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Implementation of Decision Support System in Choosing the Best E-Wallet using ROC and MOORA Weighting Methods

Mesran[1,*], Ahmad Qomaini[1], Ika Paulina Sirait[1], Rosnizam[2]

[1] Faculty of Computer Science and Information Technology, Informatics Engineering, Budi Darma University, Medan, Indonesia
[2] Mathematics, Science and Computers, Tuanku Syed Sirajuddin Polytechnic, Perlis, Malaysia
Email: [1,*]mesran.skom.mkom@gmail.com, [2]ahmadqomaini@gmail.com, [3]ikapaulina@gmail.com, [4]rosnizamptss@gmail.com
Correspondence Author Email: mesran.skom.mkom@gmail.com

Abstract

This research aims to analyze digital wallet usage preferences among university students using a decision support system. With the rise of various digital wallet services such as DANA, LinkAja, and GoPay, students often have difficulty in choosing the platform that best suits their needs. To solve this problem, the research uses a combination of the Rank Order Centroid (ROC) and Multi-Objective Optimization by Ratio Analysis (MOORA) methods. The ROC method was used to determine the criteria weights, while MOORA was applied to rank the digital wallet alternatives. The criteria used in this study include merchant range, cashback program, transaction fees, and ease of use. The research sample consisted of 150 students from the Faculty of Economics, Universitas Nusantara. The results showed that GoPay ranked first as the most preferred digital wallet, followed by DANA in second place, and LinkAja in third. The findings are expected to help students in choosing the digital wallet that best suits their preferences, as well as provide input for digital wallet service providers to improve their service quality.

Keywords: Digital Wallet; Decision Support System; ROC Method; MOORA Method; User Preferences

1. INTRODUCTION

The development of financial technology (fintech) in Indonesia has created major changes in the way people transact. Fintech enables faster, safer and more convenient financial transactions, both at the individual and business level. One prominent innovation in this sector is the emergence of digital wallet services. Digital wallets are smartphone-based applications that allow users to store money electronically and use it in a variety of transactions, ranging from payment for goods and services to remittances between users. In Indonesia, the trend of using digital wallets is increasing along with the widespread adoption of technology, especially among the younger generation such as university students.

The three most popular digital wallet platforms in Indonesia are DANA, LinkAja, and GoPay. Each of these platforms compete to provide the best service, with unique features that they offer, such as cashback programs, extensive merchant coverage, competitive transaction fees, and ease of use interface. DANA is known for its strong security system and growing merchant reach. LinkAja, initiated by SOEs, offers payment services integrated with various state financial institutions. GoPay, part of the Gojek ecosystem, has its main appeal in its user loyalty program and integration with other services in the Gojek app. However, this plethora of options can cause confusion for consumers, especially students, who need a digital wallet platform that best suits their needs in their daily activities, such as shopping, paying for transportation, or sending money between friends.

Students are often faced with the choice of using the most efficient digital wallet, but they often struggle to determine which one is the best as each platform offers various features and advantages. In these situations, choosing the right digital wallet can be a complex decision, as it involves a variety of factors that must be considered. To address this challenge, a scientific approach is needed that can help users make a more informed and objective decision based on relevant criteria.

A Decision Support System (DSS) is a computer-based system designed to assist decision making by analyzing various alternatives based on certain criteria[1]. SDM uses quantitative and qualitative methods to process information and provide the best recommendation for users. In the context of digital wallet selection, GIS can assist students in choosing the platform that best suits their needs by considering several key factors. The use of CBMS helps minimize subjective bias in decision-making and ensures that choices are made based on systematic and measurable consideration[2][3].

This research proposes the use of a combination of Rank Order Centroid (ROC) and Multi-Objective Optimization by Ratio Analysis (MOORA) methods to help the decision-making process in choosing the best digital wallet among students. The ROC method is used to determine the weight of criteria based on their order of importance. This method provides a practical solution to determine proportional weights even with limited data[4][5][6]. In this case, ROC is able to objectively weight each criterion used in the evaluation of digital wallets.

