Volume. 7 No 2 December (2024)

e-ISSN: **2615-3270**
p-ISSN: **2615-3599**

Eigen Mathematics Journal

Homepage jurnal: https://eigen.unram.ac.id/ index.php/eigen

The Decision on Selecting the Best Laptop Using Analytical Hierarchy Process and Simple Additive Weighting Method at the Faculty of MIPA University of Mataram

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A B S T R A C T

Laptops have the potential to increase educational productivity in Indonesia. For example, students at the Faculty of Mathematics and Natural Sciences (MIPA) at the University of Mataram now feel involved. However, the decision to choose the right laptop according to the needs of students is difficult. The research population used was active students from the class of 2020-2023, Faculty of Mathematics and Natural Sciences (MIPA), University of Mataram. This research aims to determine the best laptop selection based on alternative laptop brands, namely Asus Vivobook, Acer 3, HP 14S, Dell Vostro 14, and Lenovo IP1. Further criteria include price, processor, Random Access Memory (RAM), Read Only Memory (ROM), and screen size. The methods used are the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) methods. The research results show that the first priority position is filled by the Asus Vivobook with a weight of 0,26 for the AHP method and the Lenovo IP1 with a weight of 0,898 for the SAW method. The results of priority comparisons using euclidean distance, it was found that the most optimal method for deciding on the best laptop was the AHP method. The AHP method has a value closest to 0 (zero), namely with an average value of 0,127, while the SAW method has an average value of 0,798.

Keywords: Decision, Best Laptop, Analytical Hierarchy Process (AHP), Simple Additive Weighting (SAW)

Submitted: 01-07-2024; Accepted: 05-12-2024; Doi: https://doi.org/10.29303/emj.v7i2.231

1. Introduction

One innovation in technology is a communication tool that makes activities easier. This can be seen several years ago, there were Personal Computers (PC) which were tube-shaped and used a CPU as hardware. As time went by, the PC experienced a revolution in the form of laptops which were in great demand because they could be used anywhere. Using a laptop is very helpful and makes it easier for users to complete work. The ease of using laptops to complete work has increased competition for laptop market share in Indonesia. This is proven by the presence of various laptop brands in the Indonesian market including Acer, Asus, Dell, Lenovo, HP, Apple, and others. Based on data from the International Data Corporation (IDC), the best laptop in first place in Q2 2023 is Lenovo with a market share of 23,1%. In second place is HP with a market share of 21,8% and in third place is Dell with a gain of 16,8%. The fourth position of the best laptop brand is Apple with a market share of 8,6%. The last position is Acer at 6,4%, and other brands at 23,3%.

The laptop products that exist today are due to the support of increasingly advanced technology. Good and best technology drives new changes to laptop specifications. Cheap and affordable prices are a consideration when choosing a laptop (Sunarsa and Handayani, 2016). Therefore, laptops are important for various aspects, one of which has great potential in education. Laptops have the potential to increase educational productivity in Indonesia. For example, this is now being felt by students at the Faculty of Mathematics and Natural Sciences (MIPA), University of Mataram. The productivity of using a laptop is adjusted to existing needs, such as if the performance is high enough to require a long duration of work and research, requiring support from a laptop that is comfortable and durable. This shows that when buying a laptop it must be adjusted to consumer needs.

Laptops are a basic need for consumers, but the decision to choose the right laptop according to the needs of students is difficult. Because there are many laptop brands with varying feature specifications and prices (Ginting,

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2015). The quality you have will affect the price of the laptop, meaning the higher the specifications, the higher the price and vice versa. Each brand has a different view, each consumer has a different reason for choosing that brand. Financial factors also have a big influence on consumers who buy laptops. So many students are confused about choosing the best laptop brand (Ramadina and Yulia, 2022).

Several studies have discussed selecting laptops for certain needs, such as Kirana *et al*. (2023) implemented the Analytical Hierarchy Process (AHP) method in a laptop selection decision support system. Decision making will pay attention to the priority value of each criterion and alternative given. The laptop criteria used are price, processor and RAM according to the most important priorities. Then Firdaus and Nuraeni (2022) explained that the emergence of various types of laptop brands with different specifications would trigger problems of confusion in the decision to choose the best laptop. Finally, it can be completed efficiently and effectively using the Simple Additive Weighting (SAW) method. The criteria for decision making are price, screen size, processor, RAM type, hard disk/SSD, Bluetooth and webcam.

