JURNAL INFORMATIKA DAN REKAYASA PERANGKAT LUNAK (JATIKA)
Volume 6, Number 2, June 2025, Page 122-136
E-ISSN 2797-2011 P-ISSN 2797-3492
https://publikasi.teknokrat.ac.id/index.php/jatika/index
DOI: https://doi.org/10.33365/jatika.v6i2.129

Integration of RECA Weighting and MARCOS Methods in Decision Support Systems for the Selection of the Best Customer Recommendations

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Abstract: In a competitive business environment, selecting the best customers is a strategic step to improve marketing efficiency and build profitable long-term relationships. However, this process is often constrained by subjectivity in determining criteria and evaluating alternatives. This study aims to apply an objective and measurable decision-making model by integrating of the Respond to Criteria Weighting (RECA weighting) and the method of measurement of alternatives and ranking according to compromise solution (MARCOS). The RECA weighting is used to determine the weight of criteria based on the response to their level of importance, while MARCOS is used to evaluate and rank customer alternatives based on proximity to the ideal solution. The final ranking of customers is determined using the RECA weighting method and MARCOS, which reflects the final value of each customer alternative; Customer 3 obtained the highest final score of 1.2339, indicating the best overall performance based on the established evaluation criteria. Furthermore, Customer 7 and Customer 1 are in second and third place with scores of 1.2096 and 1.1546, respectively, indicating that these three customers are the main candidates to be prioritized in the customer relationship strategy. The result of the integration of these two methods provides a decision support system that is able to generate accurate and logical customer ratings, and supports data-driven strategic decision-making. This model is expected to be an effective solution in improving the quality of business decisions, especially in managing customer relationships more on target and efficiently. This research makes a significant contribution to the development of DSS by integrating the RECA weighting method and the MARCOS method to enhance objectivity in determining criterion weights and to produce a more stable and accurate ranking of alternatives in the process of selecting the best customer recommendations.
Keywords: Customer Selection; Decision Support System; RECA Weighting; MARCOS Method; Multi-Criteria Decision Making (MCDM)

1. INTRODUCING

In a competitive business strategy, selecting the best customers is a crucial step to improve marketing efficiency, maximize profits, and build long-term, mutually beneficial relationships[1]–[3].

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Not all customers provide the same value to the company; Some may have high buying potential, strong loyalty, or significant influence on the market. By identifying and focusing efforts on the most valuable customers, companies can allocate resources more appropriately, improve customer retention, and design more effective service and communication strategies. Therefore, determining the best customer is not only a matter of transaction volume, but also reflects a strategic approach to sustainable customer relationship management[4], [5]. A key problem in selecting the best customers is the lack of an objective and measurable system or method to evaluate and identify the customers who make the most significant contribution to business continuity and growth. This often leads companies to make decisions based on intuition or incomplete data, which can ultimately lead to inefficient resource allocation and decreased effectiveness of marketing strategies as well as customer loyalty.

Decision Support Systems (DSS) play an important role in aiding data-driven decision-making by providing analytical tools capable of processing, filtering, and presenting relevant information in a systematic and objective manner[6]–[8]. In the context of selecting the best customers, SPK allows decision-makers to evaluate various criteria such as transaction value, loyalty, growth potential, and purchase frequency with a measurable and consistent approach. DSS not only improves decision accuracy, but also speeds up the analysis process, minimizes subjectivity, and supports more efficient and data-driven business strategies. Through mathematical modeling and multi-criteria decision-making techniques, DSS assists companies in prioritizing customers based on their strategic value. This is especially important in a dynamic business environment, where speed and precision in decision-making can provide a competitive advantage[9]–[11]. With DSS support, companies can be more proactive in designing marketing strategies, managing customer relationships, and allocating resources optimally to achieve long-term business goals.

The purpose of integrating the Response to Criteria (RECA Weighting) and the Measurement of Alternatives and Ranking according to Compromise Solution (MARCOS) method is to produce a decision-making system that is more objective, accurate, and responsive to the characteristics and weights of each criterion in the alternative evaluation process. The RECA method is used to systematically determine the level of importance of each criterion based on the response or response to the level of relevance of the criterion, thus generating a weight that reflects real priorities in the context of the decision[12]. Meanwhile, the MARCOS method is used to assess and rank alternatives based on their proximity to the ideal solution and its distance from the anti-ideal solution[7], [13], [14]. By combining the two, the best customer selection process becomes more transparent, data-driven, and able to reflect the balance between ideal expectations and real conditions in business decision-making.

The integration of RECA and MARCOS methods offers a number of advantages that strengthen the multi-criteria decision-making process, especially in the context of selecting the best customers. The RECA method provides objectivity in determining the weighting of criteria by based on the relevant responses or responses to each criterion, so that the weighting results become more accurate and reflect real priorities. Meanwhile, the MARCOS method is able to comprehensively evaluate alternatives by measuring their proximity to the ideal solution and away from the anti-ideal solution, resulting in a more realistic and balanced alternative ranking. The combination of these two methods is flexible and adaptable in a variety of business contexts, and supports data-driven strategic decision-making. With logical, measurable, and minimal subjectivity evaluation results, the integration of RECA and MARCOS helps companies in determining the best customers effectively and efficiently, as well as supporting the development of more targeted marketing and service strategies.