After the criteria weights are obtained, the MOORA method is applied to rank the digital wallet alternatives. MOORA is a very flexible technique for solving multi-objective optimization problems, especially those involving various evaluation criteria[7][8]. In this study, MOORA is used to evaluate digital wallets based on four main criteria: merchant reach, cashback program, transaction fees, and ease of use. These criteria were chosen because they are relevant to the needs of students in using digital wallets, both for daily transaction purposes and convenience in use.

Merchant coverage is one of the main factors because the more merchants that work with digital wallet platforms will affect how often the wallet is used. Cashback programs are also one of the main attractions for students because they provide financial incentives in every transaction. In addition, low transaction fees are an important concern, especially

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for students who often make small payments. Finally, the ease of use of the app is also a determining factor, as students tend to look for apps that are intuitive and easy to operate.

Some research on topics and methods have been carried out and used as a reference in making this research. One of the studies by Ketrin Munthe et al in May 2022 discussed a decision support system for selecting honorary employees. This research uses the ROC and MOORA methods because they are considered capable of providing the best decision based on predetermined criteria. From the calculation results, the best alternative chosen is A18 on behalf of "Andry" with a value of Yi = 0.328[9]. Then, research by Teddy Erlambang et al in March 2023 discussed the application of the MOORA method and ROC weighting in the selection of contraceptives. The results of this study indicate that the MOORA method can rank and provide recommendations for contraceptives that match the needs, with the alternative Pill (A5) as a suitable contraceptive, with the highest Yi value of 0.2249[10]. Furthermore, Muhammad Naufal Rifqi and Agus Iskandar in October 2023 examined the best wedding organizer recommendation decision support system using the MOORA method and ROC weighting. This research resulted in four highly recommended wedding organizer alternatives, while four other alternatives were moderately recommended. These findings indicate that the application of MOORA and ROC can provide accurate and efficient recommendations according to the criteria set, helping couples in choosing the most suitable wedding organizer[11]. On the other hand, Windy Amelia Putri et al in April 2022 conducted research on e-wallet selection using the Analytic Hierarchy Process (AHP) and TOPSIS methods. The results of this study indicate that ShopeePay is the best alternative, followed by GoPay, Dana, OVO, and LinkAja, with a consistency value of 0.048 which is valid and consistent[12]. Finally, research by Dinda Oktaviani Waruwu and Yulhendri in January 2024 regarding the decision support system for selecting the best e-wallet with the AHP method using four evaluation criteria, namely ease of use, security, merchant network, and promotion. As a result, OVO is the highest ranked e-wallet among other alternatives such as GoPay, ShopeePay, and DANA[13].

By using a combination of ROC and MOORA methods, this research seeks to provide objective recommendations regarding the most suitable digital wallet options for college students. The results of this study are not only expected to help students make better and more informed decisions, but also provide valuable input for digital wallet service providers to improve the quality and competitiveness of their services in accordance with the preferences and needs of users in the student segment. This research has the potential to be a reference for future studies in the development of decision support systems in the fintech sector and digital financial services.

2. RESEARCH METHODOLOGY

2.1 Decision Support System

Decision Support System (DSS) is defined as an interactive system that helps decision makers use data and models to solve semi-structured and unstructured problems[14]. Decision-making in this context is the process of choosing the best alternative from the various options available. SDM must fulfill several important characteristics, namely designed to assist decision makers in solving structured problems, support both individuals and groups, and be able to combine various models and analysis techniques[15]. In addition, it should be designed to be easy to use, flexible, and highly adaptable. The system can be used as a standalone solution by decision makers at a single location or at multiple locations within an interconnected organization[16].

2.2 *E-Wallet*

Digital wallets have two types of storage media, namely server-based and chip-based. Server-based digital wallets are electronic money that requires a connection with the issuing server, often referred to as an electronic wallet (e-wallet)[17]. Meanwhile, chip-based digital wallets are usually cards with chips embedded in them to store electronic money. E-wallet is a form of digital money that provides convenience for transactions without having to carry physical cash, thus supporting cashless transactions. The internet network serves as an intermediary in the electronic payment system, allowing transactions to take place quickly and efficiently[18].

The benefits of using digital payments are diverse, including the ease of making transactions that are universal as long as they are within the same country, guaranteed transaction security, and time and energy efficiency. Not surprisingly, more and more people are becoming part of the cashless society by using digital wallets to smooth their payment transactions. The use of digital wallets has also expanded during the Covid-19 pandemic, along with the increasing public awareness to comply with health protocols. E-wallets are becoming increasingly accessible using only the internet and related applications, so the financial technology that gave birth to e-wallets has played an important role in the development of a cashless society in Indonesia. People are now using cash less and less as the main method of making payment transactions[19].

