

Decision of E-Commerce Services for Students Using Analitical Hierarchy Process (AHP) as Decision Support for E-Commerce Shopping Service Selection

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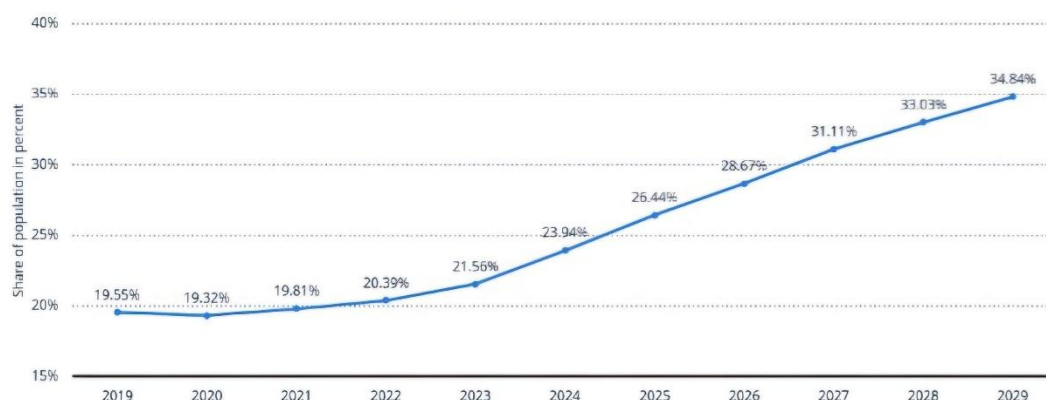
Abstract Online shopping is becoming a habit among the public due to the convenience it offers. This research aims to help consumers choose the appropriate e-commerce application, using the Analytic Hierarchy Process (AHP) method and involving 33 respondents. The three e-commerce platforms analyzed are Shopee, Tokopedia, and Lazada. The results show that Shopee ranks first in all evaluated criteria, namely price, delivery speed, transaction security, and product completeness. Thus, Shopee has become the most chosen platform by respondents. The first and subsequent rankings in the Price Criteria = Shopee with 53.27%. Delivery Speed Criteria = Shopee 36.8%. Transaction Security Criteria = Shopee 54.14%. Product Completeness Criteria = Shopee 63.07%. If we look at the processed data we obtained, the Shopee application was chosen 4 times, or among all the criteria, Shoope is in the first position.

Keywords: Online Shopping, E-Commerce Apps, Decision Makers, Analytical Hierarchy Process (AHP).

Introduction

The rapid development of technology and information has affected all sectors of life. This has changed the way humans behave, one of which is shopping. In today's digital world, individuals tend to shop through e-commerce rather than coming directly to traditional or modern markets. Based on data from the Ministry of Trade of the Republic of Indonesia, the number of e-commerce users in Indonesia has continued to increase since 2020, until in 2023 the number of e-commerce users in Indonesia was 58.63 million users. The number of e-commerce users in Indonesia is expected to continue to increase until 2029 reaching 99.1 million users. Here is Figure 1, a graph of e-commerce users in Indonesia:

Figure 1. Graph of e-commerce users in Indonesia



Source : (Processed by PDSI, Ministry of Trade)

Chart of e-commerce users in Indonesia

Based on the data above, we can see that the number of e-commerce users will continue to grow every year. As we can see there are several applications that are often visited by consumers, namely, in

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(Dihni, 2022) Similar Web Databoks data, Shopee has 191 million visitors, Tokopedia 136 million visitors, Lazada has 83 million visitors, Blibli 37 million visitors and then Bukalapak is 19 million visits. The data above are the five most widely used e-commerce in Indonesia.

Before going further, the author will explain the definition of e-commerce. Maulana, et al (2018) supported by David KJ and Tjurban T in (Purnama & Putri, 2021) explain e-commerce is a business procedure carried out with communication networks and computers to introduce, offer, buy and sell products to consumers. In this study, researchers will focus on Shopee, Tokopedia and Lazada. Because, these three marketplaces are most often used by students.