Research on the selection of the best customers was carried out by Jayanti (2025) the application of the SAW method to select the most loyal partners based on four criteria, where the Pertamina-Meco E&P Simenggaris Job was selected as the best partner who would be rewarded to strengthen cooperation and increase company profits[15]. Research from Ariati (2025) The application of the Multi Attribute Utility Theory (MAUT) Method in the development of DSS for customer management optimization helps companies in optimizing resource allocation, but also allows companies to build more personal relationships with customers[16]. Research from Handoko (2024) The combination of the Entropy and GRA weighting methods in choosing the best customers is to use a more objective and accurate approach in assessing customers based on various relevant criteria[17]. Research from Sinaga

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(2024) on the application of the Analytical Hierarchy Process (AHP) method supports decisions in recommending the best customers for rewards that contribute to increasing the efficiency and success of business operations[18]. Although various previous studies have examined the selection of the best customers using the SAW, MAUT, Entropy-GRA, and AHP methods, there is a research gap related to the use of the RECA weighting method and the MARCOS method. The RECA method offers a more adaptive objective approach to determining the weight of criteria based on comparisons between alternatives, while MARCOS provides an advantage in generating more representative rankings by considering ideal and anti-ideal solutions simultaneously. Until now, no research has been found that integrates RECA and MARCOS in the context of loyal customer selection, even though the combination of the two methods has the potential to provide more accurate and comprehensive results in data-driven strategic decision-making.

The purpose of this study is to apply and implement an objective and measurable decision-making model in the selection of the best customers by integrating the RECA weighting method and the MARCOS method. Through this integration, the research aims to produce an evaluation system that is able to accurately determine the weight of criteria based on the response to the importance of each criterion, as well as rank alternative customers based on their proximity to the ideal solution. The results of this study can contribute to improving the effectiveness of marketing strategies and customer relationship management through a more systematic and data-driven approach to decision-making.

2. RESEARCH METHODOLOGY

2.1. Research Stage

The stages of research are systematic steps taken by researchers in the process of searching, collecting, processing, analyzing, and drawing conclusions about a problem or phenomenon. These stages are designed to ensure that the research process is conducted in a structured, valid, and scientifically accountable manner. Figure 1 illustrates the stages followed in this research.

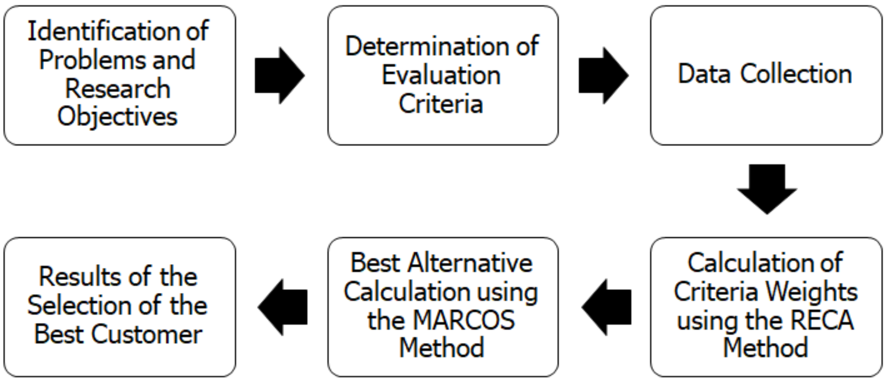

Figure 1. Research Stage

The first stage of figure 1 is problem identification and research objectives, where the existing problems are outlined and the goals to be achieved are set. Next, evaluation criteria determination is carried out, which is the process of determining the factors or aspects that will be used as the basis for assessing the existing alternatives. After the criteria are determined, the next step is data collection, which includes gathering information or values from each alternative based on the established criteria. The fourth stage is criteria weight calculation using the RECA Method, where each criterion is assigned a weight according to its level of importance to maintain objectivity in the assessment. The weights are then used in the best alternative calculation process using the MARCOS Method, a multi-criteria decision-making method to determine the ranking of each alternative. Finally, the results of the best customer selection are obtained, which is the output of the overall process indicating the customers with the best performance based on the criteria and methods used.

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2.2. Identification of Problems and Research Objectives

In a competitive business environment, companies need to identify and retain their best customers to enhance loyalty, operational efficiency, and profitability. However, the selection process for the best customers is often conducted subjectively without a systematic and measurable approach. Inaccuracies in determining priority customers can lead to strategic losses, such as suboptimal resource allocation and low customer retention rates. This issue highlights the need for a decision support system that can objectively evaluate customer performance based on a number of relevant criteria. Based on this issue, the main objective of this research is to develop a decision support system that integrates the RECA weighting method and MARCOS to support the selection process of the best customers. The RECA method is used to calculate the objective weights of each criterion based on the variation of data preferences, while MARCOS is utilized to evaluate and rank alternatives based on their proximity to the ideal solution. With the integration of these two methods, the resulting system is expected to provide selection results that are fairer, more rational, and accurate.