The differences between this research and previous studies are the research location, a larger number of subjects, and initial testing of research instruments in the form of measuring the truth and reliability of the data. The research instrument tests the criteria used in order to obtain the appropriate criteria weights and results to compare in the laptop selection case study. This research will later carry out the application of two methods, namely the AHP and SAW methods in selecting the best laptop at the Faculty of MIPA, University of Mataram, especially among students.

The aim of the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) methods is to help obtain decision making results from various specified options (Firmansyah, et.al., 2023). The AHP method is used to compare between criteria, as well as to have a comparison of alternatives for each criterion. The SAW method to obtain results from priority weights is dependent on giving values to existing criteria (Amir and Devi, 2022).

The concepts of the SAW and AHP methods have the same goals and their respective advantages. The update with previous research is that a comparison of the two methods was carried out in a case study of laptop selection among students. Therefore, this research will obtain an optimal method that makes decision making easier in choosing the best laptop according to the needs of students at the Faculty of MIPA, University of Mataram.

2. Method

The data used is primary data through the distribution of paperbased questionnaires and Google forms. The research population was active student respondents from the class of 2020-2023, Faculty of Mathematics and Natural Sciences (MIPA) University of Mataram. Calculation of sample size using the Isaac & Michael formula. Then Accidental Sampling became the sampling technique in this research.

The methods used in this research are Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW). Explanation of research steps as follows:

a. Validity and reliability test

The validity test is carried out by calculating the r value for each statement (Sahir, 2021).

$$r_{xy} = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{\sqrt{\left[n\sum_{i=1}^{n} {x_i}^2 - \left(\sum_{i=1}^{n} x_i\right)^2\right]\left[n\sum_{i=1}^{n} {y_i}^2 - \left(\sum_{i=1}^{n} y_i\right)^2\right]}} \quad (1)$$

where r_{xy} is the correlation coefficient, x is the answer score for each statement, y is the total score for each statement, and n is the number of respondents. The test criteria is if $r_{count} > r_{table}$ (error level $0{,}05$) then the instrument is declared valid (Slamet and Wahyuningsih, 2022).

Reliability test by calculating the $Cronbach's\ Alpha$ value, which is the formula (Sahir, 2021).

$$r = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum_{i=1}^{k} {S_i}^2}{{S_t}^2}\right) \quad (2)$$

where r is the reliability coefficient, k is the number of statement items, ${S_i}^2$ is the variance of the score for each statement item, and ${S_t}^2$ is the total score variance. The decision making criteria is if $Cronbach's\ Alpha \geq 0{,}6$ then the statement items in the questionnaire are reliable or reliable (Slamet and Wahyuningsih, 2022).

b. *Sample Determination*

If the questionnaire is valid and reliable, then determine the sample size by using the Isaac and Michael formula as follows:

$$s = \frac{\lambda^2\, NPQ}{d^2(N-1) + \lambda^2 PQ} \quad (3)$$

where s is the sample size, λ^2 is the chi-square value ($dk = 1\ and\ \alpha = 5\%$), N is the population size, P and Q are the population proportions $(0{,}5)$, and d is the error rate $(0{,}05)$.

c. *Analytical Hierarchy Process*

- Formation of hierarchical structure
  Form a hierarchical structure using levels starting with general objectives, followed by criteria and selected alternatives.
- Pairwise comparison matrix between criteria and alternative
  Prepare a pairwise comparison matrix using the Geometric Mean (GM) calculation to maintain different respondents' opinions with the following formula (Marpaung, 2023):

  $$GM = \sqrt[n]{a_1 \times a_2 \times \ldots \times a_n} \quad (4)$$

  where a_i with $i = 1{,}2, \ldots, n$ is the respondent's answer and n is the number of respondents.
- Calculation of priority weight (PW) for criteria and alternative
  Find priority weight (PW) through calculations (Indah *et al.*, 2021) as follows:

$$PW = \frac{\sum_{i=1}^{n} W_{ni}}{n} \quad (5)$$

where W is the normalized matrix element and n is the number of criteria or alternatives being compared.