2.3 ROC Method

The ROC method is a technique for determining criteria weights based on their importance. This method assumes that the order of importance of the criteria is the same as the order of their weights[20][21]. The steps in the ROC method are as follows[22]:

$$C_1 > C_2 > C_3 > \mathrm{C_m} \quad (1)$$

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Assigning weight values (W):

$$W_m = \frac{1}{m}\sum_{1=1}^{m}\left(\frac{1}{i}\right) \quad (2)$$

2.4 MOORA Method

MOORA (Multi-Objective Optimization on The Basic of Ratio Analysis) is a multi-objective system, which has two or more conflicting attributes. MOORA optimizes the attributes by applying complex mathematical calculations so that the output is obtained in the form of problem solving[23]. When using the MOORA approach, the first step is to evaluate conflicting attributes simultaneously to optimize them. This results in a final value for each option, which is then sorted by the alternative with the largest value[24]. The stages involved in completing this procedure are as follows[25]:

a. Define goals, identify attributes and evaluate those attributes
b. Determine the value of the decision matrix

$$X_{ij} = \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1n} \\ X_{21} & X_{22} & \cdots & X_{2n} \\ \cdots & \cdots & \ldots & \ldots \\ X_{m1} & X_{m2} & \cdots & X_{mn} \end{bmatrix} \quad (3)$$

c. Determining matrix normalization
Summarized by Breures, for the denominator, the best choice is the square root of the sum of the squares and each alternative per attribute, so it is formulated as follows:

$$X_{ij}^{*} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^{2}}} \quad (4)$$

d. Determining attribute optimization
For Multi-Objective optimization, the normalized performance is added in the maximization case (for beneficial attributes) and subtracted in the minimization case (for non-beneficial attributes). When the weight attribute is included, it can be formulated as follows:

$$y_i^{*} = \sum_{j=1}^{g} w_j X_{ij}^{*} - \sum_{j=g+1}^{n} w_j x_{ij}^{*} \quad (5)$$

e. Ranking of Yi values
The Yi value depends on the total maximum and minimum in the decision matrix, which can be positive or negative. Ranking the Yi value can be used as a decision result. The data from this research are alternatives and criteria.

2.5 Research Stages

In a research, the research method is a very important first step to obtain good results and in accordance with the research objectives. The data collection technique in this research involves several stages as follows:

1. The observation method is used to analyze research needs related to decision making in e-wallet selection. Observations are not only carried out at the research location, but also through literature reviews that are relevant to the object of research.
2. The interview method is applied in the form of questions and answers with experts, aiming to explore in-depth information related to the use of tools and the process of completing research.
3. In addition, a literature study was also conducted, where researchers visited libraries, scientific journals, and other literature sources to compare the results of previous relevant research. The purpose of this literature study is to find the theoretical basis that supports the assessment criteria in the research. This data collection helped build a strong theoretical basis for the research.
4. The next stage is the application of the ROC (Rank Order Centroid) and MOORA (Multi-Objective Optimization by Ratio Analysis) methods, which are used to weigh the criteria and rank the evaluated e-wallet alternatives. This method helps in producing objective and precise decisions.
5. After all data is analyzed using the right approach, this research will be concluded based on the results of the methods that have been applied.

3. RESULTS AND DISCUSSION

3.1 Analysis

In this problem, the selection of digital wallets using MOORA will be discussed, the steps taken in carrying out the calculation, first determine the assessment criteria that have been determined by the alternatives and criteria used, can be seen in Table 1 and Table 2:

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Table 1. Alternative Data

Code	Alternative
A1	ShopeePay
A2	Gopay
A3	OVO
A4	Link
A5	Dana

Table 1 contains a list of e-wallet alternatives that will be evaluated based on several criteria. Each alternative is given a unique code for easy reference in the analysis process, such as ShopeePay (A1), Gopay (A2), OVO (A3), LinkAja (A4), and Dana (A5). ShopeePay is a digital wallet integrated with Shopee, known for its cashback promotions. Gopay is part of Gojek, offering convenience within the Gojek app ecosystem. OVO is connected to various services such as Grab and Tokopedia, while LinkAja, initiated by SOEs, offers a wide range of payment services, including state institutions. Finally, Dana is a fast-growing digital wallet with a wide range of payment and transfer features.