2.3. Determination of Evaluation Criteria

Determining evaluation criteria is an important step in the multi-criteria decision-making process, as these criteria serve as the basis for assessing and comparing the performance of each alternative. In the context of selecting the best customers, the criteria used must be relevant and reflect the customer's contribution to the performance and business goals of the company. Based on literature studies and discussions with management, several key criteria have been established, including: purchase volume (V1) as a benefit, payment accuracy (V2) as a cost, customer loyalty (V3) as a benefit, growth potential (V4) as a benefit, and stability of business relationships (V5) as a benefit. Each of these criteria is considered to play a strategic role in reflecting the long-term value and contribution of each customer to the company. In addition, to maintain objectivity in the assessment process, each criterion must be measurable with available and verifiable data. Therefore, the selection of criteria takes into account not only theoretical or strategic aspects, but also practical aspects related to data availability and ease of evaluation. These established criteria then serve as the basis for developing the decision matrix, which is then processed using the RECA method to determine its objective weights before the ranking of alternatives is carried out using the MARCOS method.

2.4. Respond to Criteria Weighting (RECA Weighting)

RECA weighting is an objective method used to determine the weight or relative importance of each criterion in the multi-criteria decision-making process. This method is designed to represent the level of influence of a criterion on the overall evaluation of alternatives in a logical and consistent manner. RECA weighting takes into account the responses or contributions of each criterion towards the performance differences among alternatives. In its approach, RECA calculates weights by considering the variance in values resulting from each criterion, so that criteria that contribute more significantly to the differentiation among alternatives will receive higher weights.

The decision matrix is an initial table that presents the assessment values of each alternative against each criterion. These values can be the results of evaluations from the obtained data. This matrix serves as the foundation in the entire analysis process created using the following equation.

$$X = \begin{bmatrix} x_{11} & \cdots & x_{n1} \\ \vdots & \ddots & \vdots \\ x_{1m} & \cdots & x_{nm} \end{bmatrix} \quad (1)$$

Preference values are the initial values of the decision matrix that indicate the performance level of each alternative against each criterion before being normalized. This shows how good or bad an alternative is in meeting a criterion calculated using the following equation.

$$PV_{ij} = \frac{x_{ij}}{\sqrt[n]{\prod_{i=1}^{n} x_{ij}}} \quad (2)$$

Normalization aims to equalize the value scale of all criteria so that they can be fairly compared, calculated using the following equation.

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$$R_{ij} = \frac{PV_{ij}}{PV_j^{max}} \tag{3}$$

The standard value is the average value of the normalization results for each criterion. It is calculated by summing all normalized values per criterion calculated using the following equation.

$$N_j = \frac{1}{N} \sum R_{ij} \tag{4}$$

The value of preference variation reflects how far the values of each alternative against a criterion differ from the standard value calculated using the following equation.

$$\emptyset_j = \sum_{i=1}^{m} \left[R_{ij} - N\right]^2 \tag{5}$$

Preference deviation is the result of the summation of all preference value differences from the standard value. This value represents the total contribution of a criterion in differentiating alternatives calculated using the following equation.

$$\Omega_j = \left|1 - \emptyset_j\right| \tag{6}$$

Criterion weights are calculated based on the proportion of the deviation values to the total deviation of all criteria, using the following equation.

$$w_j = \frac{\Omega_j}{\sum_{j=1}^{n} \Omega_j} \tag{7}$$

The final result of this RECA weighting reflects the relative importance level of a criterion in the decision-making process that is objective based on the data used.

2.5. Research Stage

The MARCOS method is one of the methods in multi-criteria decision making that aims to measure and rank alternatives based on the compromise solution that is closest to the ideal condition. This method was introduced to refine the decision-making process by considering the relationship between each alternative and the ideal and anti-ideal alternatives. MARCOS operates on the principle that the best alternative is the one that has the highest proximity to the ideal solution and the furthest distance from the anti-ideal solution.

The decision matrix is an initial table that presents the assessment values of each alternative against each criterion. These values can be the results of evaluations from the obtained data. This matrix serves as the foundation in the entire analysis process created equation (1).

Ideal solutions and anti-ideal solutions are used to assess how closely alternatives approach the best or worst conditions for each criterion. This solution is to help determine the ranking or preferences of each alternative based on relevant criteria created using the following equation.

$$AAI = min_{x_{ij}};\ AI = max_{x_{ij}};\ benefit\ criteria \tag{8}$$

$$AAI = max_{x_{ij}};\ AI = min_{x_{ij}};\ cost\ criteria \tag{9}$$

Normalization aims to equalize the value scale of all criteria so that they can be fairly compared, calculated using the following equation.

$$n_{ij} = \begin{cases} \frac{x_{ij}}{x_{ai}};\ benefit\ criteria \\ \frac{x_{ai}}{x_{ij}};\ cost\ criteria \end{cases} \tag{10}$$

Multiplying the normalized values by the weights of each criterion. These weights indicate the level of importance of each criterion in decision-making.

$$v_{ij} = w_j * n_{ij} \tag{11}$$

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The alternative utility value is a measure that describes how close each alternative is to the ideal solution. This utility value is calculated by comparing the weighted value of each alternative against the weighted value of the ideal solution calculated using the following equation.

