errors, indicating that users experience fewer errors compared to Tokopedia and Bukalapak. This is an aspect that Shopee should maintain by continually monitoring and improving its software application programs and website. However, in other sub-criteria, including Learnability, Efficiency, Memorability, Satisfaction, Fulfillment, System Availability, Privacy, Responsiveness, Compensation, and Contact, Shopee secures the second position below Tokopedia but above Bukalapak.

In terms of Usability, Shopee could enhance its user interface to be more user-friendly, easier to remember, and more straightforward to learn. Improving the efficiency of the purchase process could further enhance Learnability, Efficiency, Memorability, and Satisfaction. Offering attractive promotions, expanding the product catalog could boost Fulfillment and System Availability. Ensuring the security of customer data and responding promptly to customer complaints could improve Privacy and Responsiveness. Strengthening compensation guarantees in case of issues and enhancing the performance of customer service in serving customers could elevate Compensation and Contact. In conclusion, Shopee has the potential to enhance its performance by addressing these areas of improvement in its e-commerce services.

C. Bukalapak

Bukalapak is ranked last below Shopee and Tokopedia in this research findings. Bukalapak needs to take cues from Shopee and Tokopedia in enhancing its services and features for customers. A more aggressive promotional strategy is necessary to attract more customers. In terms of Usability, Bukalapak could improve its user interface to be more user-friendly, easier to remember, and easier to learn. Efficiency in the purchasing process should also be enhanced to improve Learnability, Efficiency, Memorability, and Satisfaction. Additionally, offering attractive promotions, expanding the product catalog, and providing various payment

options could boost Fulfillment and System Availability. Ensuring the security of customer data and responding promptly to customer complaints could enhance Privacy and Responsiveness. Strengthening compensation guarantees in case of issues and improving the performance of customer service in serving customers could elevate Compensation and Contact. In conclusion, Bukalapak has opportunities for improvement in various aspects of its e-commerce services to enhance its ranking and overall performance in the market.

5.2.2 For Further Researchers

For future improvements, there are several suggestions that can be considered by companies and for further research. These recommendations include exploring integrations other than AHP and TOPSIS for e-commerce selection. Additionally, conducting comparisons of e-commerce platforms with alternative criteria could provide valuable insights for future research endeavours.

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