- Test the consistency of criteria and alternative
  The Consistency Index (CI) can be obtained with the following formula:

$$CI = \frac{(P-n)}{(n-1)} \quad (6)$$

where CI is the consistency index, P is the consistency weight, and n is the number of elements. Futhermore, *Consistency Ratio* (CR) can be formulated as follows:

$$CR = \frac{CI}{RI} \quad (7)$$

where RI is the random index. If the value ($CR \leq 0{,}1$) then the calculation results are declared consistent. If not, then the assessment is repeated (Marimin, 2004).

- Formation of global priority
  The global priority value (GP) is the priority weight of each alternative multiplied by the priority weight of the criteria (Sudradjat *et al*., 2020). Then sorted from the largest value to the smallest to determine the order of priority in research.

d. ***Simple Additive Weighting***

- Determining criteria
  Determine the criteria (K_j) that will be used as a reference in decision making.
- Determining preference weights
  Gives a preference weight value or level of importance (W) to each criterion used, which is symbolized as follows:

$$W = [W_1, W_2, W_3, W_4, \ldots, W_j] \quad (8)$$

- Suitability rating value
  Determine the suitability rating of each alternative for each criterion.
- Formation of decision matrix
  Create a decision matrix (X) which is formed from the suitability rating value of each alternative for each of the following criteria (Febriyanto and Rusi, 2020).

$$X = \begin{bmatrix} x_{11} & x_{12} & \ldots & x_{1n} \\ x_{21} & x_{22} & \ldots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (9)$$

- Decision matrix normalization
  The normalization stage is adjusted to the type of each criterion (cost or profit) and forms a normalized matrix (R) (Febriyanto and Rusi, 2020).

$$r_{ij} = \begin{cases} \frac{x_{ij}}{max\ x_{ij}} & if\ j\ is\ the\ benefit\ attribute\ (benefit) \\ \frac{min\ x_{ij}}{x_{ij}} & if\ j\ is\ a\ cost\ attribute\ (cost) \end{cases} \quad (10)$$

The normalized matrix (R) is as follows:

$$R = \begin{bmatrix} r_{11} & r_{12} & \ldots & r_{1n} \\ r_{21} & r_{22} & \ldots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix} \quad (11)$$

- Preference value
  The resulting prefernce value (V_i) is obtained from the sum of the multiplication of the normalized matrix row elements (R) with the preference weights (W) corresponding to the matrix column elements (r), where the formula is as follows (Febriyanto and Rusi, 2020):

$$V_i = \sum_{j=1}^{n} W_j r_{ij} \quad (12)$$

e. **Test priority Results**
Testing by measuring the similarity (matching) of the average priorities of the AHP and SAW methods which are closest to 0 (zero) using euclidean distance (Firgiawan *et al*., 2019).

f. **Decision making results**
Decisions are taken according to the final results so as to obtain the best alternative as the final conclusion.

3. Results and Discussion

This research utilizes the Analytical Hierarchy Process and Simple Additive Weighting methods in selecting the best laptop at the Faculty of Mathematics and Natural Sciences (MIPA), University of Mataram. Before obtaining research data, the questionnaire was tested through validity and reliability tests. Questionnaires were given to 33 students of the Faculty of MIPA, University of Mataram. According to Zahra and Rina (2018), validity and reliability test measurements were carried out on the initial questionnaire with a minimum sample size of 30 respondents. The aim is that the questionnaire used is of high quality and provides reliable information.

3.1 Validity and Reliability Test

The r_{tabel} value is based on the number of samples and the significance level, namely 0,344. The results of the validity test calculation show that the value of $r_{xy} \geq r_{table}$ means all statement items are valid. Furthermore, from decision making in the reliability test, the $Cronbach's\ Alpha$ value was obtained, namely $0{,}816 > 0{,}6$. So, it can be explained that questionnaires can be used in this research.

3.2 Sample Determination

The total population is 1,256 active students from the class of 2020-2023, Faculty of MIPA, University of

Mataram. The results of calculating the number of samples using the Isaac and Michael formula obtained 294 samples. This number of samples became the final respondents in obtaining AHP and SAW method data. Accidental sampling is a sampling technique based on spontaneity factors. This sampling is used because it can be done easily and quickly, thereby saving time and costs.