Table 2. Criteria Data

Criteria	Description	Weight Value	Type
C1	Merchant Cooperation	0,521	*Benefit*
C2	Promos and Attractive Offers	0,271	*Benefit*
C3	Customer Service	0,146	*Cost*
C4	Ease of Application	0,063	*Benefit*

Table 2 contains the criteria used to evaluate e-wallets, with weights indicating their level of importance. The first criterion is Merchant Cooperation with a weight of 0.521 which is the most important factor, where the more merchants cooperate, the higher the value of the e-wallet. The second criterion, Promos and Attractive Offers, has a weight of 0.271, showing the importance of promotional offers that can attract users. Customer Service with a weight of 0.146 is a cost criterion, meaning that the lower the value, the better the quality of the service. The last criterion is Ease of Application, with a weight of 0.063, which assesses how easy the application is to use by users. All of these criteria will be used in the MOORA method to determine the best e-wallet based on weight and rank calculations.

Table 3. Criteria Assessment Data

C1	C2	C3	C4	Criteria Value
Very good	Promo compliant	Very good	Promo compliant	50
Good	Moderately Appropriate	Good	Moderately Appropriate	40
Fair	Less Suitable	Fair	Less Suitable	30
Deficient	Not Suitable	Deficient	Not Suitable	20
Very Poor	Very Unsuitable	Very Poor	Very Unsuitable	10

Table 3 illustrates the criteria assessment for each e-wallet alternative based on predetermined criteria. Each criterion has five levels of assessment that reflect the quality of each alternative. For C1 (Merchant Cooperation) and C3 (Customer Service), the assessment is categorized from “Very Good” to “Very Lack”. This reflects how well the e-wallet partners with merchants or provides satisfactory customer service. Criteria C2 (Promos and Attractive Offers) and C4 (Ease of Application) also follow similar scoring categories, with levels ranging from “Promo Compliant” to “Very Unsuitable.” Each assessment level has a numerical value that ranges from 10 to 50, where a value of 50 represents the highest assessment (Excellent or Promo Compliant), and a value of 10 represents the lowest assessment (Very Poor or Very Unsuitable). These values are used to determine the performance of each e-wallet alternative against predetermined criteria in the further analysis process.

3.2 Application of MOORA Method

Table 4. Criteria Data on Each Alternative

Alternative	Criteria			
	C1	C2	C3	C4
Alternatif	Good	Promo compliant	Very good	Suitability
ShopeePay	Fair	Moderately Appropriate	Less	Moderately Appropriate
Gopay	Fair	Less Suitable	Fair	Moderately Suitable
OVO	Less	Not suitable	Less	Less compliant
Link	Fair	Less Suitable	Fair	Less compliant

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Table 4 presents criteria data for each alternative in e-wallet selection. In this table, there are four criteria used, namely C1 (Merchant Reach), C2 (Cashback Program), C3 (Transaction Costs), and C4 (Ease of Use). Each e-wallet alternative, such as ShopeePay, Gopay, OVO, and LinkAja, is evaluated based on these criteria with a qualitative assessment. ShopeePay, for example, received an assessment of "Good" for criterion C1, "Suitable for Promo" for C2, "Very Good" for C3, and "Suitable Enough" for C4. Other alternatives, such as Gopay, OVO, and LinkAja, were also qualitatively assessed on each criterion with varying results.