$$S_i = \sum_{i=1}^{n} v_{ij} \tag{12}$$

$$K_i^- = \frac{S_i}{S_{aai}} \tag{13}$$

$$K_i^+ = \frac{S_i}{S_{ai}} \tag{14}$$

The ideal utility value, the anti-ideal utility value, and the final utility value together provide a comprehensive picture of the performance of each alternative. This allows decision-makers to choose the alternative that most closely meets the desired criteria in the context of multi-criteria decision-making calculated using the equation below.

$$f_{(K_i^-)} = \frac{K_i^+}{K_i^+ + K_i^-} \tag{15}$$

$$f_{(K_i^+)} = \frac{K_i^-}{K_i^+ + K_i^-} \tag{16}$$

$$f_{(K_i)} = \frac{K_i^+ + K_i^-}{1 + \frac{1 - f_{(K_i^+)}}{f_{(K_i^+)}} + \frac{1 - f_{(K_i^-)}}{f_{(K_i^-)}}} \tag{17}$$

The final results of the scores in the MARCOS method are an important stage in the decision-making process that involves several alternatives based on various criteria. This result provides an overview of how well each alternative meets the predetermined criteria, making it easier for decision-makers to choose the best alternative.

3. RESULT AND DISCUSSIONS

The integration of the RECA weighting method and MARCOS in a decision support system aims to enhance the objectivity and accuracy in the process of selecting the best customers. The RECA method is used to determine the weights of each criterion objectively based on the variation of alternative data preferences for each criterion. The weights generated reflect the extent to which a criterion can differentiate performance among alternatives, thus reducing the influence of subjectivity in the evaluation. By leveraging a data-driven approach, RECA provides a strong weighting foundation before ranking the alternatives. After the criteria weights are determined using RECA, the process of selecting the best customers continues with the MARCOS method. MARCOS measures the performance of each alternative against the ideal and anti-ideal solutions, and calculates the utility value to determine the relative position of each customer. This method considers not only the proximity to the ideal condition but also the distance from the worst condition, thus resulting in a more balanced evaluation. The combination of these two methods allows the decision support system to provide recommendations that are more transparent, accurate, and accountable in selecting the best customers based on a number of relevant criteria.

3.1. Data Collection

Data collection is a crucial stage in this research because it forms the foundation for the entire evaluation and decision-making process. The collected data includes performance scores for each customer against the previously established evaluation criteria, which are purchase volume, payment accuracy, customer loyalty, growth potential, and business relationship stability. The data sources come from the company's internal records such as sales reports, payment histories, and evaluations of customer relationships over a specific period. To ensure reliability, the data used has undergone a verification and validation process by relevant parties in the company.

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Table 1. Customer Assessment Data

Customer ID	V1	V2	V3	V4	V5
Customer 1	78	4.5	4.0	4.3	4.7
Customer 2	65	3.8	4.1	3.9	4.0
Customer 3	90	4.9	4.6	4.7	4.8
Customer 4	50	3.5	3.7	3.8	3.9
Customer 5	74	4.2	4.3	4.0	4.2
Customer 6	68	3.9	4.0	4.2	4.1
Customer 7	88	4.8	4.5	4.6	4.6
Customer 8	70	4.1	4.2	4.0	4.3

The data collection method was conducted quantitatively using documentation and structured interviews with marketing managers and related staff. Each customer alternative was evaluated based on a numerical score reflecting the level of achievement for each criterion. The results of this stage were then used to form the initial decision matrix, which was further processed through the RECA method for objective criterion weighting, before being applied in the MARCOS method to determine the best customers based on a compromise solution approach.

3.2. Calculation of Criteria Weights using the RECA Method

The stages of calculating the criteria weights are conducted using the RECA (Respond to Criteria Assessment) method. The RECA method is designed to provide objective weights based on the level of dispersion and the differences in preferences of each alternative against each criterion. The RECA procedure begins by compiling a decision matrix based on the assessment data of the five criteria, namely purchase volume (V1), payment accuracy (V2), customer loyalty (V3), growth potential (V4), and relationship stability (V5), as shown in Table 1. The resulting decision matrix from equation (1) is as follows.

$$X = \begin{bmatrix} 78 & 4.5 & 4.0 & 4.3 & 4.7 \\ 65 & 3.8 & 4.1 & 3.9 & 4.0 \\ 90 & 4.9 & 4.6 & 4.7 & 4.8 \\ 50 & 3.5 & 4.7 & 3.8 & 3.9 \\ 74 & 4.2 & 4.3 & 4.0 & 4.2 \\ 68 & 3.9 & 4.0 & 4.2 & 4.1 \\ 88 & 4.8 & 4.5 & 4.6 & 4.6 \\ 70 & 4.1 & 4.2 & 4.0 & 4.3 \end{bmatrix}$$

The preference values are the initial values of the decision matrix that indicate the performance level of each alternative against each criterion before being normalized, calculated using equation (2), the resulting preference values are as follows.

$$PV_{11} = \frac{x_{11}}{\sqrt[8]{\prod_{i=1}^{8} x_{i1}}} = \frac{78}{\sqrt[8]{78 * 65 * 90 * 50 * 74 * 68 * 88 * 70}} = \frac{78}{71.8113} = 1.0862$$

The results of the calculation of preference values for each alternative based on the overall criteria are displayed in table 2.

