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IMPLEMENTATION OF THE MOORA METHOD IN A DECISION SUPPORT SYSTEM (DSS) FOR DATA-DRIVEN SELECTION OF RESEARCH GRANT RECIPIENTS

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Abstract

The process of determining research grant recipients for lecturers plays an important role in supporting the improvement of research quality in academic environments. However, research grant selection that is still carried out manually may lead to several challenges, particularly in the evaluation process and the management of assessment data. Therefore, this study is conducted within the context of research grant management at the Institute for Research and Community Service (LPPM) of Universitas Muhammadiyah Kalimantan Timur (UMKT). This study aims to apply the Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method to a data-driven Decision Support System (DSS) to support the research grant selection process. A quantitative applied approach is used by utilizing secondary data, including research grant proposal data, assessment criteria along with their weights, and reviewer evaluation results obtained from LPPM UMKT. The implementation of the MOORA method is carried out through several stages, namely the construction of a decision matrix, data normalization, criteria weighting, optimization value calculation, and proposal ranking. The developed decision support system is implemented as a web-based application using the Laravel framework and a MySQL database. The results show that the application of the MOORA method is able to produce a ranking of research grant proposals based on the specified criteria and weights. The system can assist LPPM UMKT in managing the research grant selection process in a more structured and data-based manner, and can be used as a supporting tool for decision-making in research grant selection at higher education institutions.

Keywords: Decision Support System, MOORA Method, Research Grants, Data-Driven, LPPM UMKT

INTRODUCTION

Research grants are one form of university support aimed at improving the quality of research conducted by lecturers. Through research grants, lecturers are encouraged to produce research that is focused and aligned with institutional needs. In addition to supporting research activities, grants also contribute to enhancing institutional performance, particularly in terms of accreditation and scientific publications. Research grant programs are also related to the implementation of the National Research Master Plan (RIRN), which aims to strengthen research competitiveness at both national and global levels (Zhang & Goyal, 2024). Therefore, the management of research grants must be carried out in a structured and accountable manner. One of the key stages in this management process is the selection of research grant proposals. In practice, the research grant selection process still faces various challenges, especially when conducted manually. This condition is also experienced by the Institute for Research and Community Service (LPPM) at Universitas Muhammadiyah Kalimantan Timur (UMKT) as the manager of internal research grants. The proposal selection process, which is still conducted manually, requires a relatively long time. In addition, the high administrative workload often makes it difficult for administrators to recap and evaluate proposals. Assessments that rely entirely on human judgment also have the potential to create differences in perspectives among reviewers (Steven et al., 2025). This situation may give rise to perceptions of subjectivity and reduce trust in the results of the research grant selection process (Selang et al., 2024). These issues indicate the need for a system that can support decision-making in a more objective manner. One solution that can be implemented is the use of a Decision Support System (DSS). A Decision Support System (DSS) is a computer-based system designed to assist

decision-makers in solving problems involving multiple criteria. With the implementation of a DSS, proposal evaluation data, lecturer data, and selection criteria can be processed in a structured manner. The selection process can therefore be carried out more quickly and consistently. Moreover, the use of a DSS can reduce dependence on subjective judgment because decisions are generated based on measurable calculations (Yogi et al., 2024). The implementation of a DSS is also considered capable of clarifying evaluation stages and producing more consistent decisions in research grant selection (Wicaksono et al., 2024). One method commonly used in the development of Decision Support Systems (DSS) is Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA). The MOORA method is used to process multiple criteria with different characteristics, namely benefit and cost criteria. This method has a relatively simple calculation process, making it easy to implement in computer-based systems. Compared to other methods such as AHP and TOPSIS, MOORA has advantages in computational efficiency and ranking stability (Nurhaliza et al., 2022). Research conducted by (Siregar, 2021) shows that the MOORA method achieved an accuracy level of approximately 79% in a scholarship selection case. Although it does not always produce the highest accuracy, MOORA remains relevant due to its ease of implementation and flexibility.

Various studies have demonstrated that the MOORA method can be applied in different decision-making cases. For example, (Sinaga, 2025) applied MOORA in the selection of financial assistance for underprivileged students and obtained more structured results. Another study by (Syawali et al., 2025) used MOORA in selecting the best rice seedlings based on several criteria. In addition, Nuari (2024) utilized the MOORA method to determine a web application development platform. Research by (Piantari et al., 2024) also concluded that the MOORA method is capable of producing consistent decisions in scholarship selection processes. These findings indicate that MOORA is sufficiently flexible and can be applied to various multi-criteria problems. In addition to considering the method used, selecting the research object is also an important aspect of this study. The Institute for Research and Community Service (LPPM) at Universitas Muhammadiyah Kalimantan Timur plays a strategic role in managing and selecting lecturer research grants annually.