The purpose of this study is to identify the main criteria used by consumers when choosing a marketplace. Although it is now in a digital era, consumers still often experience confusion in making choices about the same product but have different prices. Even with the various conveniences offered today, there are still a number of negative aspects that can arise, such as delivery problems, service quality, product mismatches, security, and so on. Therefore, this research aims to make it easier for students to find which e-commerce can be chosen when compared with several criteria and after the results come out, it can be found which e-commerce dominates the criteria using the Analytical Hierarchy Process (AHP) method.

Where the Analytical Hierarchy Process (AHP) method is a method that facilitates the decision-making process. Analytical Hierarchy Process (AHP) is a decision support method developed by Thomas L., Saaty in 1980. AHP is a decision-making tool that describes a complex problem in a hierarchical structure with many levels consisting of goals, criteria, and alternatives. (Agus, I Nengah Dwijayadi et al., 2018). Some previous researchers have similarities and differences such as similarities in alternatives and in criteria that are used as objects of research and differences. For example, about the criteria studied, such as the criteria for experts who become sources and criteria in selecting comparison criteria. Examples of comparison criteria in research (Hardini, Khamaludin & Rahayu, 2023) that have promo criteria variables, product prices, payment methods, discounts, and product completeness. In research (Mahendra & Nugraha, 2020) has variable criteria for reputation, price, product, customer care, delivery, UX and apps, payment, security and policies. The use of various methods is also one of the other differences. And third there is research (Verina et al., 2021) has criteria for the suitability of goods, free shipping vouchers, accuracy of delivery of goods. In the research of Putri, D. A, & Wijianto, R. (2021). This study uses AHP for consumer preferences for e-commerce in Indonesia by considering several criteria, this study found that Tokopedia is the top choice of consumers followed by Shopee, Lazada, and Bukalapak.

There are various kinds of marketplaces in Indonesia that can make it easier for consumers to choose which marketplace is more affordable in terms of price, product quality, delivery speed and product safety. Each marketplace must have its own shortcomings and advantages. In order to make it easier for consumers to choose the marketplace to be selected, research was conducted using the Analytical Hierarchy Process (AHP) method.

Literature Review

Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process method is a multicriteria decision-making approach developed by Thomas L. Saaty in 1980. AHP is used to solve complex problems by decomposing them into a hierarchical structure consisting of main objectives, criteria, sub-criteria (if any), and decision alternatives (Saaty, 1980).

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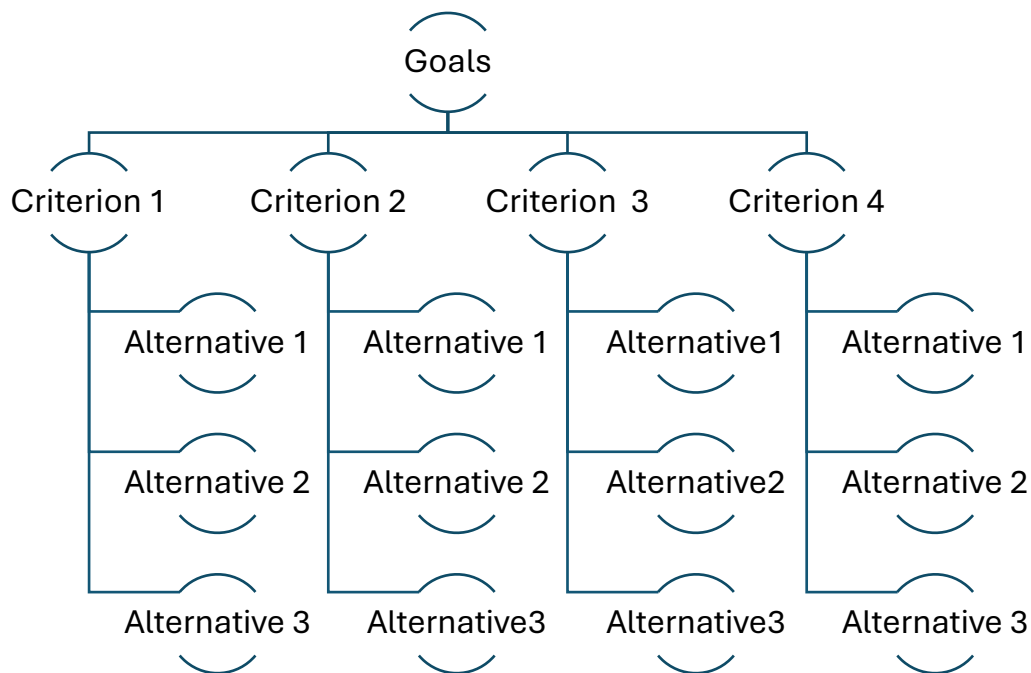
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Table 1. Pairwise Comparison Scale

