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Prioritizing Regional Research and Innovation Program Proposals Using a MOORA-Based Decision Support System: A Case Study of Asahan Regency

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Abstract: The evaluation of regional research and innovation program proposals at the Regional Planning, Research, and Development Agency (BAPPERIDA) of Asahan Regency is still conducted manually, which may lead to subjectivity and inefficiency in the decision-making process. This study aims to develop a Decision Support System (DSS) using the Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method to support the prioritization of regional research and innovation proposals. The study evaluates ten proposal alternatives based on five criteria: program relevance, innovation level, implementation potential, resource readiness, and budget feasibility. The criterion weights were determined through expert judgment involving five evaluators from BAPPERIDA. The MOORA method was applied to normalize the evaluation data, incorporate the criterion weights, and calculate the optimization value for each alternative. The results show that alternative A8, Gunting Saga (Gerakan Cegah Stunting Siap Siaga), obtained the highest optimization score of 0.2340, followed by A7 with 0.2097 and A3 with 0.2082. The results indicate that the proposed DSS can provide a structured ranking of regional research and innovation proposals based on predetermined criteria and weights. The system can support BAPPERIDA in evaluating proposals and determining priority programs in a more systematic and measurable manner.

Keywords: Decision Support System; MOORA Method; Proposal Prioritization; Regional Research and Innovation; BAPPERIDA.

1. Introduction

Regional development requires a data-, research-, and innovation-based approach to ensure that public policies are aligned with regional needs and emerging challenges. Local governments therefore need decision-making processes that are supported by relevant evidence rather than relying solely on intuition or previous experience. In this process, the Regional Planning, Research, and Development Agency (BAPPERIDA) has an important role in coordinating regional development planning and supporting research and innovation activities related to local strategic issues. BAPPERIDA of Asahan Regency is an institution that was transformed from the Regional Development Planning Agency (Bappeda). In addition to formulating and coordinating regional development planning, BAPPERIDA is responsible for supporting research and innovation activities that are relevant to regional priorities. One of these activities is the selection of regional research and innovation program proposals, which can serve as a basis for developing research-based policies and determining programs that deserve priority support.

The selection of regional research and innovation proposals involves several challenges, particularly in terms of objectivity, consistency, and efficiency. Proposals may be submitted by various parties, including Regional Apparatus Organizations (OPD), universities, research institutions, and local innovators. The number and diversity of proposals require decision-makers to consider several aspects simultaneously before determining which proposals should receive priority. Without a structured analytical approach, differences in assessment and the large amount of information that must be considered may make the selection process less consistent. A decision support system is therefore needed to assist decision-makers in assessing and ranking proposals according to predefined criteria. A Decision Support System (DSS) is a computer-based system that assists decision-makers in evaluating alternatives based on specified criteria and weights. In a multi-criteria decision-making problem, a DSS can provide a structured basis for comparing alternatives and producing a ranking according to the assessment model used. In the present study, the alternatives are regional research and innovation program proposals submitted by various institutions and stakeholders. Each proposal is treated as an alternative that is assessed against several criteria to determine its priority for consideration as a leading regional research and innovation program.

Table 1. Alternative Data of Regional Research and Innovation Program Proposals in Asahan Regency for 2026

Kode Alternatif	Nama Kecamatan	Judul Proposal Riset / Inovasi	Fokus Bidang
A1	Kisaran Timur	MAS BERLIAN (Masyarakat Bersih Lingkungan) Kecamatan Kota Kisaran Timur	Lingkungan
A2	Rawang Panca Arga	JIWA RAGA (Jumat Bersih Warga Rawang Panca Arga)	Sosial
A3	Rawang Panca Arga	PAdIE (Pelayanan Administrasi yang Inovatif & Efisien) Kecamatan Rawang Panca Arga	Administrasi
A4	Sei Dadap	SODAP (Solidaritas Sei Dadap Berbagi)	Sosial
A5	Buntu Pane	KOALISI (Kolaborasi Pelayanan Dan Kegiatan Sosial Jumat Berbagi) Kecamatan Buntu Pane	Sosial
A6	Bandar Pulau	BAPULGI (Bandar Pulau Berbagi)	Sosial
A7	Aek Kuasan	JEBOL SEKAT (Jemput Bola : Sosialisasi, Edukasi dan Kegiatan Kuratif Terhadap Kesehatan Masyarakat)	Kesehatan
A8	Aek Kuasan	Gunting Saga (Gerakan Cegah Stunting Siap Siaga) Kecamatan Aek Kuasan	Kesehatan
A9	Sei Kepayang	SAPA DESA (Sentra Pelayanan Administrasi Desa)	Administrasi
A10	Tanjung Balai	SENAM SEHAT	Kesehatan