The grant selection process involves various evaluation criteria that must be considered simultaneously. However, until now, the selection process has not been fully supported by a system capable of processing evaluation data in an integrated manner. This condition has the potential to make the selection process less effective and difficult to control when the number of proposals increases. Therefore, a system is needed that can process evaluation data in a structured and consistent manner according to the needs of LPPM UMKT. Research related to Decision Support Systems (DSS) has also been conducted within Universitas Muhammadiyah Kalimantan Timur. A study by (Syaputra et al., 2023) applied the AHP-TOPSIS method in determining the best graduate students in the Nursing Study Program at UMKT through a web-based system. The study successfully increased objectivity in the evaluation process. This indicates that the implementation of systems based on multi-criteria methods is highly relevant for application at UMKT. Based on these conditions, this study focuses on implementing the MOORA method in a data-driven Decision Support System (DSS) for research grant selection at LPPM UMKT. The developed system is expected to assist the research grant selection process by utilizing the MOORA method.

LITERATURE REVIEW

The MOORA method is applied at this stage to perform the calculation and ranking of research grant proposals. The evaluation data that have been entered into the system are processed using the MOORA method based on the predetermined criteria and weights. The result of this process is a preference value and a ranking order of proposals that indicate the priority level of the research grant proposals. The use of MOORA in this ranking process serves as a computational approach to support the proposal evaluation process, as demonstrated in previous research (Rohman et al., 2024). The Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method is used in this study because it is capable of handling multi-criteria decision-making problems that involve different types of criteria, namely benefit criteria (the higher the value, the better) and cost criteria (the lower the value, the better). Using this method, the selection process of research grant proposals is conducted through calculation stages defined within the MOORA framework. The fundamental principles of the MOORA method include data normalization, criteria weighting, and the calculation of optimization values to determine the ranking of the best alternatives (Margaret et al., 2024).

METHOD

This study is classified as applied research with an applied quantitative approach. It is designed to produce a practical solution that can be directly implemented by LPPM UMKT, namely a Decision Support System (DSS) for research grant selection. The quantitative approach is employed because the data analyzed consist of numerical

values, such as proposal scores and criterion weights, which are processed mathematically using the MOORA method. The calculation results are not only used for analytical purposes but are also directly implemented into a web-based system to support a more objective and structured decision-making process. To support the implementation of this research, the author utilized several tools and materials during the development and testing process of the MOORA-based Decision Support System (DSS) for research grant selection. The research tools consist of hardware and software, while the research materials include data and supporting documents used in the analysis and decision-making process. The details of the tools and materials used are presented in Tables.

Table 1. Research Tools

Tool	**Specification/Function**
Asus Vivobook Pro 14 OLED Laptop	AMD Ryzen 7, 16 GB RAM, 512 GB SSD. Used for system development, testing, and implementation.
Operating System	Windows 11
Visual Studio Code	Code editor for web application development
Web Browser	Google Chrome / Microsoft Edge for system testing
XAMPP	Local server including Apache and MySQL
Laravel Framework	PHP framework for developing the web-based DSS
MySQL	Database for storing proposal data, criteria, and calculation results
Microsoft Excel	Used for initial data processing and verification of grant data

Table 2. Research Materials

Material	**Description**
Grant Proposal Data	Research grant proposal data from LPPM UMKT
Evaluation Criteria Data	Research grant selection criteria used by LPPM
Criteria Weight Data	Assessment weights determined based on LPPM policies
Reviewer Evaluation Data	Proposal assessment scores provided by reviewers
Applicant Lecturer Data	Identity and track record data of applicant lecturers
Research Output Data	Target research outputs as one of the evaluation criteria
Supporting Information for Grant Selection	Information obtained from LPPM UMKT

The research procedure was designed to describe the workflow of evaluating and selecting research grants using a Decision Support System (DSS) based on the MOORA method. The research stages were carried out sequentially according to the flow illustrated in Figure 2.1. The stages of the study are as follows.