Intensity of Interest	Explanation
1	Both Criteria have the same contribution to the determination of E-Commerce selection
3	Where the importance of the criterion is obvious but not so convincing as a determinant of E-Commerce selection.
5	The factor is much more important than other criteria
7	The criterion is much more important
9	The criterion is absolutely and very important
2,4,6,8	The middle value between the above two considerations

Source : Processed by Researchers

Figure 2. AHP Hierarchy Structure



Source : Processed by Researchers

E-commerce

E-commerce is an online channel that a person can reach through a computer used by business people in conducting their business activities and used by consumers to obtain information using computer assistance, which in the process begins with providing information services to consumers in making choices (Kotler and Armstrong 2012). E-commerce is the process of buying and selling and marketing goods and services through electronic systems, such as radio, television and computer networks or the internet (Wong 2010).

From several definitions of e-commerce, the researcher then defines e-commerce as a system that connects technology, applications, and business processes to connect companies (producers), consumers, and certain communities. Through this system, there is an exchange of goods between

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companies (producers) and consumers through electronic transactions, followed by the process of shipping between regions until it reaches consumers.

Based on this understanding, researchers identify that there are important factors that are of concern to consumers when choosing e-commerce. These factors include price criteria, delivery speed, transaction security and the completeness of the products being sold. Therefore, these variables are used as the basis in this study to measure consumer preferences in choosing an e-commerce platform.

Consumer behavior in e-commerce

Consumer behavior is the study of how individuals, groups, and organizations choose, buy, and use goods, services, ideas, or experiences to satisfy their needs and wants (Kotler and Keller, 2016). The factors that influence consumer behavior are cultural, social, personal, and psychological factors. In the context of students as e-commerce consumers, students have a tendency to choose the platform used, this student behavior is influenced by factors:

1. Price: Usually students tend to choose products with competitive prices according to their budget.
2. Ease of Access: E-commerce platforms provide easy access through applications and the internet.
3. Transaction Convenience: Fast payment processing and features such as product reviews enhance the shopping experience.

Decision Making in Online Shopping

A decision support system is a system that can support the work of a decision maker in solving or providing solutions to semi-structured problems through methods of providing information or recommendations for advice on decisions to be made. (Pratiwi, 2020). In digital transactions, trust is a key factor in purchasing decisions (Gefen et al., 2003). Decision support systems are very helpful for consumers, especially students in determining the products or goods to be selected, this system provides information and suggestions based on previous user history and interests.

Research Methods

The type of research in this research is quantitative research using the Analytical Hierarchy Process (AHP) method by identifying factors that affect certain variables, then comparing between factors to determine their level of importance. The data obtained will be processed using the AHP method, Selection or prioritization is carried out with a logical and structured procedure. These activities are carried out by representative experts related to the alternatives that will be prioritized (Wulandari, 2019).

Variables obtained from indirect observations, indirect interviews by giving questionnaires to e-commerce users and several references to articles and journals that have relevant discussions. So obtained, the variables that can be used as the best e-commerce service decision selection suitable for e-commerce users are:

1. Complete product variants/variety
Product variety is an attraction for consumers, especially being able to provide alternative choices that are more varied. Alternative choices that are more varied for consumers can encourage consumer satisfaction (Botti & Iyengar 2006).
2. Speed of Delivery (fast delivery)
The speed of delivery of goods is one of the rights for consumers, the delivery of goods is required to be "Faster is better", adjusting the needs of consumers, which can affect consumer satisfaction with the services provided.
3. Safety of Delivery
Products that are free from defects and free from loss (in the form of theft, loss, or other forms) are the wishes of all parties. Guaranteed safety of goods can be ensured not to cause complaints in the future.
4. Product price

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The amount that must be paid by consumers in order to own or benefit from a product or service (Sari, 2021).

