

## THE BEST LAPTOP RATING DECISION SUPPORT SYSTEM FOR MOORA BASED CUSTOMERS IN THE TECH KIOS LAPTOP KISARAN

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**Abstract:** Tech Kios Laptop Kisaran is a business engaged in selling used laptops with various brands and specifications to meet customer needs. However, the selection process is still conducted manually and relies on subjective judgment, which may result in less accurate recommendations. This study aims to design and implement a Decision Support System using the MOORA (Multi-Objective Optimization on the Basis of Ratio Analysis) method to objectively determine the best used laptop. The criteria applied in this study include brand, screen resolution, laptop size, and battery durability. The system was developed through requirement analysis, system design, implementation, and black-box testing. The results show that the system successfully generates rankings based on MOORA preference values. The highest optimization value of 0.4321 was achieved by Lenovo IdeaPad Slim (A04) and Lenovo ThinkPad (A06), indicating that these two alternatives are the best recommended used laptops. Therefore, the developed system enhances the objectivity, effectiveness, and accuracy of the laptop selection process at Tech Kios Laptop Kisaran.

**Keywords:** decision support system; MOORA; multi criteria; used laptop; recommendation.

**Abstrak:** Tech Kios Laptop Kisaran merupakan usaha yang bergerak di bidang penjualan laptop bekas dengan berbagai merek dan spesifikasi untuk memenuhi kebutuhan pelanggan. Namun, proses pemilihan laptop masih dilakukan secara manual dan bergantung pada penilaian subjektif, sehingga berpotensi menghasilkan rekomendasi yang kurang akurat. Penelitian ini bertujuan untuk merancang dan mengimplementasikan Sistem Pendukung Keputusan menggunakan metode MOORA (Multi-Objective Optimization on the Basis of Ratio Analysis) guna menentukan laptop bekas terbaik secara objektif. Kriteria yang digunakan dalam penelitian ini meliputi merek, resolusi layar, ukuran laptop, dan ketahanan daya baterai. Pengembangan sistem dilakukan melalui tahapan analisis kebutuhan, perancangan sistem, implementasi, serta pengujian menggunakan metode black-box. Hasil penelitian menunjukkan bahwa sistem mampu menghasilkan peringkat alternatif berdasarkan nilai preferensi MOORA. Nilai optimasi tertinggi sebesar 0,4321 diperoleh oleh Lenovo IdeaPad Slim (A04) dan Lenovo ThinkPad (A06), yang menunjukkan bahwa kedua alternatif tersebut merupakan rekomendasi laptop bekas terbaik. Dengan demikian, sistem yang dikembangkan mampu meningkatkan objektivitas, efektivitas, dan ketepatan dalam proses pemilihan laptop bekas di Tech Kios Laptop Kisaran.

**Kata kunci:** laptop bekas; MOORA; multi-kriteria; rekomendasi; sistem pendukung keputusan.

### INTRODUCTION

The advancement of information technology plays a significant role in

supporting decision-making processes across various sectors, including trade and customer services [1]. An information system consists of

interconnected components such as human resources, hardware, software, data, and procedures that work together to produce accurate and relevant information [2]. In the context of used laptop sales, the large number of alternatives with relatively similar specifications often makes it difficult for customers to determine the most appropriate choice.

Tech Kios Laptop Kisaran is a business engaged in selling used laptops with various brands and models. Based on sales data, differences in sales levels among brands can be observed, even when the specifications are nearly identical. This indicates that purchasing decisions are influenced not only by price but also by other factors such as brand, laptop size, screen resolution, and battery durability. However, the recommendation process is still conducted manually and relies on subjective judgment, which may lead to less optimal decision outcomes.

A Decision Support System (DSS) is a computer-based system developed to assist decision-making by processing and analyzing relevant data and information [3]. Research conducted by Cindy et al. [4] shows that the combination of SAW and TOPSIS methods can generate systematic decisions in employee reward selection. Lutfi et al. [5] demonstrated that the SAW method is effective for weighting and ranking alternatives in selecting the best employees. Rizki [6] explained that the AHP method is widely used because it can systematically structure hierarchical criteria. Ilham et al. [7] stated that the SMART method is capable of producing alternative rankings in the selection of the best teachers.

The Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method is considered a simpler and more efficient approach in

the normalization and ranking process [8]. Sawitri et al. [9] proved that MOORA can objectively generate alternative rankings in selecting the best technicians. Syahrani and Nasution [10] also showed that the MOORA method can be applied in a decision support system to provide measurable and transparent recommendations for determining loyal customers. Nur and Hartatiks [11] demonstrated that MOORA can deliver accurate laptop purchase recommendations based on several criteria, including price, processor, RAM, screen size, and hard drive capacity.