3.3 Analytical Hierarchy Process

The AHP method process starts from establishing a hierarchical structure, compiling a pairwise comparison matrix, calculating priority weights, to testing logical consistency.

a. Formation of Hierarchical Structure

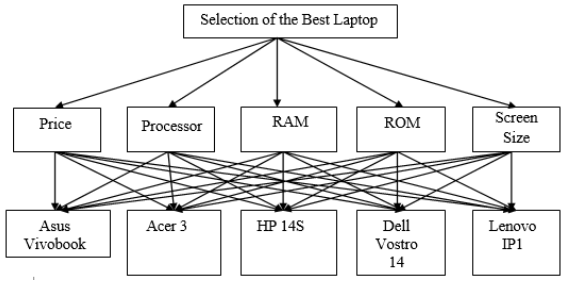

Figure 1 – Hierarchical Struture of Laptop Research

b. Between Criteria

The recapitulation results of the pairwise comparison assessment of criteria can be seen in Table 1.

Table 1 – Recapitulation of Criteria Pairwise Comparison Assessment

Criteria	K1	K2	K3	K4	K5
K1	1	0,41	0,318	0,36	1,027
K2	2,439	1	1,265	1,298	2,589
K3	3,145	0,791	1	1,322	3,101
K4	2,778	0,77	0,756	1	2,85
K5	0,974	0,386	0,322	0,351	1
N	10,336	3,357	3,661	4,331	10,567

The recapitulation of the pairwise comparison assessment of criteria explains the results for each criterion, where K1 (price), K2 (processor), K3 (RAM), K4 (ROM), and K5 (screen size). Then the results of the priority weights or local priorities for each criterion can be seen in Table 2 below.

Table 2 – Local Priority of Each Criteria

	K1	K2	K3	K4	K5	PW
K1	0,097	0,122	0,087	0,083	0,097	0,097
K2	0,236	0,298	0,346	0,3	0,245	0,285
K3	0,304	0,236	0,273	0,305	0,293	0,282
K4	0,269	0,229	0,207	0,231	0,27	0,241
K5	0,094	0,115	0,088	0,081	0,095	0,095
N	1	1	1	1	1	

Table 2 shows the processor criteria (K2) with the greatest weight, meaning that this criterion is the main priority in the decision to select the best laptop. Therefore, processor specifications are the first consideration. Meanwhile, the screen size criterion has the smallest weight and gets the lowest priority in the decision to choose the best laptop.

Testing logical consistency criteria requires consistency weight values. The consistency weight (P) was obtained at 5,04 and the Consistency Index (CI) value was obtained, namely 0,01. The criteria used in this study consisted of 5, so the Random Index (RI) was determined, namely 1,12. The calculation result of the Consistency Ratio (CR) value is $0{,}009 < 0{,}1$, meaning that the pairwise comparison data between criteria is consistent.

c. Price Criteria (K1)

The recapitulation results of the pairwise comparison assessment based on K1 are in Table 3.

Table 3 – Recapitulation of Pairwise Comparison Assessment of Alternatives Based on Price (K1)

(K1)	A1	A2	A3	A4	A5
A1	1	1,945	1,2	2,127	1,466
A2	0,514	1	0,803	1,316	0,986
A3	0,833	1,245	1	1,944	1,398
A4	0,47	0,76	0,514	1	0,695
A5	0,682	1,014	0,715	1,439	1
N	3,499	5,964	4,232	7,826	5,545

Then the results of priority weights or alternative local priorities based on K1 are in Table 4 below.

Table 4 – Alternative Local Priority Based on Price (K1)

	A1	A2	A3	A4	A5	PW
A1	0,286	0,326	0,284	0,272	0,264	0,286
A2	0,147	0,168	0,19	0,168	0,178	0,17
A3	0,238	0,209	0,236	0,248	0,252	0,237
A4	0,134	0,127	0,121	0,128	0,125	0,127
A5	0,195	0,17	0,169	0,184	0,18	0,18
N	1	1	1	1	1	

Table 4 shows that the Asus Vivobook (A1) prioritizes price. Therefore, for consideration in choosing the best laptop that suits your needs is the Asus Vivobook with affordable price criteria.