Looking at the data obtained, there were 33 respondents consisting of 20 men and 13 women with an age range of 18-30 years. The research stages consist of the introduction stage, data collection stage, data processing stage, analysis and discussion stage, conclusion and suggestion stage.

1. Introduction Stage

The introduction stage consists of several parts, namely, field studies, literature studies, problem identification, problem formulation and research objectives.

2. Data collection stage

There are two data that must be collected, namely primary data. Questionnaire data taken using the Saaty comparison scale (found in the AHP method) and secondary data obtained through books, articles and journals.

3. Data Processing Stage

The data that has been obtained is processed by manual calculation using the AHP method. According to (Indah, 2023) Here's how the calculation works:

- a. After the respondent's data is collected, add up each column and calculate the average.
- b. Enter the average result into a 3x4 size comparison matrix
- c. After the matrix multiplication results are known, add up each row in the matrix. And add up all the total n rows.
- d. After that, calculate the eigen vector with the formula total row n divided by the total of all total rows n.
- e. The max is the result of the row sum divided by the corresponding relative priority element.
- f. Calculate the consistency index (CI) using the following formula:

$$CI = \frac{\lambda_{max} - n}{n}$$

n = Number of elements or elements

- g. Calculate the consistency ratio (CR) using the following formula:

$$CR = \frac{CI}{IRC}$$

CR = Consistency Ratio

CI = Consistency Index

RI = Random index

- h. Ensure the consistency of the hierarchy. Judgment data must be replaced, if the value is more than 10%. However, if the consistency ratio $(CI/IR) \leq 0.1$ then the calculation obtained is correct and can be said to be consistent.

4. Analysis and discussion

This stage analyzes the results obtained, where this stage produces conclusions to determine the best e-commerce services from the data obtained.

5. Conclusion and Suggestion

The last stage of a study contains conclusions obtained from the results of research that answers the objectives of this study.

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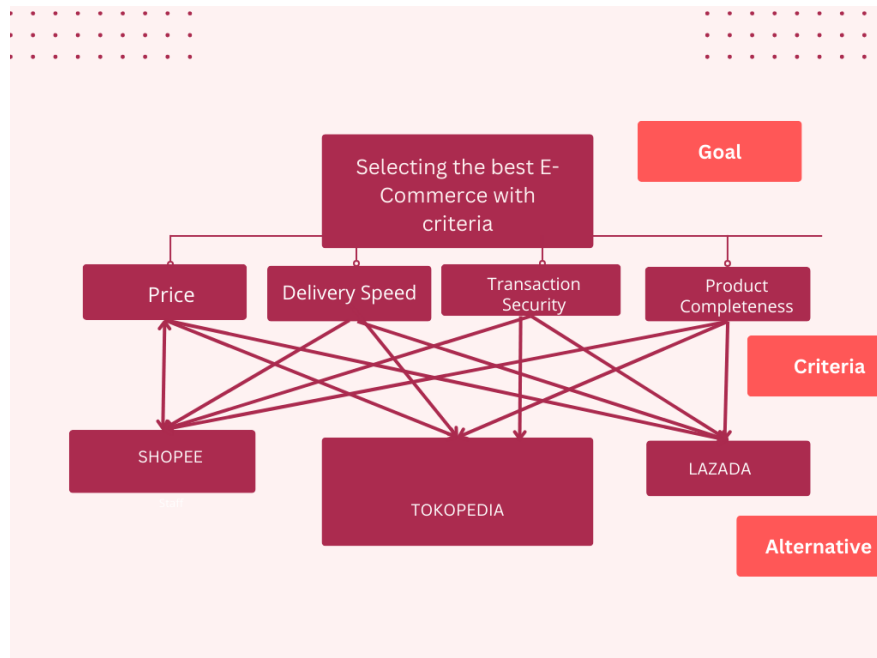


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Results

Based on the criteria and alternatives that have been explained, a hierarchical structure is obtained which is useful in facilitating data processing and as a goal. The following is the hierarchical structure that is compiled.