Table 2. Preference Value

Customer ID	V1	V2	V3	V4	V5
Customer 1	1.0862	1.0746	0.9601	1.0296	1.0896
Customer 2	0.9052	0.9075	0.9841	0.9338	0.9273
Customer 3	1.2533	1.1702	1.1042	1.1253	1.1128
Customer 4	0.6963	0.8358	0.8881	0.9098	0.9041
Customer 5	1.0305	1.0030	1.0322	0.9577	0.9737
Customer 6	0.9469	0.9314	0.9601	1.0056	0.9505
Customer 7	1.2254	1.1463	1.0802	1.1014	1.0664

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Customer 8	0.9748	0.9791	1.0081	0.9577	0.9968

Normalization aims to standardize the value scale of all criteria so that they can be compared fairly calculated using equation (3), the results of the normalization that have been calculated are as follows.

$$R_{11} = \frac{PV_{11}}{PV_1^{max}} = \frac{1.0862}{1.2533} = 0.8667$$

The results of the calculation of normalization values for each alternative based on the overall criteria are displayed in table 3.

Table 3. Normalization Value

Customer ID	V1	V2	V3	V4	V5
Customer 1	0.8667	0.9184	0.8696	0.9149	0.9792
Customer 2	0.7222	0.7755	0.8913	0.8298	0.8333
Customer 3	1.0000	1.0000	1.0000	1.0000	1.0000
Customer 4	0.5556	0.7143	0.8043	0.8085	0.8125
Customer 5	0.8222	0.8571	0.9348	0.8511	0.8750
Customer 6	0.7556	0.7959	0.8696	0.8936	0.8542
Customer 7	0.9778	0.9796	0.9783	0.9787	0.9583
Customer 8	0.7778	0.8367	0.9130	0.8511	0.8958

The standard value is the average value of the normalization results for each criterion. It is calculated by summing all normalized values per criterion calculated using equation (4), the resulting standard values that have been calculated are as follows.

$$N_1 = \frac{1}{8}\sum_{i=1}^{n} R_{i1} = \frac{1}{8} * (0.8667 + 0.7222 + 1.0000 + 0.5556 + 0.8222 + 0.7556 + 0.9778 + 0.7778)$$

$$N_1 = \frac{1}{8} * (6.4778) = 0.8097$$

The results of the calculation of standard values for each alternative based on the overall criteria are displayed in table 4.

Table 4. Standard Value

	V1	V2	V3	V4	V5
Standard Value	0.8097	0.8597	0.9076	0.8910	0.9010

The value of preference variation reflects how far the value of each alternative against a criterion differs from the standard value calculated using equation (5), the results of the calculated preference variation values are as follows.

$$\emptyset_1 = \sum_{i=1}^{8} [R_{i1} - N_1]^2$$

$$\emptyset_1 = (R_{11} - N_1)^2 + (R_{21} - N_1)^2 + (R_{31} - N_1)^2 + (R_{41} - N_1)^2 + (R_{51} - N_1)^2 + (R_{61} - N_1)^2 + (R_{71} - N_1)^2 + (R_{81} - N_1)^2$$

$$\emptyset_1 = (0.8667 - 0.8097)^2 + (0.7222 - 0.8097)^2 + (1.0000 - 0.8097)^2 + (0.5556 - 0.8097)^2 + (0.8222 - 0.8097)^2 + (0.7556 - 0.8097)^2 + (0.9778 - 0.8097)^2 + (0.7778 - 0.8097)^2$$

$$\emptyset_1 = 0.0032 + 0.0077 + 0.0362 + 0.0646 + 0.0002 + 0.0029 + 0.0282 + 0.0010$$
$$\emptyset_1 = 0.1441$$

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The results of the calculation of preference variation values for each alternative based on the overall criteria are displayed in table 5.

Table 5. Preference Variation Value

	V1	V2	V3	V4	V5
Preference Variation Value	0.1441	0.0703	0.0281	0.0339	0.0345

Preference deviation is the result of the sum of all differences in preference values against the standard value. This value represents the total contribution of a criterion in distinguishing alternatives calculated using equation (6), the resulting preference deviation value that has been calculated is as follows.

$$\Omega_1 = |1 - \emptyset_1| = |1 - 0.1441| = 0.8559$$

The results of the calculation of preference deviation values for each alternative based on the overall criteria are displayed in table 5.

Table 5. Preference Deviation Value

	V1	V2	V3	V4	V5
Preference Deviation Value	0.8559	0.9297	0.9719	0.9661	0.9655

The criteria weights are calculated based on the proportion of deviation values against the total deviation of all criteria calculated using equation (6), the resulting criterion weight values that have been calculated are as follows.

$$w_1 = \frac{\Omega_1}{\sum_{j=1}^{5} \Omega_j} = \frac{0.8559}{0.8559 + 0.9297 + 0.9719 + 0.9661 + 0.9655} = \frac{0.8559}{4.6891} = 0.1825$$

The results of the calculation of criteria weights values for each alternative based on the overall criteria are displayed in table 6.