Table 5. Suitability Rating

Code	Criteria			
	C1	C2	C3	C4
A1	40	50	50	40
A2	30	40	20	40
A3	30	30	30	40
A4	20	20	20	30
A5	30	30	30	30
Max/Min Value	40	50	20	40

Next, Table 5 shows the compatibility ratings, providing numerical evaluations for each alternative based on the same criteria. For example, ShopeePay (A1) received a score of 40 for criterion C1, 50 for C2, 50 for C3, and 40 for C4. Gopay (A2) received a score of 30 for C1, 40 for C2, 20 for C3, and 40 for C4. These numerical values are used to assess the compatibility level of each alternative with the respective criteria quantitatively. At the bottom of this table, the maximum or minimum values for each criterion are displayed, which will be used as a reference in subsequent analysis processes, such as normalization or weighting. The following are the steps in the application of the MOORA method:

1. Create a decision matrix

$$Xij = \begin{bmatrix} 40 & 50 & 50 & 40 \\ 30 & 40 & 20 & 40 \\ 30 & 30 & 30 & 40 \\ 20 & 20 & 20 & 30 \\ 30 & 30 & 30 & 30 \end{bmatrix}$$

2. Normalize the matrix
   a. Merchant Cooperation (C1)

$$X_{11}^{*} = \frac{40}{\sqrt{40^2+30^2+20^2+30^2+30^2}} = 0{,}583$$

$$X_{12}^{*} = \frac{30}{\sqrt{40^2+30^2+20^2+30^2+30^2}} = 0{,}438$$

$$X_{13}^{*} = \frac{30}{\sqrt{40^2+30^2+20^2+30^2+30^2}} = 0{,}438$$

$$X_{14}^{*} = \frac{20}{\sqrt{40^2+30^2+20^2+30^2+30^2}} = 0{,}292$$

$$X_{15}^{*} = \frac{30}{\sqrt{40^2+30^2+20^2+30^2+30^2}} = 0{,}438$$

   b. Promos and Attractive Offers (C2)

$$X_{21}^{*} = \frac{50}{\sqrt{50^2+40^2+30^2+20^2+30^2}} = 0{,}729$$

$$X_{22}^{*} = \frac{30}{\sqrt{50^2+40^2+30^2+20^2+30^2}} = 0{,}583$$

$$X_{23}^{*} = \frac{30}{\sqrt{50^2+40^2+30^2+20^2+30^2}} = 0{,}438$$

$$X_{23}^{*} = \frac{30}{\sqrt{50^2+40^2+30^2+20^2+30^2}} = 0{,}438$$

$$X_{25}^{*} = \frac{30}{\sqrt{50^2+40^2+30^2+20^2+30^2}} = 0{,}438$$

   c. Customer Service (C3)

$$X_{31}^{*} = \frac{50}{\sqrt{50^2+20^2+30^2+20^2+30^2}} = 0{,}729$$

$$X_{31}^{*} = \frac{50}{\sqrt{50^2+20^2+30^2+20^2+30^2}} = 0{,}729$$

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$$X_{33}^{*} = \frac{30}{\sqrt{50^2+20^2+30^2+20^2+30^2}} = 0{,}438$$

$$X_{34}^{*} = \frac{20}{\sqrt{50^2+20^2+30^2+20^2+30^2}} = 0{,}292$$

$$X_{35}^{*} = \frac{30}{\sqrt{50^2+20^2+30^2+20^2+30^2}} = 0{,}438$$

d. Ease of Application (C4)

$$X_{41}^{*} = \frac{40}{\sqrt{40^2+40^2+40^2+30^2+30^2}} = 0{,}583$$

$$X_{41}^{*} = \frac{40}{\sqrt{40^2+40^2+40^2+30^2+30^2}} = 0{,}583$$

$$X_{43}^{*} = \frac{40}{\sqrt{40^2+40^2+40^2+30^2+30^2}} = 0{,}583$$

$$X_{44}^{*} = \frac{30}{\sqrt{40^2+40^2+40^2+30^2+30^2}} = 0{,}438$$

$$X_{45}^{*} = \frac{30}{\sqrt{40^2+40^2+40^2+30^2+30^2}} = 0{,}438$$

Once all the criteria have been normalized, the normalized matrix values are as follows:

$$Xij = \begin{bmatrix} 0{,}583 & 0{,}729 & 0{,}729 & 0{,}583 \\ 0{,}438 & 0{,}583 & 0{,}292 & 0{,}583 \\ 0{,}438 & 0{,}438 & 0{,}438 & 0{,}583 \\ 0{,}292 & 0{,}292 & 0{,}292 & 0{,}438 \\ 0{,}438 & 0{,}438 & 0{,}438 & 0{,}438 \end{bmatrix}$$