Figure 3. Research Alternative Criteria in Hierarchical Structure



Source : Processed by Researchers

Price Criteria Comparison Results

After the variable data is obtained, calculations are carried out to find CI (Consistency Index) and CR (Consistency Rate), the first step is to calculate the total matrix. Division between red cells and green cells is carried out to find out the data in empty cells (Example; Division in red cells: Shopee-Tokopedia / 1: 2.39 = 0.44). Then the division data that has been obtained is summed according to the available columns, as shown in the table below.

Table 1. Price Criteria Comparison

	SHOPEE	TOKOPEDIA	LAZADA
SHOPEE	1	2,39	2,27
TOKOPEDIA	0,44	1	1,71
LAZADA	0,44	0,58	1
TOTAL	1,88	3,97	4,98

Source : Processed by Researchers

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Table 2. Matrix calculation

	MATRIKS			MEAN
	SHOPEE	TOKOPEDIA	LAZADA	
SHOPEE	0,53	0,60	0,46	0,53
TOKOPEDIA	0,23	0,25	0,34	0,28
LAZADA	0,23	0,15	0,20	0,19
	1,00	1,00	1,00	1,00

Source : Processed by Researchers

Manual Matrix calculation stages / steps to find Consistency Index & Consistency Rate Chow Test

$$\begin{bmatrix} 1 & 2,39 & 2,27 \\ 0,42 & 1 & 1,71 \\ 0,44 & 0,58 & 1 \end{bmatrix} \times \begin{bmatrix} 0,53 \\ 0,28 \\ 0,19 \end{bmatrix} = \begin{bmatrix} 0,53 & 0,67 & 0,43 \\ 0,22 & 1 & 0,32 \\ 0,23 & 0,16 & 1 \end{bmatrix}$$

$$\begin{pmatrix} 1,63 & 0,53 \\ 0,83 & 0,28 \\ 0,59 & 0,19 \end{pmatrix} = \begin{pmatrix} 3,07 \\ 2,95 \\ 3,09 \end{pmatrix} \quad \Sigma = 9,11$$

$$\lambda_{maks} = \frac{9,11}{3} = 3,04$$

$$CI = \frac{(\lambda_{maks} - n)}{(n - 1)} = \frac{(3,04 - 3)}{(3 - 1)} = 0,02$$

Untuk $n = 3$, $RI = 0,58$, maka:

$$CR = \frac{CI}{RI} = \frac{0,02}{0,58} = 0,03$$

Table 3. Comparison results

Apps	Rank	EV%
Shopee	1	53,27
Tokopedia	2	27,47
Lazada	3	19,26
CI	0,02	
CR	0,03	Consistent

Source : Processed by Researchers

The table above shows the comparison results of three online shopping applications (Shopee, Tokopedia, and Lazada) based on price criteria using the AHP method. Shopee is the best choice with the highest weight (53.27%), followed by Tokopedia (27.47%) and Lazada (19.26%). The Consistency Ratio (CR) value of 0.03 indicates that this assessment is consistent and can be used as a basis for decision making.

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Speed Criteria Comparison Result

Table 4. Speed Criteria Comparison Result

	SHOPEE	TOKOPEDIA	LAZADA
SHOPEE	1	1,24	1,19
TOKOPEDIA	0,81	1	1,36
LAZADA	0,84	0,74	1
	2,65	2,98	3,55

	SHOPEE	TOKOPEDIA	LAZADA	MEAN
SHOPEE	0,38	0,42	0,34	0,38
TOKOPEDIA	0,30	0,34	0,38	0,34
LAZADA	0,32	0,25	0,28	0,28
	1	1,00	1	1