Testing the consistency of logistic alternatives obtained a weight consistency value (P) of 5,01 and a Consistency Index (CI) of 0,003. The criteria used in this study consisted of 5, so the Random Index (RI) was determined, namely 1,12. The calculation result of the Consistency Ratio (CR) value is $0{,}003 < 0{,}1$, meaning that the pair comparison data between alternatives based on Price criteria (K1) is consistent.

d. Processor Criteria (K2)

The recapitulation results of the pairwise comparison assessment based on K2 are in Table 5.

Table 5 – Recapitulation of Pairwise Comparison Assessment of Alternatives Based on Processor (K2)

(K2)	A1	A2	A3	A4	A5
A1	1	1,744	0,87	1,904	1,457
A2	0,573	1	0,782	1,362	1,072
A3	1,149	1,279	1	2,047	1,723
A4	0,525	0,734	0,489	1	0,7
A5	0,686	0,933	0,58	1,429	1
N	3,933	5,69	3,721	7,742	5,952

Then the results of priority weights or alternative local priorities based on K2 are in Table 6 below.

Table 6 – Alternative Local Priority Based on Proscessor (K2)

	A1	A2	A3	A4	A5	PW
A1	0,254	0,307	0,234	0,246	0,245	0,257
A2	0,146	0,176	0,21	0,176	0,18	0,178
A3	0,292	0,225	0,269	0,264	0,289	0,268
A4	0,133	0,129	0,131	0,129	0,118	0,128
A5	0,174	0,164	0,156	0,185	0,168	0,169
N	1	1	1	1	1	

Table 6 shows that the HP 14S (A3) prioritizes the processor. Therefore, for consideration in choosing the best laptop that suits your needs is the HP 14S with good processor criteria.

Testing the consistency of logistic alternatives obtained a weight consistency value (P) of 5,018 and a Consistency Index (CI) of 0,004. The criteria used in this study consisted of 5, so the Random Index (RI) was determined, namely 1,12. The calculation result of the Consistency Ratio (CR) value is $0{,}004 < 0{,}1$, meaning that the pair comparison data between alternatives based on processor criteria (K2) is consistent.

e. RAM Criteria (K3)

The recapitulation results of the pairwise comparison assessment based on K3 are in Table 7.

Table 7 – Recapitulation of Pairwise Comparison Assessment of Alternatives Based on RAM (K3)

(K3)	A1	A2	A3	A4	A5
A1	1	1,698	1,04	2,433	1,366
A2	0,589	1	0,731	2,052	0,978
A3	0,962	1,368	1	2,67	1,551
A4	0,411	0,487	0,375	1	0,57
A5	0,732	1,022	0,645	1,754	1
N	3,694	5,575	3,791	9,909	5,465

Then the results of priority weights or alternative local priorities based on K3 are in Table 8 below.

Table 8 – Alternative Local Priority Based on RAM (K3)

	A1	A2	A3	A4	A5	PW
A1	0,271	0,305	0,274	0,246	0,25	0,269
A2	0,159	0,179	0,193	0,207	0,179	0,184
A3	0,26	0,245	0,264	0,269	0,284	0,265
A4	0,111	0,087	0,099	0,101	0,104	0,101
A5	0,198	0,183	0,17	0,177	0,183	0,182
N	1	1	1	1	1	

Table 8 shows that the Asus Vivobook (A1) prioritizes RAM. Therefore, for consideration in choosing the best laptop that suits your needs is the Asus Vivobook with the criteria of RAM and good storage.

Testing the consistency of logistic alternatives obtained a weight consistency value (P) of 5,021 and a Consistency Index (CI) of 0,005. The criteria used in this study consisted of 5, so the Random Index (RI) was determined, namely 1,12. The calculation result of the Consistency Ratio (CR) value is $0{,}004 < 0{,}1$, meaning that the pair comparison data between alternatives based on RAM criteria (K3) is consistent.

f. ROM Criteria (K4)

The recapitulation results of the pairwise comparison assessment based on K4 are in Table 9.