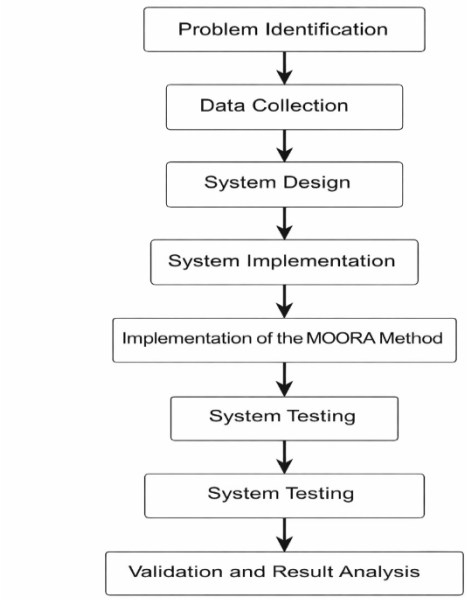


Figure 1. Research Procedure

Problem Identification

The initial stage of the research began with observing the existing research grant selection process at LPPM UMKT. Based on preliminary observations, the selection process was still conducted manually, requiring considerable time, especially when the number of proposals was large. In addition, manual assessments had the potential to create differences in evaluation among reviewers. From these conditions, the need emerged for a system that could assist the research grant selection process to become more structured, objective, and user-friendly. The MOORA method was selected as the ranking solution because previous studies demonstrated its ability to provide more consistent decision results compared to other methods in multi-criteria problems (Saputra & Mailoa, 2025).

Data Collection

After identifying the problem, the next stage involved collecting the necessary data for the research. The collected data included lecturer research grant proposal data, evaluation criteria and their weights, as well as assessment data provided by reviewers. These data were obtained from LPPM UMKT and served as the basis for the evaluation and data processing within the system to be developed. The data collection approach, which relied on evaluation and criteria data, aligns with previous studies on the design of MOORA-based decision support systems (Wicaksono et al., 2024).

System Design

The system design stage aimed to describe how the decision support system would function according to the needs of LPPM UMKT. At this stage, the system workflow, functional requirements, and data structures were designed. The objective was to ensure that the developed system would be capable of managing proposal data, processing evaluations, and generating research grant selection results in a clear and structured manner.

System Implementation

After completing the design stage, the system was implemented as a web-based application. At this stage, all previously developed designs were translated into an operational system. The implementation allowed the system to manage proposal data, facilitate reviewer input of evaluations, and automatically display the research grant selection results.

Implementation of the MOORA Method

At this stage, the MOORA method was applied to calculate and rank research grant proposals. The evaluation data entered into the system were processed using the MOORA method based on predetermined criteria and weights. The output of this process consisted of preference values and proposal rankings indicating the priority of research grant proposals. The use of MOORA in the ranking process served as a computational approach to support proposal evaluation, as demonstrated in previous studies (Rohman et al., 2024).

System Testing

After implementing the MOORA method, system testing was conducted to ensure that all features and functions operated properly and as expected. The testing process utilized research grant proposal data to verify whether the system could generate accurate calculation results and display the output appropriately.

Validation and Result Analysis

The final stage involved validation and analysis of the developed system's results. Validation was carried out by comparing the system-generated calculation results with manual calculations to ensure the accuracy of the MOORA method. Subsequently, an analysis of the research grant selection results was conducted to evaluate the consistency between system-generated results, manual calculations, and the applied selection process.

RESULTS AND DISCUSSION

Results of the Decision Support System Implementation

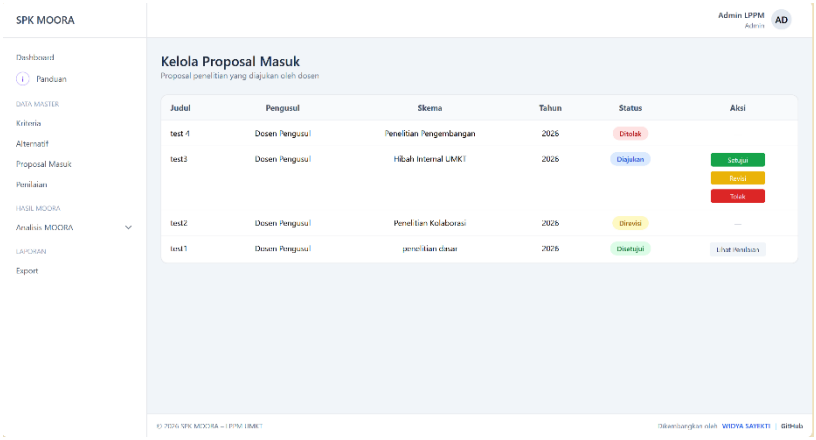
Based on the data analysis results presented in the previous subsection, the lecturer research grant selection process was implemented into a web-based Decision Support System (DSS). This system was developed to assist in managing research grant proposal data, evaluation criteria data, and reviewer assessment results so that the selection process can be conducted in a more structured and computerized manner. Through this system, proposal data that