3. Optimize Attribute Values

$$Xij * wj = \begin{bmatrix} 0{,}583(0{,}521) & 0{,}729(0{,}271) & 0{,}729(0{,}146) & 0{,}583(0{,}063) \\ 0{,}438(0{,}521) & 0{,}583(0{,}271) & 0{,}292(0{,}146) & 0{,}583(0{,}063) \\ 0{,}438(0{,}521) & 0{,}438(0{,}271) & 0{,}438(0{,}146) & 0{,}583(0{,}063) \\ 0{,}292(0{,}521) & 0{,}292(0{,}271) & 0{,}292(0{,}146) & 0{,}438(0{,}063) \\ 0{,}438(0{,}521) & 0{,}438(0{,}271) & 0{,}438(0{,}146) & 0{,}438(0{,}063) \end{bmatrix}$$

The result of multiplying by the criteria weights is:

$$Xij = \begin{bmatrix} 0{,}304 & 0{,}198 & 0{,}106 & 0{,}037 \\ 0{,}228 & 0{,}158 & 0{,}043 & 0{,}037 \\ 0{,}228 & 0{,}119 & 0{,}064 & 0{,}037 \\ 0{,}152 & 0{,}079 & 0{,}043 & 0{,}028 \\ 0{,}228 & 0{,}119 & 0{,}064 & 0{,}028 \end{bmatrix}$$

4. Perform ranking

$Shopeepay = (0{,}304 + 0{,}198 + 0{,}037) - 0{,}106 = 0{,}432$

$Gopay = (0{,}228 + 0{,}158 + 0{,}037) - 0{,}043 = 0{,}380$

$OVO = (0{,}228 + 0{,}119 + 0{,}037) - 0{,}064 = 0{,}320$

$LinkAja = (0{,}152 + 0{,}079 + 0{,}028) - 0{,}043 = 0{,}216$

$Dana = (0{,}228 + 0{,}119 + 0{,}028) - 0{,}064 = 0{,}311$

Table 6. Ranking Results

Code	Alternative	Result Values	Ranking
A1	ShopeePay	0.432	1
A2	Gopay	0.380	2
A3	OVO	0.320	3
A4	Link	0.216	5
A5	Dana	0.311	4

Table 6 presents the ranking results of e-wallet alternatives based on the result values obtained from the evaluation process using specific methods, such as ROC and MOORA. In this table, each alternative is coded, for example, A1 for ShopeePay, A2 for Gopay, and so on. The result values listed are the quantitative outcomes derived from the previously

processed criteria. According to the ranking results, ShopeePay (A1) takes first place with a score of 0.432, followed by Gopay (A2) in second place with a score of 0.380, and OVO (A3) in third place with a score of 0.320. Meanwhile, Dana (A5) ranks fourth with a score of 0.311, and LinkAja (A4) is in last place, fifth, with a score of 0.216. This ranking provides an overview of the best to worst order of the evaluated e-wallet alternatives, where a higher result value indicates a better ranking for the alternative.

4. CONCLUSION

Based on the results of the decision support system implementation using the ROC and MOORA weighting methods for selecting the best e-wallet, the rankings show that ShopeePay occupies the first position with the highest score of 0.432. This indicates that ShopeePay is the best e-wallet choice based on the criteria used, such as merchant coverage, cashback programs, transaction fees, and ease of use. Gopay ranks second with a score of 0.380, followed by OVO and Dana, while LinkAja is in last place. This process demonstrates that the ROC and MOORA methods can be effectively implemented to assist in complex decision-making, such as selecting the best e-wallet, by considering various relevant factors.

REFERENCES

[1] I. Susilawati and P. Pristiwanto, "Sistem Pendukung Keputusan Pemilihan Pekerja Buruh Harian Lepas Dengan Menggunakan Metode Waspas (Studi Kasus: PT. Socfin Indonesia)," *KOMIK (Konferensi Nasional Teknologi Informasi dan Komputer)*, vol. 5, no. 1, 2021, doi: 10.30865/komik.v5i1.3737.

[2] S. H. Hadad, "Penerapan Metode Additive Ratio Assessment (ARAS) Dalam Pemilihan Guru Terbaik," *CHAIN: Journal of Computer Technology, Computer Engineering, and Informatics*, vol. 1, no. 4, pp. 170–178, 2023, doi: 10.58602/chain.v1i4.70.