Table 9 – Recapitulation of Pairwise Comparison Assessment of Alternatives Based on ROM (K4)

(K4)	A1	A2	A3	A4	A5
A1	1	1,795	1,116	1,011	1,389
A2	0,557	1	0,749	0,69	1,113
A3	0,896	1,335	1	1,024	1,593
A4	0,989	1,449	0,977	1	1,357
A5	0,72	0,898	0,628	0,737	1
N	4,162	6,477	4,47	4,462	6,452

Then the results of priority weights or alternative local priorities based on K4 are in Table 10 below.

Table 10 – Alternative Local Priority Based on ROM (K4)

	A1	A2	A3	A4	A5	N	PW
A1	0,24	0,277	0,25	0,227	0,215	1,209	0,242
A2	0,134	0,154	0,168	0,155	0,173	0,783	0,157
A3	0,215	0,206	0,224	0,229	0,247	1,122	0,224
A4	0,238	0,224	0,219	0,224	0,21	1,114	0,223
A5	0,173	0,139	0,14	0,165	0,155	0,772	0,154
N	1	1	1	1	1	5	

Table 10 shows that the Asus Vivobook (A1) prioritizes ROM. Therefore, for consideration in choosing the best laptop that suits your needs is the Asus Vivobook with the criteria that the ROM has a large capacity.

Testing the consistency of logistic alternatives obtained a weight consistency value (P) of 5,014 and a Consistency Index (CI) of 0,004. The criteria used in this study consisted of 5, so the Random Index (RI) was determined, namely 1,12. The calculation result of the Consistency Ratio (CR) value is $0{,}004 < 0{,}1$, meaning that the pair comparison data between alternatives based on ROM criteria (K4) is consistent.

g. Screen Size Criteria (K5)

The recapitulation results of the pairwise comparison assessment based on K5 are in Table 11.

Table 11 – Recapitulation of Pairwise Comparison Assessment of Alternatives Based on Screen Size (K5)

(K5)	A1	A2	A3	A4	A5
A1	1	1,863	1,105	1,645	1,385
A2	0,537	1	0,793	1,378	1,081
A3	0,905	1,261	1	1,754	1,451
A4	0,608	0,726	0,57	1	0,717
A5	0,722	0,925	0,689	1,395	1
N	3,772	5,775	4,157	7,172	5,634

Then the results of priority weights or alternative local priorities based on K5 are in Table 12 below.

Table 12 – Alternative Local Priority Based on Screen Size (K5)

	A1	A2	A3	A4	A5	PW
A1	0,265	0,323	0,266	0,229	0,246	0,266
A2	0,142	0,173	0,191	0,192	0,192	0,178
A3	0,24	0,218	0,241	0,245	0,258	0,24
A4	0,161	0,126	0,137	0,139	0,127	0,138
A5	0,191	0,16	0,166	0,195	0,177	0,178
N	1	1	1	1	1	

Table 12 shows that the Asus Vivobook (A1) prioritizes screen size. Therefore, for consideration in choosing the best laptop that suits your needs is the Asus Vivobook with the criteria of a screen size that is comfortable to use.

Testing the consistency of logistic alternatives obtained a weight consistency value (P) of 5,022 and a Consistency Index (CI) of 0,006. The criteria used in this study consisted of 5, so the Random Index (RI) was determined, namely 1,12. The calculation result of the Consistency Ratio (CR) value is $0{,}005 < 0{,}1$, meaning that the pair comparison data between alternatives based on screen size criteria (K5) is consistent.

h. Formation of Global Priority

Global priority (GP) states the relative importance of an element to the overall goal. The following is the complete global priority calculation.

$$\begin{bmatrix} 0{,}286 & 0{,}257 & 0{,}269 & 0{,}242 & 0{,}266 \\ 0{,}17 & 0{,}178 & 0{,}184 & 0{,}157 & 0{,}178 \\ 0{,}237 & 0{,}268 & 0{,}265 & 0{,}224 & 0{,}24 \\ 0{,}127 & 0{,}128 & 0{,}101 & 0{,}223 & 0{,}138 \\ 0{,}18 & 0{,}169 & 0{,}182 & 0{,}154 & 0{,}178 \end{bmatrix} \times \begin{bmatrix} 0{,}097 \\ 0{,}285 \\ 0{,}282 \\ 0{,}241 \\ 0{,}095 \end{bmatrix}$$

$$= \begin{bmatrix} 0{,}26 \\ 0{,}158 \\ 0{,}157 \\ 0{,}043 \\ 0{,}017 \end{bmatrix}$$

The results of the global priority calculation are shown in full in Table 13 as follows.