were previously stored in documents and Microsoft Excel files can now be managed centrally. In addition, the system processes reviewer evaluation data using the MOORA method to generate rankings of research grant proposals.

Implementation of Research Grant Proposal Management

The initial stage of system implementation begins with managing research grant proposal data. This feature is used by the LPPM Admin to monitor and manage proposals submitted by applicant lecturers. On the Incoming Proposal Management page, the system displays a list of proposals containing information such as the proposal title, applicant name, grant scheme, submission year, and proposal status. The proposal status may include submitted, approved, revised, or rejected. The LPPM Admin has the authority to take action on submitted proposals, such as approving proposals to proceed to the evaluation stage, requesting revisions, or rejecting proposals that do not meet the initial requirements. The interface of the research grant proposal management page is shown in Figure

Figure 2. Incoming Proposal Display – LPPM Admin



With this feature, the preliminary proposal selection process can be conducted centrally and properly documented, thereby facilitating proposal data management before entering the reviewer evaluation stage.

Implementation of Criteria Data and Weight Management

After the proposals are managed, the next stage is the management of evaluation criteria. This feature is also accessed by the LPPM Admin and functions to determine the criteria used in the research grant selection process. On the Criteria Data page, the system displays a list of evaluation criteria, including the criteria code, criteria name, criteria type (benefit or cost), and criteria weight. The total weight of all criteria is maintained at 1 (one) as a requirement for implementing the MOORA method. Benefit-type criteria indicate that higher values are considered better, while cost-type criteria indicate that lower values are preferred. This configuration serves as an essential foundation for the normalization process and the calculation of the MOORA optimization score. The display of the criteria data page is shown in Figure.

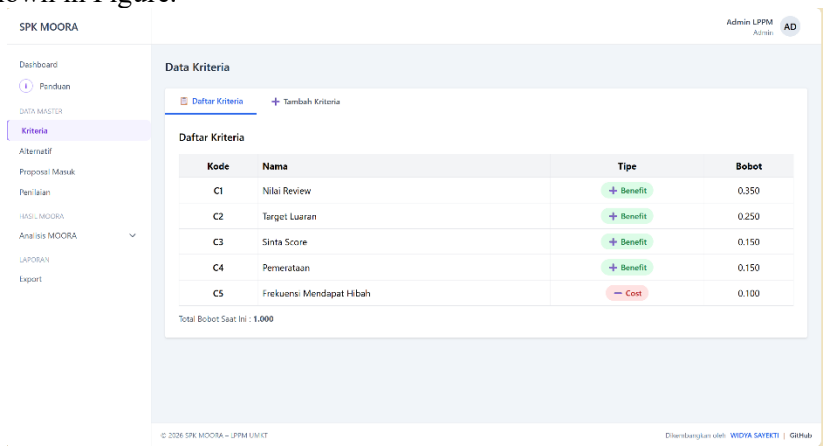


Figure 3. Criteria Data Display – LPPM Admin

With adjustable criteria and weight management by LPPM, the system can align with policies implemented in each research grant period.

Implementation of Proposal Evaluation by Reviewers

The next stage is the proposal evaluation process conducted by the reviewers. On the Grant Proposal Evaluation Data page, reviewers can assign scores to proposals based on the previously established criteria. The system displays a list of proposals ready for evaluation, along with score input fields for each criterion (C1 to C5). The scores provided are numerical and represent the feasibility level of the proposal for each respective criterion. These evaluation data are then stored in the database and used as the primary input for the MOORA method calculation process. To facilitate data analysis, the system provides a grant year selection feature, allowing reviewers to focus on a specific period. The interface of the proposal evaluation page by reviewers is shown in Figure.