Table 6. Criteria Weights Value

	V1	V2	V3	V4	V5
Criteria Weights Value	0.1825	0.1983	0.2073	0.2060	0.2059

The results of the calculation using the RECA weighting method yielded the weight of each criterion as follows: V1 (Purchase Volume) has a weight of 0.1825, indicating a moderate contribution to the decision. Criterion V2 (Payment Accuracy) received a weight of 0.1983, reflecting an important role in customer evaluation, although not the most dominant. Meanwhile, V3 (Customer Loyalty) emerged as the criterion with the highest weight of 0.2073, indicating that the loyalty factor is considered the most crucial in determining the best customers. Next, V4 (Growth Potential) has a weight of 0.2060 and V5 (Relationship Stability) follows with a weight of 0.2059, both indicating a very significant and nearly balanced contribution in decision-making.

3.3. Best Alternative Calculation using the MARCOS Method

After obtaining the weights of each criterion through the RECA method, the next stage is to determine the best alternative using the MARCOS method. The MARCOS method is a multi-criteria decision-making approach that evaluates alternatives based on their relative position to the ideal solution (best solution) and the anti-ideal solution (worst solution). By using the MARCOS method, decision-making becomes more rational and measurable as it considers the relative relationships of each alternative against the best and worst conditions. This provides clarity in recommending the best customers based on all the evaluation criteria that have been established.

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https://publikasi.teknokrat.ac.id/index.php/jatika/index
DOI: https://doi.org/10.33365/jatika.v6i2.129

The decision matrix is an initial table that presents the assessment values of each alternative against each criterion. These values can be the results of evaluations from the obtained data. This matrix serves as the foundation in the entire analysis process created equation (1).

$$X = \begin{bmatrix} 78 & 4.5 & 4.0 & 4.3 & 4.7 \\ 65 & 3.8 & 4.1 & 3.9 & 4.0 \\ 90 & 4.9 & 4.6 & 4.7 & 4.8 \\ 50 & 3.5 & 4.7 & 3.8 & 3.9 \\ 74 & 4.2 & 4.3 & 4.0 & 4.2 \\ 68 & 3.9 & 4.0 & 4.2 & 4.1 \\ 88 & 4.8 & 4.5 & 4.6 & 4.6 \\ 70 & 4.1 & 4.2 & 4.0 & 4.3 \end{bmatrix}$$

Ideal solutions and anti-ideal solutions are used to assess how close alternatives are to the best or worst conditions for each criterion. These solutions help determine the ranking or preference of each alternative based on the relevant criteria created using equations (8) and (9). The results of the ideal and anti-ideal solutions are displayed in table 7.

Table 7. Ideal Solutions and Anti-ideal Solutions Value

	V1	V2	V3	V4	V5
Ideal Solutions	50	4.9	3.7	3.8	3.9
Anti-ideal Solutions	90	3.5	4.6	4.7	4.8

Normalization aims to standardize the value scale of all criteria so that they can be compared fairly calculated using equation (10), the results of the normalization that have been calculated are as follows.

$$n_{11} = \frac{x_{11}}{AI} = \frac{78}{90} = 0.8667$$

The results of the calculation of normalization values for each alternative based on the overall criteria are displayed in table 8.

Table 8. Normalization Value

Customer ID	V1	V2	V3	V4	V5
AAI	1.0000	0.2857	1.0000	1.0000	1.0000
Customer 1	0.8667	0.7778	0.8696	0.9149	0.9792
Customer 2	0.7222	0.9211	0.8913	0.8298	0.8333
Customer 3	1.0000	0.7143	1.0000	1.0000	1.0000
Customer 4	0.5556	1.0000	0.8043	0.8085	0.8125
Customer 5	0.8222	0.8333	0.9348	0.8511	0.8750
Customer 6	0.7556	0.8974	0.8696	0.8936	0.8542
Customer 7	0.9778	0.7292	0.9783	0.9787	0.9583
Customer 8	0.7778	0.8537	0.9130	0.8511	0.8958
AI	0.5556	0.7143	0.8043	0.8085	0.8125

After the decision matrix has been normalized, the next step is to perform weight multiplication, which involves multiplying each element in the normalized matrix by the respective criterion weights calculated using equation (11), resulting in the preference deviation values that have been calculated as follows.

$$v_{11} = w_1 * n_{11} = 0.1825 * 0.8667 = 0.1582$$

The results of the calculation of weight multiplication values for each alternative based on the overall criteria are displayed in table 8.

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Table 8. Weight Multiplication Value

Customer ID	V1	V2	V3	V4	V5
AAI	0.1825	0.0566	0.2073	0.2060	0.2059
Customer 1	0.1582	0.1542	0.1802	0.1885	0.2016
Customer 2	0.1318	0.1826	0.1847	0.1710	0.1716
Customer 3	0.1825	0.1416	0.2073	0.2060	0.2059
Customer 4	0.1014	0.1983	0.1667	0.1666	0.1673
Customer 5	0.1501	0.1652	0.1937	0.1753	0.1802
Customer 6	0.1379	0.1779	0.1802	0.1841	0.1759
Customer 7	0.1785	0.1446	0.2028	0.2016	0.1973
Customer 8	0.1420	0.1692	0.1892	0.1753	0.1845
AI	0.1014	0.1416	0.1667	0.1666	0.1673

The alternative utility value is a measure that describes the extent to which each alternative approaches the ideal solution. This utility value is calculated by comparing the weighted value of each alternative against the weighted value of the ideal solution calculated using equations (12), (13), and (14). The calculated alternative utility values are displayed in table 9.