Source : Processed by Researchers

$$\begin{bmatrix} 1 & 1,24 & 1,19 \\ 0,81 & 1 & 1,36 \\ 0,84 & 0,74 & 1 \end{bmatrix} \times 0,34 = \begin{bmatrix} 0,38 & 0,42 & 0,33 \\ 0,31 & 0,34 & 0,38 \\ 0,32 & 0,25 & 0,28 \end{bmatrix}$$

$$\begin{pmatrix} 1,13 & 0,38 \\ 1,03 & 0,34 \\ 0,85 & 0,28 \end{pmatrix} = \begin{pmatrix} 2,99 \\ 3,03 \\ 3,04 \end{pmatrix} \quad \Sigma = 9,05$$

$$\lambda_{max} = \frac{9,05}{3} = 3,02$$

$$CI = \frac{(\lambda_{max} - n)}{(n - 1)} = \frac{(3,02 - 3)}{(3 - 1)} = 0,01$$

$$\text{For } n=3, RI=0,58, \text{ then : } CR = \frac{CI}{RI} = \frac{0,01}{0,58} = 0,01$$

Table 5. the results of the application comparison

Apps	Rank	EV%
Shopee	1	36,87
Tokopedia	2	33,57
Lazada	3	29,55
CI	0,01	
CR	0,01	Consistent

Source : Processed by Researchers

The table above shows the results of the application comparison based on the service speed criteria. Shopee ranks highest with a weight of 36.87%, followed by Tokopedia (33.57%) and Lazada

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(29.55%). The Consistency Ratio (CR) value of 0.01 indicates that the comparison is consistent and feasible as a basis for decision making.

Safety Criteria Comparison Results

Table 6. Safety Criteria Comparison

MATRIX	SHOPEE	TOKOPEDIA	LAZADA
SHOPEE	1	2,23	2,76
TOKOPEDIA	0,45	1	2,33
LAZADA	0,36	0,43	1
TOTAL	1,81	3,66	6,09

	SHOPEE	TOKOPEDIA	LAZADA	MEAN
SHOPEE	0,55	0,61	0,45	0,54
TOKOPEDAI	0,25	0,27	0,38	0,30
LAZADA	0,20	0,12	0,16	0,16
	1,00	1,00	1,00	1,00

Source : Processed by Researchers

$$\begin{bmatrix} 1 & 2,23 & 2,76 \\ 0,45 & 1 & 2,33 \\ 0,36 & 0,43 & 1 \end{bmatrix} \times \begin{bmatrix} 0,54 \\ 0,30 \\ 0,16 \end{bmatrix} = \begin{bmatrix} 0,54 & 0,67 & 0,44 \\ 0,24 & 0,30 & 0,37 \\ 0,19 & 0,13 & 0,16 \end{bmatrix}$$

$$\begin{pmatrix} 1,65 & 0,54 \\ 0,92 & 0,30 \\ 0,48 & 0,16 \end{pmatrix} = \begin{pmatrix} 3,06 \\ 3,05 \\ 3,02 \end{pmatrix} \quad \Sigma = 9,13$$

$$\lambda_{max} = \frac{9,13}{3} = 3,04$$

$$CI = \frac{(\lambda_{max} - n)}{(n - 1)} = \frac{(3,04 - 3)}{(3 - 1)} = 0,03$$

$$\text{For } n=3, RI=0,58, \text{ then: } CR = \frac{CI}{RI} = \frac{0,03}{0,58} = 0,05$$

Table 7. Comparison results

Apps	Rank	EV%
Shopee	1	54,14
Tokopedia	2	29,98
Lazada	3	15,89
CI	0,03	
CR	0,05	Consistent

Source : Processed by Researchers

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The table above presents the results of the evaluation of the security level of the three e-commerce applications. Shopee obtained the highest score of 54.14%, indicating a level of security that is superior to Tokopedia (29.98%) and Lazada (15.89%). The Consistency Ratio (CR) value of 0.05 indicates that the results of this assessment are consistent and can be accounted for in the decision-making process.