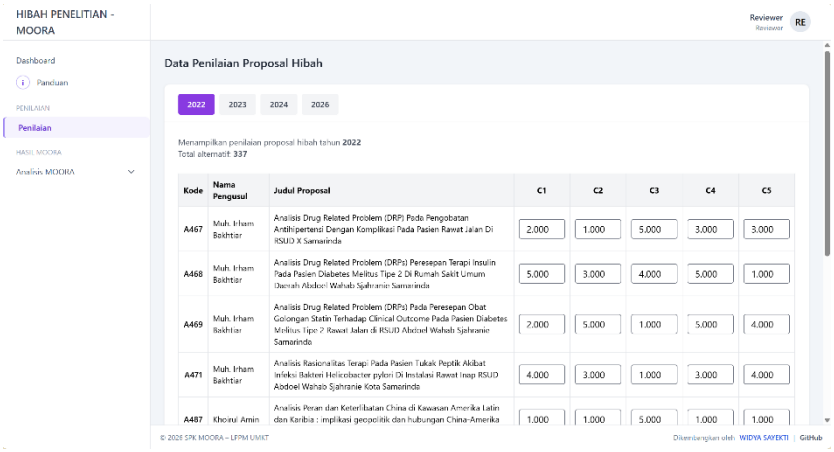


Figure 4. Proposal Evaluation Display – Reviewer

This feature is designed to facilitate the proposal assessment process by reviewers based on the criteria defined within the system.

Decision Matrix Construction and MOORA Calculation Process

After all evaluation data have been collected, the system automatically constructs a decision matrix based on the proposal scores for each criterion. This decision matrix is then further processed through the normalization stage in accordance with the MOORA method formula. On the Decision Matrix and Normalization Matrix pages, the system displays the data in tabular form. For display efficiency and system performance reasons, the matrix data are presented using a pagination mechanism, so only a portion of the data is shown on each page. Nevertheless, all proposal data are fully processed in the MOORA calculation. This differs from the Ranking page, where the system displays the final ranking results of all proposals, as the data have already been summarized into final optimization values. The displays of the decision matrix, normalization matrix, and MOORA ranking results are shown in Figure.