Source : Bapperida Asahan Regency, 2026

The data used in this study consist of ten proposal alternatives from different subdistricts in Asahan Regency, covering environmental, social, administrative, and health-related areas. The proposals include MAS BERLIAN (A1), JIWA RAGA (A2), PAdIE (A3), SODAP (A4), KOALISI (A5), BAPULGI (A6), JEBOL SEKAT (A7), Gunting Saga (A8), SAPA DESA (A9), and SENAM SEHAT (A10). These alternatives are assessed using criteria representing several dimensions of program assessment, including relevance to strategic issues and regional development priorities, innovation level, implementation potential, resource readiness, and budget feasibility. The criteria are assigned weights according to their relative importance and subsequently used in the MOORA calculation to obtain the final ranking. One method that can be used for multi-criteria decision-making is the Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA). MOORA evaluates several alternatives based on multiple criteria by normalizing the decision matrix and calculating an optimization value for each alternative. The resulting values can then be used to rank the alternatives. The method has been applied in various decision-making problems. Nuari (2024), for example, developed a MOORA-based decision support system for selecting web application development platforms. Silaban (2024) applied MOORA to employee selection, while Mubaroq *et al.* (2023) implemented the method to determine the most developed village. These studies indicate that MOORA can be applied to decision-making problems involving multiple alternatives and criteria.

The application of MOORA in the present study is directed toward a regional government planning context, particularly the prioritization of research and innovation program proposals. The criteria used in this study consider the relevance of proposals to regional development priorities, their level of innovation, implementation potential, resource readiness, and budget feasibility. These aspects require a systematic assessment because proposal prioritization involves different types of information and considerations. A MOORA-based DSS can therefore be used to convert the assessment results into a structured ranking that can support the decision-making process at BAPPERIDA of Asahan Regency. The development of a DSS is also expected to provide a more consistent basis for evaluating proposals. Rather than replacing the role of decision-makers, the system can assist them by processing assessment results according to predetermined criteria and weights. This approach can reduce the amount of manual calculation required and provide a clearer record of how the ranking is obtained. The system is therefore intended to support the proposal prioritization process and provide recommendations that can be considered alongside the judgment of decision-makers.

From an academic perspective, this study contributes to the application of decision support systems and multi-criteria decision-making methods in the context of regional research and innovation planning. From a practical perspective, the system is intended to support BAPPERIDA of Asahan Regency in organizing proposal assessments and determining priorities based on the criteria established for the study. The proposed approach may also provide a basis for further development of digital decision-support tools for regional research and innovation planning. Based on the studies reviewed in this research, MOORA has been applied to several selection and classification problems, including scholarship selection, employee evaluation, village classification, and water quality assessment. However, its application to the prioritization of regional research and innovation program proposals within a local government planning agency remains limited. Proposal prioritization has particular characteristics because it involves multiple stakeholders, different assessment dimensions, and the conversion of qualitative judgments into quantitative scores. This creates a need for a structured decision-making approach that can accommodate several criteria simultaneously. Therefore, this study aims to develop a MOORA-based Decision Support System to support the prioritization of regional research and innovation program proposals at BAPPERIDA of Asahan Regency.

2. Literature Review

2.1 Decision Support System (DSS)

A Decision Support System (DSS) is a computer-based system designed to support decision-makers in addressing semi-structured problems by providing relevant information, analysis, and recommendations. DSS can support both individual and group decision-making by helping users evaluate available alternatives according to specific criteria (Jana *et al.*, 2022). In decision-making problems involving multiple alternatives and criteria, a DSS can provide a structured basis for comparing alternatives and determining their relative priorities. The DSS is used to support the evaluation and prioritization of regional research and innovation program proposals. Each proposal is treated as an alternative and evaluated according to predefined criteria and weights. The system processes the assessment data and produces a ranking that can be used by decision-makers as supporting information when determining proposal priorities. Therefore, the DSS in this study does not replace the role of decision-makers but provides a systematic basis for comparing proposals.