Table 9. Alternative Utility Value

Customer ID	S_i	K_i^-	K_i^+
AAI	0.8584		
Customer 1	0.8827	1.0284	1.3829
Customer 2	0.8417	0.9806	1.3187
Customer 3	0.9434	1.0990	1.4779
Customer 4	0.8003	0.9323	1.2537
Customer 5	0.8646	1.0072	1.3545
Customer 6	0.8561	0.9973	1.3411
Customer 7	0.9248	1.0773	1.4488
Customer 8	0.8603	1.0022	1.3477
AI	0.7436		

The ideal utility value, anti-ideal utility value, and final utility value together provide a comprehensive picture of the performance of each alternative calculated using equations (15), (16), and (17). The results of the ideal utility value, anti-ideal utility value, and the calculated final utility values of the alternatives are displayed in table 10.

Table 10. Alternative Utility Value

Customer ID	$f_{(k_i^-)}$	$f_{(k_i^+)}$	$f_{(k_i)}$
Customer 1	0.5735	0.4265	1.1546
Customer 2	0.5735	0.4265	1.1010
Customer 3	0.5735	0.4265	1.2339
Customer 4	0.5735	0.4265	1.0467
Customer 5	0.5735	0.4265	1.1308
Customer 6	0.5735	0.4265	1.1197
Customer 7	0.5735	0.4265	1.2096
Customer 8	0.5735	0.4265	1.1252

The MARCOS method has been applied to determine the best customer alternatives by considering five criteria that have been weighted using the RECA method. With this MARCOS approach, the decisions made are more objective because they take into account both the systematically calculated weights of the criteria and the relative position of each alternative against extreme conditions (best and worst).

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3.4. Results of the Selection of the Best Customer

The results of the calculations performed using the MARCOS method show the final utility values for each customer alternative. This value reflects how close each customer is to the ideal condition based on all predetermined evaluation criteria. The alternative with the highest utility value is considered the best alternative as it closely approaches the ideal solution, as displayed in the ranking in the following figure 2.

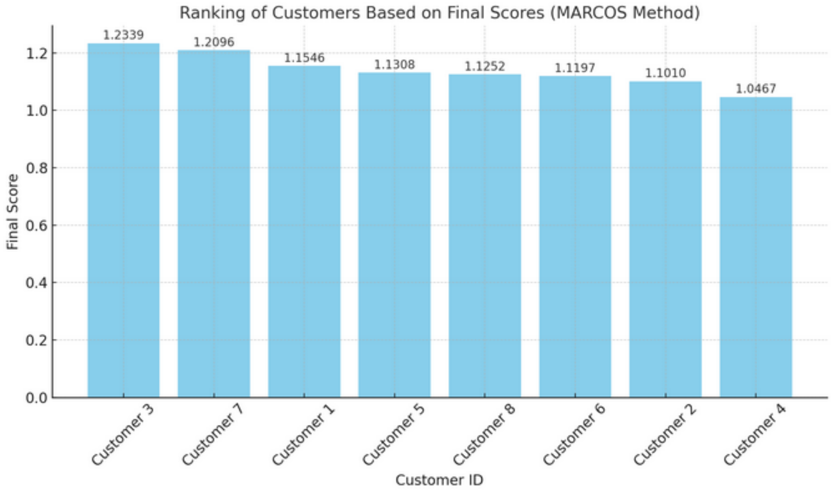

Figure 2. Results of the Best Customer Ranking

The ranking results of the alternatives in Chart 2 show the final ranking of each customer based on the final scores calculated using the MARCOS method. Customer 3 achieved the highest score of 1.2339, followed by Customer 7 (1.2096) and Customer 1 (1.1546), indicating that they are the best candidates for priority customers. Meanwhile, Customer 4 received the lowest score (1.0467), which indicates that its contribution is relatively lower compared to the others. This chart provides a clear visual representation of the effectiveness of each alternative in the decision-making process.

3.5. Discussion

Sensitivity analysis in this study is conducted to evaluate the extent to which changes in criterion weights affect the final results of alternative ranking in the decision support system. By varying the weights on several key criteria, this analysis identifies the stability and reliability of the RECA-MARCOS integration method against changes in decision-maker preferences. The scenarios of changes in criterion weights are presented in table 11.

Table 11. Scenario of Criterion Weight Change

Results of Weight Changes	V1	V2	V3	V4	V5
Weight V1 is increased to 0.05	0.2214	0.1889	0.1974	0.1962	0.1961
Weight V2 is increased to 0.05	0.1738	0.2365	0.1974	0.1962	0.1961
Weight V3 is increased to 0.05	0.1738	0.1889	0.2450	0.1962	0.1961
Weight V4 is increased to 0.05	0.1738	0.1889	0.1974	0.2438	0.1961
Weight V5 is increased to 0.05	0.1738	0.1889	0.1974	0.1962	0.2437
Weight V1 is decreased to 0.05	0.1395	0.2087	0.2182	0.2168	0.2167
Weight V2 is decreased to 0.05	0.1921	0.1561	0.2182	0.2168	0.2167
Weight V3 is decreased to 0.05	0.1825	0.1983	0.1573	0.206	0.2059
Weight V4 is decreased to 0.05	0.1921	0.2087	0.2182	0.1642	0.2167
Weight V5 is decreased to 0.05	0.1921	0.2087	0.2182	0.2168	0.1641

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https://publikasi.teknokrat.ac.id/index.php/jatika/index
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The scenario of weight changes in table 11 shows the results of weight changes for each criterion that were increased and decreased by 0.05 while keeping the final weight after the change equal to 1. The ranking results from the changes in criterion weights are displayed in figure 3.