Table 13 – Global Priority of Each Alternative

	K1	K2	K3	K4	K5	GP
A1	0,286	0,257	0,269	0,242	0,266	0,26
A2	0,17	0,178	0,184	0,157	0,178	0,158
A3	0,237	0,268	0,265	0,224	0,24	0,157
A4	0,127	0,128	0,101	0,223	0,138	0,043
A5	0,18	0,169	0,182	0,154	0,178	0,017

Based on the research results of the AHP research method, it was found that the priority order of the five alternative laptops in this study was that the first position was filled by the Asus Vivobook (A1) with a weight of 0,26. The second position is filled by Acer 3 (A2) with a weight of 0,158. The third position is filled by the HP 14S (A3) with a weight of 0,157. The fourth position is filled by the Dell Vostro 14 (A4) with a weight of 0,043, and the last position is filled by the Lenovo IP1 (A5) with a weight of 0,017.

3.4 Simple Additive Weighting

The SAW method process starts from determining criteria, determining preference weight values and suitability ratings, forming a decision matrix, calculating normalization of the decision matrix, to calculating preference values. Based on observations with respondents, 5 criteria were obtained, namely K1 as price (cost), K2 as processor (benefit), K3 as RAM (benefit), K4 as ROM (benefit), and K5 as screen size (benefit). Each criterion is weighted into grades 1 to 5 including 1 = Very Bad, 2 = Bad, 3 = Fair, 4 = Good, and 5 = Very Good.

Table 14 – Criteria Data

Name	Data	Weight
Price	6.500.000 – 6.525.000	1
	6.550.000 – 6.575.000	2
	6.600.000 – 6.625.000	3
	6.650.000 – 6.675.000	4
	6.700.000 – 6.725.000	5
Processor	Pentium	1
	Celeron	2
	AMD R3	3
	Core i3	4
	Core i5	5
RAM	4 GB	1
	8 GB	2
	16 GB	3
	32 GB	4
	64 GB	5
ROM	128 GB	1
	256 GB	2
	512 GB	3
	1 TB	4
	2 TB	5
Screen Size	12 inch	1
	17 inch	2
	13 inch	3
	16 inch	4
	14 inch	5

Then the preference weight value or level of importance (W) for each criterion based on respondent data is price (K1) of 0,20, processor (K2) of 0,21, RAM (K3) of 0,21, ROM (K4) of 0,20, and the screen size (K5) of 0,18. The preference weight value or level of importance explains the determination of the weight of criteria aimed at laptop specification needs. The following is laptop data that will be used as an alternative in this research.

Table 15 – Alternative Data

	K1	K2	K3	K4	K5
A1	6.600.000	AMD 7320	8 GB	512 GB	14 inch
A2	6.650.000	Intel Ci3 N305 (8 Core)	8 GB	512 GB	14 inch
A3	6.700.000	Ci3 1115G4	8 GB	512 GB	14 inch
A4	6.675.000	Core i3 7130U	4 GB	1 TB	14 inch
A5	6.500.000	AMD R3 7320U	8 GB	512 GB	14 inch

Next, create a decision matrix (X) which is formed from Table 15, namely the suitability rating of each alternative for each criterion. The value of each alternative (A_i) for each criterion (K_j) has been determined as follows.

$$X = \begin{bmatrix} 3 & 3 & 2 & 3 & 5 \\ 4 & 4 & 2 & 3 & 5 \\ 5 & 4 & 2 & 3 & 5 \\ 4 & 4 & 1 & 4 & 5 \\ 1 & 3 & 2 & 3 & 5 \end{bmatrix}$$

Normalization of the decision matrix is carried out by calculating the normalized performance rating value (r_{ij}) of the alternative (A_i) on the criterion (K_j). The results of the normalization calculation of the decision matrix (X) obtained a normalized matrix (R) as follows.

$$R = \begin{bmatrix} 0,3 & 0,75 & 1 & 0,75 & 1 \\ 0,25 & 1 & 1 & 0,75 & 1 \\ 0,2 & 1 & 1 & 0,75 & 1 \\ 0,25 & 1 & 0,5 & 1 & 1 \\ 1 & 0,75 & 1 & 0,75 & 1 \end{bmatrix}$$