Although previous studies have discussed the implementation of AHP, SAW, and MOORA methods, most of them focus on employee selection, technician selection, best teacher selection, or other related fields [5], [7], [9]. The application of the MOORA method in the context of electronic product selection, particularly used laptops at the scale of a local business, has not been specifically addressed in prior research.

Based on the identified problems and the review of previous studies, this research aims to design and implement a Decision Support System using the MOORA method to determine the best used laptop recommendations at Tech Kios Laptop Kisaran. The proposed system is expected to generate objective alternative rankings based on predefined criteria, thereby improving consistency and service quality.

## **METHOD**

This research uses a quantitative method using the Decision Support System approach. Quantitative methods

are used because this research focuses on processing numerical data to produce preference values and alternative rankings for used laptops objectively. This approach allows the analysis process to be carried out in a measurable and systematic manner so that the results obtained can be used as a basis for decision making.

The data used in this research consists of alternative data and criterion data. Alternative data is in the form of used laptops available at Tech Kios Laptop Kisaran, while criterion data includes brand, laptop size, screen resolution, and battery life. All data are expressed in numerical values so that they can be processed using multicriteria decision-making methods.

The methods used in this study were Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA). The MOORA method was chosen because it has a simple, flexible calculation process, and is able to handle several assessment criteria simultaneously. In addition, the MOORA method is able to produce alternative optimization and ranking values objectively, making it easier for users to determine the best choice [8].

The initial stages of the MOORA method are [12]:

First, determining a decision matrix, which is a matrix containing the values of each laptop alternative against each of the predetermined criteria. The decision matrix can be written as follows:

$$X_{ij} = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \dots & & & \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} \quad (1)$$

Explanation of Symbols:

X = Decision matrix

$x_{ij}$  = Performance value of alternative  $i$  with respect to criterion  $j$

$i$  = Index of alternatives ( $i = 1, 2, \dots, m$ )

$j$  = Index of criteria ( $j = 1, 2, \dots, n$ )

$m$  = Total number of alternatives

$n$  = Total number of criteria

The decision matrix represents the initial data containing the performance values of each alternative against all predetermined criteria.

Second, determine the normalization matrix, The decision matrix is then normalized to eliminate scale differences between criteria. The normalization process is carried out using the following equation:

$$X^*_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^m X_{ij}^2}} \quad (2)$$

Explanation of Symbols:

$x'_{ij}$  = Normalized value of alternative  $i$  on criterion  $j$

$x_{ij}$  = Original value of alternative  $i$  on criterion  $j$

$m$  = Total number of alternatives

$\sum$  = Summation symbol

$x_{ij}^2$  = Squared value of alternative  $i$  on criterion  $j$

$\sqrt{\quad}$  = Square root symbol

Normalization is performed to eliminate scale differences among criteria so that all values become comparable.

Third, determining a weighted normalization matrix, Once a normalized matrix is obtained, the next step is to calculate the optimization value for each alternative. The optimization value is obtained by adding the value of the criterion that is advantageous (*benefit*) and reduce the value of cost criteria (*cost*), as shown in the following equation:

$$Y_i = \sum_{j=1}^n w_j \times x_{ij} \tag{3}$$

Explanation of Symbols (Optimization Formula) :

$Y_i$  = The optimization score of alternative  $i$ .

$w_j$  = The weight assigned to criterion  $j$ .

$x_{ij}$  = The normalized performance value of alternative  $i$  under criterion  $j$ .

$i$  = The alternative index ( $i = 1, 2, m$ ).

$J$  = The criterion index ( $j = 1, 2, \dots, n$ ).

$n$  = Signifies the total number of criteria considered in the study.

$\Sigma$  = The summation operator.

As all criteria applied in this research are categorized as benefit criteria, the optimization value is obtained by aggregating all weighted normalized values without performing any subtraction process.

Last, Determine preference or ranking values, Value  $Y_i$  the resulting one is used as a basis in the ranking process for used laptop alternatives. Alternative with value  $Y_i$  highest is the best alternative.