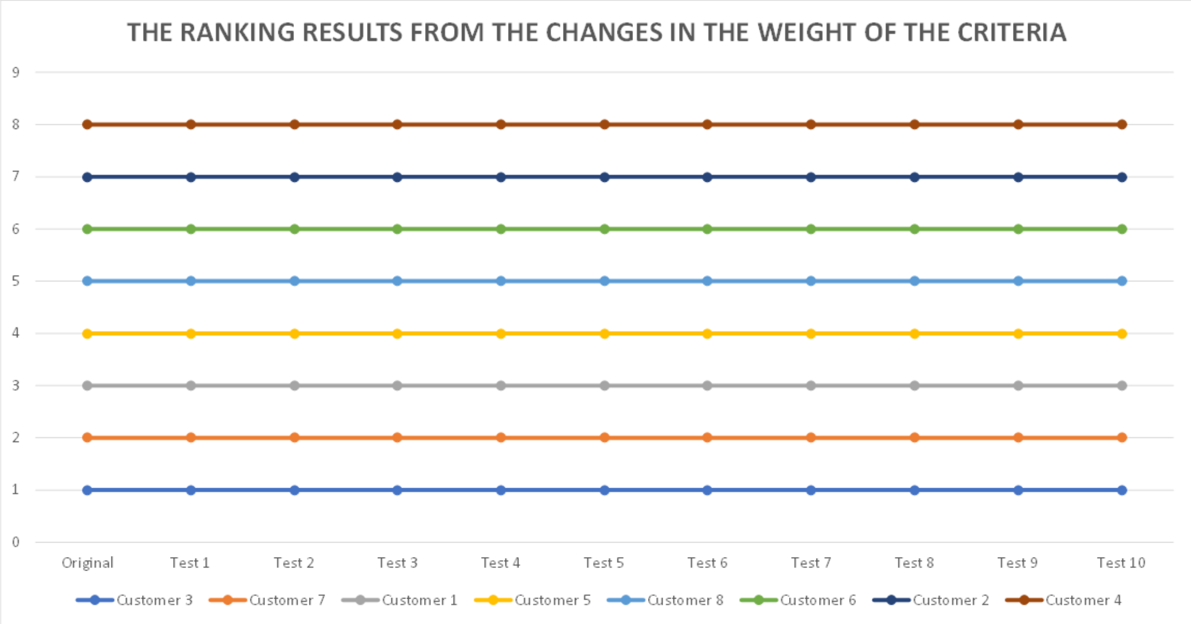

Figure 3. The Ranking Results from the Changes in the Weight of the Criteria

The results of the sensitivity analysis on changes in criterion weights in customer ranking using the integration of the RECA and MARCOS methods illustrate the stability of each customer's ranking from the initial condition (Original) to ten test scenarios (Test 1 to Test 10) that represent variations in criterion weights. It is observed that all customers consistently maintain their rankings in each scenario, without any shifts in rank. This indicates that the methods used are very stable and robust against changes in criterion weights, and it shows that the results of the best customer recommendations are not easily affected by fluctuations in criterion assessments. Therefore, this decision support system can be relied upon to provide consistent results even in the face of changes in preferences or emphasis on specific criteria.

4. CONCLUSION

This research successfully integrates the RECA weighting method with the MARCOS method in the development of a decision support system for selecting the best customer recommendations. The RECA method is used to determine the objective weights of each criterion based on preference values and deviations, while the MARCOS method is utilized to evaluate customer alternatives based on their contributions to each criterion. The final ranking of customers is determined using the RECA weighting method and MARCOS, which reflects the final value of each customer alternative; Customer 3 obtained the highest final score of 1.2339, indicating the best overall performance based on the established evaluation criteria. Furthermore, Customer 7 and Customer 1 are in second and third place with scores of 1.2096 and 1.1546, respectively, indicating that these three customers are the main candidates to be prioritized in customer relationship strategies. Customer 5 and Customer 8 follow with scores of 1.1308 and 1.1252 respectively, indicating their performance is also quite good. Customer 6 received a score of 1.1197, while Customer 2 and Customer 4 received scores of 1.1010 and 1.0467, with Customer 4 ranking the lowest among all alternatives. This result provides a clear and data-driven reference for decision-makers in determining the most potential customers, allowing strategic focus and resources to be optimally directed towards customers that contribute the highest to the company. The integration of these two methods has proven to provide comprehensive, objective, and reliable ranking results in

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supporting the company's strategic decision-making process, particularly in the management and development of relationships with potential customers. This research makes a significant contribution to the development of DSS by integrating the RECA weighting method and the MARCOS method to enhance objectivity in determining criterion weights and to produce a more stable and accurate ranking of alternatives in the process of selecting the best customer recommendations.

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https://publikasi.teknokrat.ac.id/index.php/jatika/index
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