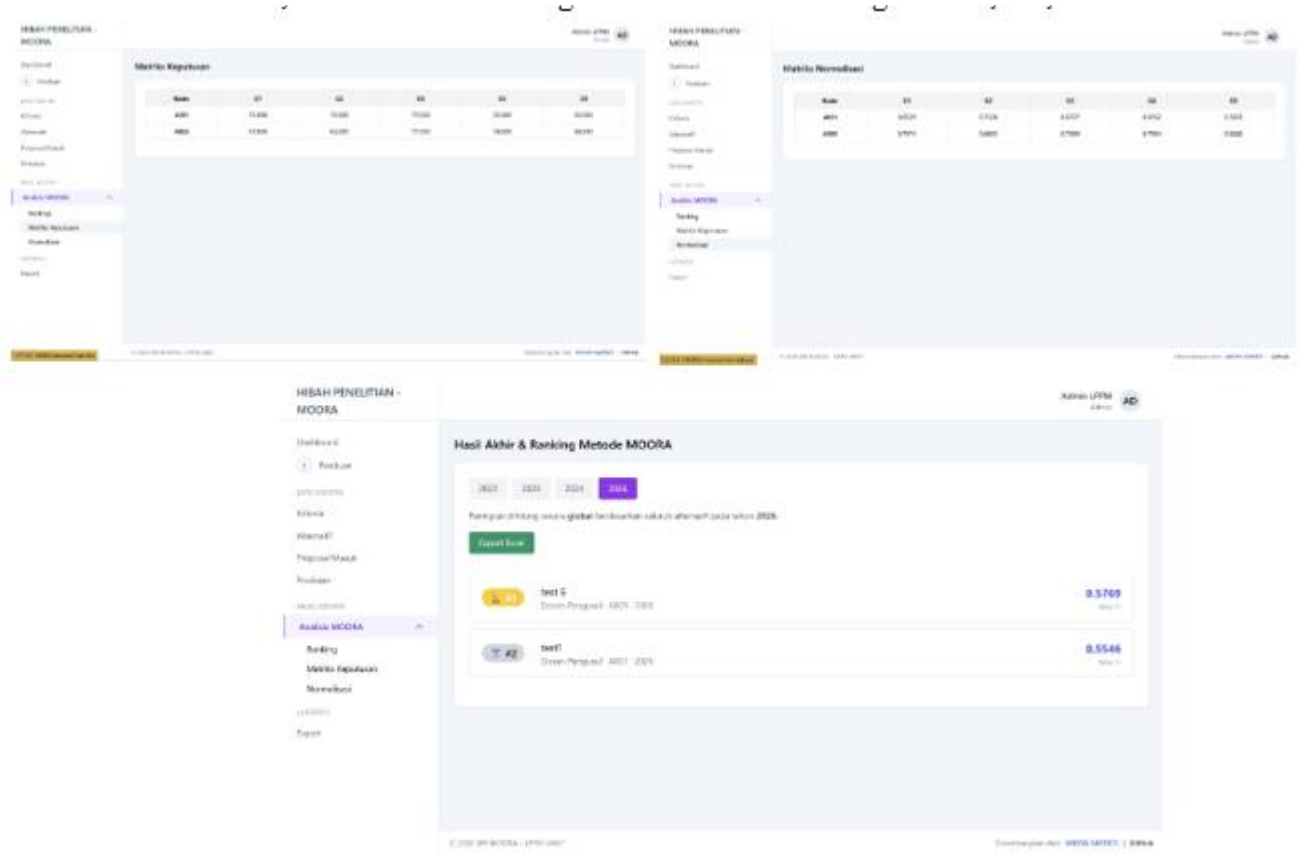


Figure 3.4 Decision Matrix, Normalization Matrix and Ranking Display

Through this mechanism, the system is capable of handling large volumes of data without affecting the accuracy of the MOORA calculation results. The generated ranking results serve as the basis for decision-making in determining which research grant proposals are most eligible for funding.

Results of MOORA Method Calculation in the System

The results of the MOORA method calculation in this study were obtained from the assessment data of lecturer research grant proposals that had been processed through a web-based Decision Support System (DSS). The calculation was conducted to determine the ranking of research grant proposals based on the criteria and weighting system established by LPPM. Overall, the system processed a total of 828 research grant proposals derived from LPPM's Microsoft Excel data. However, to facilitate understanding of the MOORA calculation stages, this subsection presents a sample calculation using four research grant proposals, consistent with the proposal data example. This example is provided to clearly explain the calculation process without displaying the entire dataset.

Example of Decision Matrix

The initial stage in the MOORA method is constructing the decision matrix. The decision matrix is formed from the proposal assessment scores for each criterion used in the research grant selection process. The rows in the matrix represent research grant proposals as alternatives, while the columns represent the assessment criteria used in the system. Based on the four sample proposals, each proposal is assigned an alternative code from A1 to A4. The values in the decision matrix are obtained from reviewer evaluations that have been input into the system. The assessment criteria consist of five criteria: Reviewer Score (C1), Output Target (C2), Sinta Score (C3), Equity Distribution (C4), and Frequency of Receiving Grants (C5). The decision matrix is shown in Table.

Table 3. Results of Decision Matrix Calculation

Alternative	C1 (Reviewer Score)	C2 (Output Target)	C3 (Sinta Score)	C4 (Equity Distribution)	C5 (Frequency of Receiving Grants)
A1	80	75	70	65	3
A2	78	80	72	68	2
A3	85	78	75	70	1
A4	82	76	73	67	4

The values in the table indicate that each proposal has different scores across the criteria. Therefore, a further process is required to normalize the values in order to standardize the scale across all criteria.

Decision Matrix Normalization

After the decision matrix is formed, the next stage is matrix normalization. Normalization is necessary because each criterion has a different assessment scale, meaning that the values across criteria cannot be directly compared. In the MOORA method, normalization is performed using the following formula:

$$x_{ij}^{*} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^{2}}}$$

(6)

As an example, the values in criterion C1 (Reviewer Score) are normalized by dividing each C1 value by the square root of the sum of the squares of all C1 values. The same process is applied to the other criteria, including those categorized as cost criteria. The results of the decision matrix normalization are shown in Table 3.5.

Table 4. Results of Normalized Decision Matrix Calculation

Alternative	C1	C2	C3	C4	C5
A1	0.48	0.46	0.46	0.46	0.55
A2	0.47	0.49	0.47	0.48	0.37
A3	0.51	0.48	0.49	0.49	0.18
A4	0.49	0.47	0.48	0.47	0.73

The normalization results indicate that all criterion values are now on a comparable scale and are ready to be used in the weighting stage.