## RESULT AND DISCUSSION

System testing was carried out using the black box testing approach to verify that the main system functions operate according to the designed specifications. The testing focused on validating inputs, processing, and outputs without examining the internal program code. A summary of the functional testing results is presented in Table 1

Table 1. Summary of Black Box Testing Results

No	Tested Feature	Expected Outcome	Status
1	Laptop Data Management (add, edit, delete)	Data is stored and updated correctly in the system	Valid
2	MOORA Calculation Process	Optimization values and rankings are generated correctly	Valid
3	Ranking Display	Alternatives are ranked and displayed accurately	Valid

The testing results indicate that all primary system functionalities perform as intended. Data input, processing using the MOORA method, and the presentation of ranking results operate correctly and consistently. Therefore, the developed Decision Support System is considered functionally reliable and suitable for assisting in the selection of the best used laptop at Tech Kios Laptop Kisaran.

The data used in this study came from used laptops available in the Tech Kios Laptop Range and were processed based on predetermined criteria. Criteria data can be found in Table 2.

Table 2. Criteria Data Table

No	Code Criterion	Name Criterion
1	C1	Brand
2	C2	Screen Resolution
3	C3	Laptop Size
4	C4	Battery Life

Furthermore, the determination of the weighting of the criteria in this study was carried out based on the results of observations and interviews with

employees and owners of the Kisaran Laptop Kios Tech Shop who are experienced in selling used laptops. Weights are determined according to the level of importance of each criterion to consumer needs in choosing a laptop. Data on the weight values of the criteria can be found in Table 3.

Table 3. Table of Criterion Weight Values

Criterion	Weight	Type
C1	0.27	Benefit
C2	0.20	Benefit
C3	0.20	Benefit
C4	0.33	Benefit

Furthermore, each alternative is coded A01 to A08 to facilitate the process of processing data and calculations using the MOORA method. Alternative data is obtained through direct observation and interviews with the store, including brands and types of laptops that are still suitable for sale and are often recommended to customers, which are then used as input data in the assessment process and decision support system calculations to determine the best used laptop. Alternative data on laptops can be found in Table 4.

Table 4. Laptop Alternative Table

Code Alternative	Laptop Brand & Type
A01	HP 245 G10
A02	Acer Aspire Slim 5
A03	Asus Vivobook 15
A04	Lenovo Pad Slim
A05	HP 14S
A06	Lenovo Thinkpad
A07	Acer Nitro 5
A08	Asus Vivobook GO 14

Next weighting, The weighting of the assessment in each alternative is obtained from the relevant authorities, where the determination of these weights is based on internal policies and considerations that have been adapted to research needs and objectives, so that the resulting assessment results can be objective and relevant. The weighting of the assessment can be found in Table 5.

Table 5. Rating Weight Table

Code	Criterion			
	C1	C2	C3	C4
A01	3	3	5	4
A02	2	5	5	5
A03	4	5	2	4
A04	5	5	5	5
A05	3	3	5	3
A06	5	5	5	5
A07	2	5	2	2
A08	4	3	5	4

Next, the normalization stage is carried out for equating value every element deep agar matrix have scale yang consistent. The normalization values can be seen in Table 6.

Table 6. Table of Normalized Values

Code	Criterion			
	C1(+)	C2(+)	C3(+)	C4(+)
A01	0.2887	0.2433	0.3978	0.3430
A02	0.1925	0.4056	0.3978	0.4287
A03	0.3849	0.4056	0.1591	0.3430
A04	0.4811	0.4056	0.3978	0.4287
A05	0.2887	0.2433	0.3978	0.2572
A06	0.4811	0.4056	0.3978	0.4287
A07	0.1925	0.4056	0.1591	0.1715
A08	0.3849	0.2433	0.3978	0.3430

After whole value deep matrix normalization obtained, step next is multiplying every value that with weight percentage yang appropriate for each criterion. Result can see Table 7.

Table 7. Table of Normalized and Weighted Values

Code	Criterion			
	C1 (+)	C2 (+)	C3 (+)	C4 (+)
A01	0.0779	0.0487	0.0796	0.1132
A02	0.0520	0.0811	0.0796	0.1415
A03	0.1039	0.0811	0.0318	0.1132
A04	0.1299	0.0811	0.0796	0.1415
A05	0.0779	0.0487	0.0796	0.0849
A06	0.1299	0.0811	0.0796	0.1415
A07	0.0520	0.0811	0.0318	0.0566
A08	0.1039	0.0487	0.0796	0.1132

The next stage involves calculating the  $Y_i$  value by summing all weighted normalized values for each alternative, since all criteria in this study are categorized as benefit criteria. Therefore, no subtraction process is applied in the calculation. The results obtained from this computation serve as the final outcome in the implementation of the MOORA method. The optimization values for each alternative are presented in Image 1.