Calculating the preference value (V_i) obtained for each value is as follows.

a. $V_1 = (0,20 \times 0,3) + (0,21 \times 0,75) + (0,21 \times 1) + (0,20 \times 0,75) + (0,18 \times 1)$
$= 0,06 + 0,1575 + 0,21 + 0,15 + 0,18$
$= 0,758$

b. $V_2 = (0,20 \times 0,25) + (0,21 \times 1) + (0,21 \times 1) + (0,20 \times 0,75) + (0,18 \times 1)$
$= 0,05 + 0,21 + 0,21 + 0,15 + 0,18$
$= 0,800$

c. $V_3 = (0,20 \times 0,2 \times) + (0,21 \times 0,1) + (0,21 \times 1) + (0,20 \times 0,75) + (0,18 \times 1)$
$= 0,04 + 0,21 + 0,21 + 0,15 + 0,18$
$= 0,790$

d. $V_4 = (0,20 \times 0,25) + (0,21 \times 1) + (0,21 \times 0,5) + (0,20 \times 1) + (0,18 \times 1)$
$= 0,05 + 0,21 + 0,105 + 0,20 + 0,18$
$= 0,745$

e. $V_5 = (0,20 \times 1) + (0,21 \times 0,75) + (0,21 \times 1) + (0,20 \times 0,75) + (0,18 \times 1)$
$= 0,20 + 0,1575 + 0,21 + 0,15 + 0,18$
$= 0,898$

Then the ranking results obtained as a priority for each alternative are shown in Table 16 as follows.

Table 16 – SAW Ranking Results

No.	Alternative	Value
1	A5	0,898
2	A2	0,800
3	A3	0,790
4	A1	0,758
5	A4	0,745

Based on the research results of the SAW method, it was found that the priority order of the five alternative laptops used as objects in this research was that the first position was filled by the Lenovo IP1 (A5) with a weight of 0,898. The second position is filled by Acer 3 (A2) with a weight of 0,800. The third position is filled by the HP 14S (A3) with a weight of 0,790. The fourth position is filled by the Asus Vivobook (A1) with a weight of 0,758, and the last position is filled by the Dell Vostro 14 (A4) with a weight of 0,745.

3.5 Comparison of Priority Results

The comparison uses euclidean distance, which is to see the most optimal method. The average priority ranking in the two methods, namely Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) is as shown in Table 17 below.

Table 17 – Comparison of AHP and SAW

Rangking	AHP	SAW
1	0,26	0,898
2	0,158	0,800
3	0,157	0,790
4	0,043	0,756
5	0,017	0,745
Average	**0,127**	**0,798**

Based on Table 17, it can be said that the AHP method is the most optimal method to use. This is because the average value of the AHP method is closest to 0 (zero), namely 0,127, while the SAW method is 0,798.

The results of this research are in line with previous research conducted by *Maratullatifah et al*. (2019). Case studies of supplier selection in restaurants with comparative results show that the AHP method is the best compared to the SAW method. Because it has a value close to zero, namely the euclidean distance of the AHP method with an average value of 0,19, while the SAW average value is 0,90.

3.6 Decision Making Results

The priority results of the Analytical Hierarchy Process (AHP) method as the final result in decision making. So, the best alternative decision taken is the Asus Vivobook. This is also a recommendation for the best laptop for students at the Faculty of Mathematics and Natural Sciences (MIPA) at University of Mataram.

4. Conclusion

Based on the results of the analysis and discussion, conclusions can be obtained including:

a. The order of priority in the Analytical Hierarchy Process (AHP) method is Asus Vivobook at 0,26, followed by Acer 3 at 0,158, HP 14S at 0,157, Dell Vostro 14 at 0,043, and Lenovo IP1 at 0,017.
b. The priority order for the Simple Additive Weighting (SAW) method is Lenovo IP1 at 0,898, followed by Acer 3 at 0,800, HP 14S at 0,790, Asus Vivobook at 0,758, and Dell Vostro 14 at 0,745.
c. The results of the priority comparison show that the AHP method is the most optimal method, because the average value of AHP is closest to 0 (zero), namely 0,127 while SAW is 0,798.

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