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Decision Support System for the Most Chosen and Preferred Smartphone Using the MOORA Method

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Abstract

The rapid development of the digital era in Indonesia has posed difficulties for consumers in choosing the right smartphone for them. This research aims to develop a DSS (Decision Support System) using the MOORA (Multi-Objective Optimization on the Basis of Ratio Analysis) method to determine the best smartphone according to consumer preferences, with criteria including smartphone price, design, usability flexibility, durability, performance, and camera quality. Evaluation is carried out by calculating the weight value of each criterion and ranking the smartphone alternatives based on a questionnaire. The research results show that the MOORA method is able to determine the best smartphone according to the people of Solo and help consumers choose the right smartphone for them. This research involves five of the most widely used smartphones in Indonesia (Apple, Samsung, Xiaomi, Oppo, Vivo, and Infinix) using the MOORA (Multi-Objective Optimization on the Basis of Ratio Analysis) method based on the defined criteria. The results show that Xiaomi smartphones rank first both in terms of quality and user quantity. The practical implications of this research are significant, providing consumers with a data-driven approach to make informed smartphone choices, thereby enhancing their purchasing satisfaction.

Keywords: *Smartphone, DSS, MOORA, Preference*

I. Introduction

Smartphones have become an essential part of everyday life, not only as communication tools but also as multifunctional devices encompassing entertainment, work, and education. In Indonesia, the smartphone market continues to grow rapidly, driven by the growth of the younger generation and the increasing use of technology. Smartphones themselves are electronic devices that function like mobile phones but are equipped with additional capabilities such as running applications, internet access, multimedia players, and various other features typically found on computers. Smartphones generally use operating systems such as Android or iOS, which allow users to install additional applications as needed. According to the Kamus Besar Bahasa Indonesia (KBBI), a smartphone is "a smart phone, a mobile phone that has various computer functions, such as accessing the internet, receiving and sending emails, and so on."

In 2024, it is estimated that the number of smartphone users in Indonesia will reach 194.26 million people. This number has increased by 2.23% compared to 2023, which had 190.03 million users [1]. However, as the smartphone market in Indonesia grows, consumers find it difficult to determine the right smartphone for them. The difficulty in determining a suitable smartphone necessitates the creation of a Decision Support System (DSS) to assist consumers in selecting their smartphones based on the feedback provided by consumers this year through questionnaires distributed to the citizens of Solo city.

Recent advancements in smartphone technology, such as the integration of AI and improved camera systems, have significantly influenced consumer preferences. Understanding these trends is crucial for developing an effective DSS that aligns with the evolving market dynamics. This study aims to create a DSS that can analyze and recommend smartphones to consumers using the MOORA method.

It is hoped that this research will provide consumers with a clear picture of the current favorite smartphones, along with clear and easily understandable data-driven analysis.

II. Method

1. Decision Support System (DSS)

According to experts, a Decision Support System (DSS) is an interactive system that supports the decision-making process by using a combination of data, models, and user interfaces (UI) to evaluate various decision scenarios. DSS is designed to address problems with unique characteristics, requiring a flexible, interactive system that can be tailored to the user's needs. DSS is typically used by middle to upper-level managers to aid in making strategic and tactical decisions involving many variables and uncertainties. [2]

The main benefit of DSS is to speed up the decision-making process. DSS allows decision-makers to obtain accurate and up-to-date information, enabling them to make better and faster decisions. DSS also helps reduce subjectivity in decision-making by providing objective and verifiable data.

2. Research methodology

The research method is a scientific way to obtain valid data, with the aim of finding, developing, and proving certain knowledge so that it can be used to understand, solve, and anticipate problems [4]. This study employs a quantitative approach. The data collection technique uses Google Forms by distributing them to individuals aged 18-30 in the Solo area.

The questionnaire was distributed to 104 respondents with 6 alternatives and 6 criteria. The data collection tool was developed with a closed questionnaire, namely a set of lists of statements or questions with possible answers that have been provided, so respondents only choose one of five alternative answers [5].