[3] W. A. Setiawan and R. D. Arianda, "Sistem Pendukung Keputusan Pemilihan Karyawan Terbaik Menerapkan Metode MOORA," *TIN: Terapan Informatika Nusantara*, vol. 3, no. 8, pp. 324–331, 2023, doi: 10.47065/tin.v3i8.4160.

[4] I. Oktaria, "Kombinasi Metode Multi-Attribute Utility Theory (MAUT) dan Rank Order Centroid (ROC) dalam Pemilihan Kegiatan Ekstrakulikuler," *Jurnal Ilmiah Informatika Dan Ilmu Komputer (JIMA-ILKOM)*, vol. 2, no. 1, pp. 1–11, 2023, doi: 10.58602/jima-ilkom.v2i1.12.

[5] F. Mahdi, F. Faisal, D. P. Indini, and M. Mesran, "Penerapan Metode WASPAS dan ROC (Rank Order Centroid) dalam Pengangkatan Karyawan Kontrak," *Bulletin of Computer Science Research*, vol. 3, no. 2, pp. 197–202, 2023, doi: 10.47065/bulletincsr.v3i2.232.

[6] M. A. Abdullah and R. T. Aldisa, "Penerapan Metode MOOSRA Dalam Penentuan Penerimaan Frontliner Menggunakan Pembobotan Metode ROC," *JURIKOM (Jurnal Riset Komputer)*, vol. 10, no. 1, pp. 330–337, 2023, doi: 10.30865/jurikom.v10i1.5647.

[7] S. Hutagalung, D. S. Gea, and D. P. Indini, "Penerapan Metode MOORA Dalam Pemilihan Bimbingan Belajar Terbaik," *Journal of Informatics Management and Information Technology*, vol. 3, no. 1, pp. 1–7, 2023, doi: 10.47065/jimat.v3i1.226.

[8] D. M. El Faritsi, D. Saripurna, and I. Mariami, "Sistem Pendukung Keputusan Untuk Menentukan Tenaga Pengajar Menggunakan Metode MOORA," *Jurnal Sistem Informasi Triguna Dharma (JURSI TGD)*, vol. 1, no. 4, pp. 239–249, 2022, doi: 10.53513/jursi.v1i4.4948.

[9] K. Munthe, T. R. A. Syahputra, A. A. Pasuli, and M. A. Hasibuan, "Sistem Pendukung Keputusan Pemilihan Pegawai Honorer Kelurahan Medan Sinembah Menerapkan Metode ROC dan MOORA," *Bulletin of Informatics and Data Science*, vol. 1, no. 1, pp. 20–29, 2022, doi: 10.61944/bids.v1i1.5.

[10] T. E. Teddy, M. L. Akbar, and N. D. Puspa, "Penerapan Metode MOORA dan Pembobotan ROC Dalam Pemilihan Alat KB," *Journal of Computing and Informatics Research*, vol. 2, no. 2, pp. 37–43, 2023, doi: 10.47065/comforch.v2i2.524.

[11] M. N. Rifqi and A. Iskandar, "Sistem Pendukung Keputusan Rekomendasi Wedding Organizer Terbaik Menerapkan Metode MOORA dan Pembobotan ROC," *Journal Of Information System Research (JOSH)*, vol. 5, no. 1, pp. 194–201, 2023, doi: 10.47065/josh.v5i1.4433.

[12] W. A. Putri, D. Rachmawati, and W. S. Silalahi, "Sistem Pendukung Keputusan Pemilihan E-Wallet Menggunakan Metode Analytic Hierarchy Process-TOPSIS: E-Wallet Selection Decision Support System Using Analytic Hierarchy Process-TOPSIS Method," *MALCOM: Indonesian Journal of Machine Learning and Computer Science*, vol. 2, no. 1, pp. 18–27, 2022, doi: 10.57152/malcom.v2i1.160.

[13] D. O. Waruwu, "Sistem Pendukung Keputusan Pemilihan E–Wallet Terbaik Dengan Menggunakan Metode Analytical Hierracy Process (AHP)," *Scientica: Jurnal Ilmiah Sains dan Teknologi*, vol. 2, no. 2, pp. 101–116, Jan. 2024, doi: 10.572349/scientica.v2i2.896.