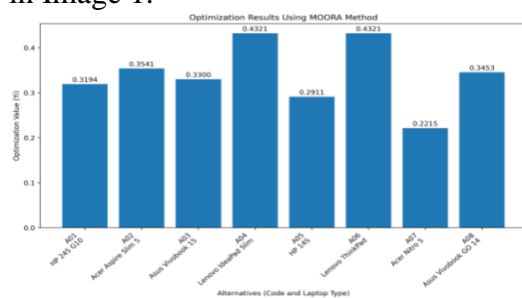


Image 1. Bar Graph of Optimization Results

The bar graph illustrates the comparison of optimization values ( $Y_i$ ) for each alternative. It can be clearly observed that A04 and A06 have the highest optimization values (0.4321), indicating that these alternatives are the top-ranked used laptops. Meanwhile, A07 has the lowest value (0.2215), making it the lowest priority alternative.

The graphical representation enhances the clarity of comparison among alternatives and provides a more visually interpretable evaluation result.

### Information System Results

In addition to generating the mathematical results of the MOORA method, this study also implements the method into a web-based Decision Support System (DSS). The developed system is designed to facilitate data management, automate the calculation process, and present ranking results in a structured and systematic manner.

The system begins with a login interface that functions as an access control mechanism to ensure data security and restrict system usage to authorized users. After successful authentication, users are directed to the main dashboard, which provides access to several modules, including criteria management, alternative data management, MOORA calculation processing, and ranking result visualization.



Image 2. Login Page

The criteria management module enables administrators to define, edit, and delete evaluation criteria used in selecting the best used laptop. Each criterion is assigned a specific weight and categorized as either a benefit or cost attribute in accordance with the MOORA method framework. This configuration serves as the foundation for the

normalization and optimization processes. Through the alternative data module, users input the list of used laptops along with their respective scores for each criterion. The stored data are subsequently processed automatically by the system through the MOORA computation module.

MOORA computations. Compared to the previous manual approach, the system improves time efficiency, minimizes subjectivity in decision-making, and generates more objective and structured recommendations for determining the best used laptop at Tech Kios Laptop Kisanan

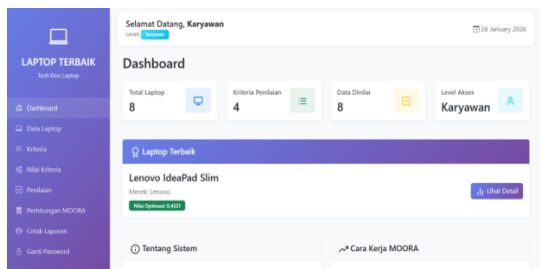


Image 3. System Dashboard

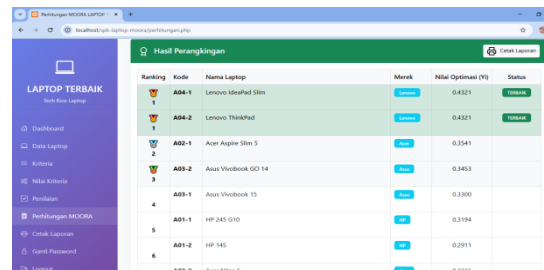


Image 5. Ranking Result Display

The calculation procedure performed by the system includes normalization of the decision matrix, computation of optimization values, and determination of the final score for each alternative. The results are presented in the form of a ranking table, where alternatives are ordered based on the highest optimization values. To enhance clarity and interpretability, the system also provides a graphical representation that visually compares the scores of each alternative.

### CONCLUSION

This research successfully implemented a MOORA-based Decision Support System to determine the best used laptop at Tech Kios Laptop Kisanan. The system processes alternatives based on brand, screen resolution, laptop size, and battery durability criteria to generate objective rankings. The results indicate that alternatives A04 and A06 achieved the highest optimization values and are recommended as the best options. The implementation of this system enhances decision-making accuracy and reduces subjectivity in the laptop selection process. Future research may consider adding more criteria, such as price and processor performance, to improve recommendation accuracy.

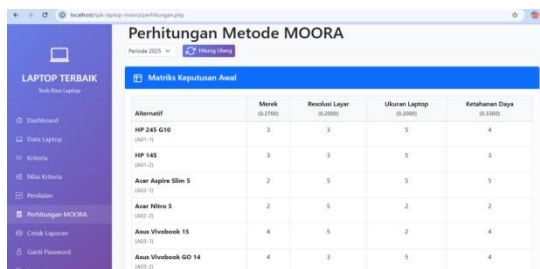


Image 4. MOORA Calculation Process

The implementation results demonstrate that the developed system is capable of performing automated calculations and producing ranking outcomes consistent with manual

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