3. MOORA Methods

The Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method was first introduced by Brauers and Zavadkas [6]. MOORA is a multi-objective system developed to optimize multiple conflicting attributes at the same time [7],[9].

One of the advantages of the MOORA method is its ability to address objectives for conflicting criteria, where criteria can either be beneficial (benefit) or non-beneficial (cost) [10]. This method generates a final score for each option, which is then ranked based on the alternatives with the highest value. The steps involved in completing this procedure are as follows [11],[12]:

a. Preparing the Decision Matrix

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

b. Calculating the Normalization Matrix

$$T = \begin{bmatrix} s & 0 & -s \cdot c_x \\ 0 & s & -s \cdot c_y \\ 0 & 0 & 1 \end{bmatrix} \quad (2)$$

c. Calculating the Preference Values

In this step, which is the core of the process, each attribute is multiplied by the criteria weights for each alternative, then the results of the advantage criteria are added and subtracted from the results of the disadvantage criteria using the following formula [14],[15],[13]:

$$Y_i = \sum_{j=1}^{g} w_j x_{ij} - \sum_{j=g+1}^{n} w_j x_{ij} \quad (3)$$

III. Results and Discussion

1. Application of Alternatives

In determining smartphone recommendations to help the community in choosing the right smartphone using the MOORA method, it starts with determining the alternative samples used.

Table 1. Alternative Data

Alternative	Brand
A1	Apple
A2	Samsung
A3	Xiaomi
A4	Oppo
A5	Vivo
A6	Invinix

2. Application of Criteria

The following is the assessment criteria data from the Decision Support System in Determining the Most Favorite Smartphone Using the MOORA Method

Table 2. Criteria Description

Criteria	Description	Weight Value (Wj)	Type
C1	Price	2	Cost
C2	Flexible	1	Benefit
C3	Design	1,5	Benefit
C4	Performance	3,0	Benefit
C5	Durable	1,5	Benefit
C6	Camera	1	Benefit

3. Alternative Weights and Criteria

The following table 3 contains data on the alternative values of each criterion.

Table 3. Alternative and Criteria

Alternatif	C1	C2	C3	C4	C5	C6
A1	2	4	4	4	3	4
A2	3	4	4	3	3	5
A3	4	4	4	4	4	4
A4	4	3	3	4	3	4
A5	3	4	3	2	4	4
A6	4	4	3	4	4	4

4. Decision Matrix

The data in Table 3 is converted into a matrix consisting of columns and rows to facilitate calculations in the next step, as presented below.

$$X = \begin{bmatrix} 2\ 4\ 4\ 4\ 3\ 4 \\ 3\ 4\ 4\ 3\ 3\ 5 \\ 4\ 4\ 4\ 4\ 4\ 4 \\ 4\ 3\ 3\ 4\ 3\ 4 \\ 3\ 4\ 3\ 2\ 4\ 4 \\ 4\ 4\ 3\ 4\ 4\ 4 \end{bmatrix} \quad (4)$$

5. Matrix Normalization

Normalization aims to unite each matrix element so that the matrix elements have uniform values [16],[17]. Here is the matrix normalization based on data in the decision matrix using equation 3 above:

$$Xij = \begin{bmatrix} 0{,}2390\ 0{,}4240\ 0{,}4618\ 0{,}4558\ 0{,}3464\ 0{,}3903 \\ 0{,}3585\ 0{,}4240\ 0{,}4618\ 0{,}3419\ 0{,}3464\ 0{,}4879 \\ 0{,}4781\ 0{,}4240\ 0{,}4618\ 0{,}4558\ 0{,}4618\ 0{,}3903 \\ 0{,}4781\ 0{,}3180\ 0{,}3464\ 0{,}4558\ 0{,}3464\ 0{,}3903 \\ 0{,}3585\ 0{,}4240\ 0{,}3464\ 0{,}2279\ 0{,}4618\ 0{,}3903 \\ 0{,}4781\ 0{,}4240\ 0{,}3464\ 0{,}4558\ 0{,}4618\ 0{,}3903 \end{bmatrix} \quad (5)$$