[14] U. Habibah and M. Rosyda, "Sistem Pendukung Keputusan Penerima Bantuan Langsung Tunai Dana Desa di Pekandangan Menggunakan Metode AHP-TOPSIS," *Jurnal Media Informatika Budidarma*, vol. 6, no. 1, pp. 404–413, 2022, doi: 10.30865/mib.v6i1.3471.

[15] D. Asdini, M. Khairat, and D. P. Utomo, "Sistem Pendukung Keputusan Penilaian Kinerja Manajer di PT. Pos Indonesia dengan Metode WASPAS," *JURIKOM (Jurnal Riset Komputer)*, vol. 9, no. 1, pp. 41–47, 2022, doi: 10.30865/jurikom.v9i1.3767.

[16] M. N. D. Satria, "Sistem Pendukung Keputusan Penerimaan Staff Administrasi Menggunakan Metode VIKOR," *Journal of Artificial Intelligence and Technology Information*, vol. 1, no. 1, pp. 39–49, 2023, doi: 10.58602/jaiti.v1i1.24.

[17] P. Nadhilah, R. I. Jatikusumo, and E. Permana, "Efektifitas Penggunaan E-Wallet Dikalangan Mahasiswa Dalam Proses Menentukan Keputusan Pembelian," *JEMMA (Journal of Economic, Management and Accounting)*, vol. 4, no. 2, pp. 128–138, 2021, doi: 10.35914/jemma.v4i2.725.

[18] H. H. Nawawi, "Penggunaan E-wallet di Kalangan Mahasiswa," *Emik*, vol. 3, no. 2, pp. 189–205, 2020, doi: 10.46918/emik.v3i2.697.

[19] Y. D. Rahmawati and R. Yuliana, "Pengaruh persepsi manfaat, persepsi kemudahan, dan persepsi keamanan terhadap keputusan penggunaan e-wallet pada mahasiswa STIE Bank BPD Jateng," *ECONBANK: Journal of Economics and Banking*, vol. 2, no. 2, pp. 157–168, 2020, doi: 10.35829/econbank.v2i2.215.

[20] R. T. Aldisa, "Analisis Perbandingan Metode ROC-WASPAS dan Entropy-WASPAS dalam Keputusan Pemberian Reward Kinerja Pegawai Hotel," *Building of Informatics, Technology and Science (BITS)*, vol. 4, no. 3, pp. 1212–1223, 2022, doi: 10.47065/bits.v4i3.2562.

[21] A. Iskandar, "Analisis Metode SAW dan WP dalam Pemilihan Costumer Service Berdasarkan Pembobotan ROC," *JURIKOM (Jurnal Riset Komputer)*, vol. 10, no. 3, pp. 686–696, 2023, doi: 10.30865/jurikom.v10i3.6218.

[22] P. A. Soleha, R. T. Aldisa, and M. A. Abdullah, "Pemilihan Waitress Resto Akul Terbaik Menerapkan Metode WASPAS dengan Pembobotan ROC," *J. Inf. Syst. Res*, vol. 4, no. 3, pp. 903–913, 2023, doi: 10.47065/josh.v4i3.3375.

[23] S. Hutagalung, D. S. Gea, and D. P. Indini, "Penerapan Metode MOORA Dalam Pemilihan Bimbingan Belajar Terbaik," *Journal of Informatics Management and Information Technology*, vol. 3, no. 1, pp. 1–7, 2023, doi: 10.47065/jimat.v3i1.226.

[24] A. P. R. Pinem, H. Indriyawati, and B. A. Pramono, "Sistem Pendukung Keputusan Penentuan Lokasi Industri Berbasis Spasial Menggunakan Metode MOORA," *JATISI (Jurnal Teknik Informatika dan Sistem Informasi)*, vol. 7, no. 3, pp. 639–646, 2020, doi: 10.35957/jatisi.v7i3.231.

[25] J. H. Lubis, M. Mesran, S. Edrin, and A. Nasution, "Sistem Pendukung Keputusan Rekomendasi Pembelian Perumahan Menerapkan Metode MOORA," *Journal of Computer System and Informatics (JoSYC)*, vol. 4, no. 3, pp. 655–662, 2023, doi: 10.47065/josyc.v4i3.3483.