Hasil Perbandingan Kriteria Kelengkapan Produk

Table 8. Comparison of Product Completeness Criteria

	SHOPEE	TOKOPEDIA	LAZADA
SHOPEE	1	3,28	4,02
TOKOPEDIA	0,30	1	2,61
LAZADA	0,25	0,38	1
	1,55	4,66	7,63

MATRIKS	SHOPEE	TOKOPEDIA	LAZADA	MEAN
SHOPEE	0,64	0,70	0,53	0,62
TOKOPEDIA	0,20	0,21	0,34	0,25
LAZADA	0,16	0,08	0,13	0,12
	1,00	1,00	1,00	1,00

Source : Processed by Researchers

$$\begin{bmatrix} 1 & 3,28 & 4,02 \\ 0,30 & 1 & 2,61 \\ 0,25 & 0,38 & 1 \end{bmatrix} \times \begin{bmatrix} 0,62 \\ 0,25 \\ 0,12 \end{bmatrix} = \begin{bmatrix} 0,62 & 0,82 & 0,48 \\ 0,19 & 0,25 & 0,31 \\ 0,16 & 0,10 & 0,12 \end{bmatrix}$$

$$\begin{pmatrix} 1,92 & 0,62 \\ 0,75 & : & 0,25 \\ 0,37 & 0,12 \end{pmatrix} = \begin{pmatrix} 3,10 \\ 3,00 \\ 3,08 \end{pmatrix} \quad \Sigma = 9,18$$

$$\lambda_{max} = \frac{9,18}{3} = 3,06$$

$$CI = \frac{(\lambda_{max} - n)}{(n - 1)} = \frac{(3,06 - 3)}{(3 - 1)} = 0,03$$

$$\text{For } n=3, RI=0,58, \text{ maka: } CR = \frac{CI}{RI} = \frac{0,03}{0,58} = 0,05$$

Table 9. Comparison results

Apps	Rank	EV%
Shopee	1	63,07
Tokopedia	2	24,74
Lazada	3	12,19
CI	0,03	
CR	0,05	Consistent

Source : Processed by Researchers

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The table above illustrates the results of the assessment of product completeness from three online shopping applications. Shopee excels with the highest score of 63.07%, followed by Tokopedia (24.74%) and Lazada (12.19%). The Consistency Ratio (CR) value of 0.05 indicates that the assessment is carried out consistently and can be used as a reference in the decision-making process.

Conclusion

Table 10. Final Results

APPLICATION	PRICE	SECURITY	SPEED	COMPLETENESS
SHOPEE	53,27%	36,87%	54,14%	63,07%
TOKOPEDIA	27,47%	33,57%	29,98%	24,74%
LAZADA	19,26%	29,55%	15,89%	12,19%

CRITERIA	SCORE
PRICE	26,99%
SPEED	17,55%
SECURITY	37,30%
COMPLETENESS	18,16%

APPLICATION	SCORE	RATING
SHOPEE	52,50%	1
TOKOPEDIA	28,98%	2
LAZADA	18,52%	3

Source : Processed by Researchers

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Based on a comparative analysis using the AHP method on the four main criteria of price, speed, security, and product completeness, the results show that Shopee occupies the top position as the best online shopping application with a total score of 52.50%. Followed by Tokopedia in second place with a score of 28.98%, and Lazada in third place with a score of 18.52%.

Shopee's dominance is due to its superior performance in all four assessment aspects, especially in terms of product completeness (63.07%) and safety (54.14%). Meanwhile, even though Tokopedia and Lazada perform quite well in some aspects, their final scores are still below Shopee due to the lower value contribution from each of the criteria that have been weighted. Thus, Shopee can be recommended as the top choice for consumers who consider various important factors in choosing an online shopping app.

Some previous studies have similar results as the results of the comparison of this research method. An example of research (Maulana, Ariza, Hidayat, Anshor, and Fatchan, 2025) based on price, interest, and discount criteria. Based on the results of the analysis, Shopee is ranked first as the top choice marketplace, followed by Lazada and Tokopedia, with the discount criteria being the most dominant factor influencing consumer decisions. From this we can know that discounts are a special attraction for consumers in Indonesia, especially students.

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