6. Optimizing Attribute

The optimization value for each alternative is determined by summing the product of the criteria weights and the maximum attribute values (benefit type) and subtracting the sum of the product of the criteria weights and the minimum attribute values (cost type). [18]-[20].

$$Xij = \begin{bmatrix} 0{,}2390(2)\ 0{,}4240(1)\ 0{,}4618(1{,}5)\ 0{,}4558(3)\ 0{,}3464(1{,}5)\ 0{,}3903(1) \\ 0{,}3585(2)\ 0{,}4240(1)\ 0{,}4618(1{,}5)\ 0{,}3419(3)\ 0{,}3464(1{,}5)\ 0{,}4879(1) \\ 0{,}4781(2)\ 0{,}4240(1)\ 0{,}4618(1{,}5)\ 0{,}4558(3)\ 0{,}4618(1{,}5)\ 0{,}3903(1) \\ 0{,}4781(2)\ 0{,}3180(1)\ 0{,}3464(1{,}5)\ 0{,}4558(3)\ 0{,}3464(1{,}5)\ 0{,}3903(1) \\ 0{,}3585(2)\ 0{,}4240(1)\ 0{,}3464(1{,}5)\ 0{,}2279(3)\ 0{,}4618(1{,}5)\ 0{,}3903(1) \\ 0{,}4781(2)\ 0{,}4240(1)\ 0{,}3464(1{,}5)\ 0{,}4558(3)\ 0{,}4618(1{,}5)\ 0{,}3903(1) \end{bmatrix} \quad (6)$$

Weighted Matrix Normalization Results:

$$Xij = \begin{bmatrix} 0{,}4730\ 0{,}4240\ 0{,}6927\ 1{,}3674\ 0{,}5196\ 0{,}3903 \\ 0{,}7170\ 0{,}4240\ 0{,}6927\ 1{,}0257\ 0{,}5196\ 0{,}4879 \\ 0{,}9560\ 0{,}4240\ 0{,}6927\ 1{,}3674\ 0{,}6927\ 0{,}3903 \\ 0{,}9560\ 0{,}3180\ 0{,}5196\ 1{,}3674\ 0{,}5196\ 0{,}3903 \\ 0{,}7170\ 0{,}4240\ 0{,}5196\ 0{,}6837\ 0{,}6927\ 0{,}3903 \\ 0{,}9560\ 0{,}4240\ 0{,}5196\ 1{,}3674\ 0{,}6927\ 0{,}3903 \end{bmatrix} \quad (7)$$

7. Rangking *Y* Value

Calculating the preference value for each alternative (student) using the MOORA formula, involves data normalization, Determining the criterion weight, changing the criterion value into a matrix, and the preferences of each criterion [21]. The last stage in the DSS process using the MOORA Method is to determine the ranking [22].

Tabel 4. Nilai *Yi*

Alternatif	Max	Min	Yi	Ranking
A1	3,867	0,424	3,443	4
A2	3.866	0,424	3,442	5
A3	4,523	0,424	4,099	1
A4	4,070	0,318	3,752	3
A5	3,427	0,424	3,003	6
A6	4,350	0,424	3,926	2

The last stage in the DSS process using the MOORA Method is to determine the ranking [24].

Tabel 5. Rankingan Alternatif

Merk Mobil	Ranking
Xiaomi	1
Infinix	2
Oppo	3
Apple	4
Samsung	5
Vivo	6

Based on the calculation results using the MOORA method related to the smartphone brand, the alternative with code A1, the Xiaomi handphone brand, is ranked 1st with a value of 4,099.

IV. Conclusion

This study has succeeded in developing a Decision Support System (DSS) with the MOORA method to identify the most favorite smartphone brands based on the preferences of smartphone users. The MOORA method excels in processing multiple criteria, simplifying data normalization, and producing objective final scores.

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