Criteria Weighting

The next stage is criteria weighting. At this stage, the normalized values are multiplied by the weight of each criterion according to its level of importance in the research grant selection process. The criterion weights used in this study were determined by the LPPM and consist of five criteria, where four criteria are categorized as benefit criteria and one criterion is categorized as a cost criterion. The details of the weights and types of criteria are presented in Table.

Table 5. Criteria Weights

Criterion	Criterion Name	Weight	Type
C1	Reviewer Score	0.35	Benefit
C2	Output Target	0.25	Benefit
C3	Sinta Score	0.15	Benefit
C4	Equity Distribution	0.15	Benefit
C5	Frequency of Receiving Grants	0.10	Cost

The normalized values shown in Table 3.5 are then multiplied by their respective criterion weights. The weighting process aims to assign proportional influence to each criterion according to its importance in determining the final ranking results of the research grant proposals.

Optimization Value Calculation and Ranking

The final stage in the MOORA method is calculating the optimization value for each alternative based on the normalized and weighted criteria results. The optimization value is used to determine the feasibility level of each research grant proposal. The optimization value is calculated by summing all benefit-type criteria values and subtracting the cost-type criteria values, as formulated below:

$$Y_i = \sum_{j \in B} w_j \, x_{ij}^* - \sum_{j \in C} w_j \, x_{ij}^*$$

Based on the optimization value calculation using the four sample proposals, the ranking results are presented in Table.

Table 6. Optimization Value and Ranking Results

Alternative	Optimization Value (Yi)	Rank
A3	0.79	1
A2	0.74	2
A1	0.70	3
A4	0.69	4

Based on Table 4, proposal A3 has the highest optimization value and therefore ranks first, indicating that it is the most eligible proposal for funding. The differences in optimization values among proposals demonstrate that the MOORA method is capable of generating a ranking order based on the combined evaluation of all criteria calculated according to their predetermined weights. In the developed Decision Support System, the decision matrix and normalization matrix pages display only newly entered data or partial test data. This limitation is implemented to maintain system performance, considering the large number of research grant proposals processed. However, the MOORA calculation process is still performed on the entire dataset stored in the database. Therefore, the display limitation affects only the system interface and does not influence the calculation results or the final ranking outcomes.

System Testing

System testing was conducted to ensure that all functions of the Decision Support System for research grant selection operate properly according to user requirements. In this study, the system testing was carried out directly by the Head of the Institute for Research and Community Service (LPPM) at Universitas Muhammadiyah Kalimantan Timur, Mrs. Paula Mariana Kustiawan, S.Hut., M.Sc., Ph.D., who acted as the primary system user. The testing method applied was functional testing (black box testing). This testing was performed by executing each system feature and observing the conformity between the input provided and the output generated, without examining the underlying program structure or source code. The testing scenarios were adjusted to match the research grant selection process implemented at LPPM. Based on the testing results, all main system features—including the login process, proposal data management, criteria and weight management, proposal evaluation, and the calculation and ranking process using the MOORA method—functioned as intended. In addition, supporting features such as data export and user account management also operated properly. Therefore, the developed Decision Support System for research grant selection is declared to function appropriately and can be utilized to support the research grant selection process within LPPM Universitas Muhammadiyah Kalimantan Timur. Detailed system testing results are provided in the appendix as supporting evidence.

CONCLUSION

Based on the results of the study that has been conducted, it can be concluded that the Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method can be implemented in a data-driven Decision Support System (DSS) to support the research grant selection process at the Institute for Research and Community Service (LPPM) of Universitas Muhammadiyah Kalimantan Timur (UMKT). The implementation of the MOORA method utilizes research grant proposal data, predetermined evaluation criteria and their respective weights, as well as reviewer assessment results processed through the system. The calculation process is carried out in several stages, starting from constructing the decision matrix, normalizing the values, applying criteria weighting, and finally calculating the optimization values that generate the ranking order of research grant proposals. Through these stages, the system is able to produce proposal rankings based on the integration of multiple evaluation criteria. The results of applying the MOORA method in the system indicate that the research grant proposal selection process can be conducted consistently based on the available data and computational procedures. The developed system is capable of processing proposal evaluation data and displaying ranking results as a basis for decision-making in the research grant selection process. Therefore, the developed Decision Support System can serve as a supporting tool for LPPM UMKT in managing and selecting research grant proposals, particularly when handling a large number of proposals that require structured data processing.

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