2.2 MOORA Method

The Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) is a multi-criteria decision-making method that can be applied to evaluate and rank alternatives based on several criteria. The method was introduced by Brauers and is designed to address decision-making problems involving multiple objectives or attributes. MOORA can accommodate criteria with different levels of importance through the use of criterion weights and can distinguish between beneficial and non-beneficial criteria. The MOORA method generally begins with the construction of a decision matrix containing the performance values of each alternative for each criterion. The values are then normalized to make the criteria comparable. The normalized values can subsequently be multiplied by the corresponding criterion weights. For the optimization process, values associated with beneficial criteria are maximized, whereas values associated with non-beneficial or cost criteria are minimized. The resulting optimization values are used to rank the alternatives, with the alternative obtaining the most favorable value receiving the highest priority. In this study, MOORA is applied to rank regional research and innovation program proposals based on program relevance, innovation level, implementation potential, resource readiness, and budget feasibility. The method is selected because the decision problem involves multiple alternatives and criteria that need to be considered simultaneously. The resulting ranking provides a quantitative basis for supporting the prioritization process at BAPPERIDA of Asahan Regency.

2.3 Comparison of Related Studies

Previous studies have applied MOORA in various decision-making contexts. The method has been used in problems such as scholarship selection, employee evaluation, teacher selection, and hotel assessment. These applications indicate that MOORA can be used to compare alternatives based on multiple criteria and produce a priority ranking. However, the decision problem addressed in this study has a different context. The alternatives are regional research and innovation program proposals that need to be assessed according to their relevance to regional priorities, innovation level, implementation potential, resource readiness, and budget feasibility. The decision also involves the prioritization of proposals within a local government planning institution. Based on the studies reviewed in this research, the application of MOORA to this type of proposal prioritization remains limited. The distinction between previous studies and the present study therefore lies primarily in the decision context and the alternatives being evaluated. While previous applications have focused on selecting individuals, institutions, products, or other types of alternatives, this study applies MOORA to prioritize regional research and innovation program proposals at BAPPERIDA of Asahan Regency. The proposed approach is intended to provide a structured and measurable basis for comparing proposals and supporting regional research and innovation planning (Samsudin *et al.*, 2023).

3. Methodology

3.1 Research Stages

This section describes the research methodology and framework used to develop a Decision Support System (DSS) for prioritizing regional research and innovation program proposals at BAPPERIDA of Asahan Regency. The research framework consists of several stages, namely problem identification, data collection, data analysis, system design, system testing, and system implementation. The research framework is presented in Figure 1.

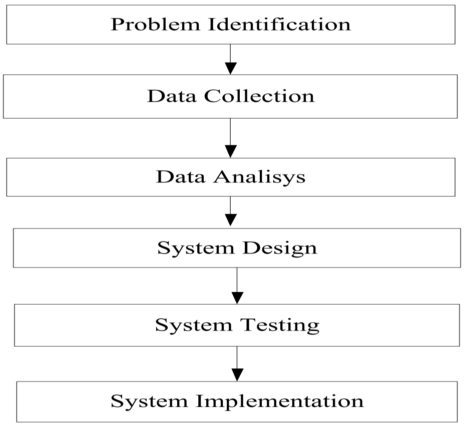


Figure 1. Research Workflow Diagram

Figure 1 the sequence of activities conducted in this study. The research begins with problem identification to determine the problems encountered in the evaluation and prioritization of regional research and innovation program proposals at BAPPERIDA of Asahan Regency. The next stage is data collection, which involves obtaining proposal data, evaluation criteria, criterion weights, and assessment values. The collected data are then analyzed using the MOORA method to determine the priority ranking of the proposal alternatives. Based on the system requirements identified during the analysis, a web-based DSS is designed using UML and developed using PHP and MySQL. The developed system is subsequently tested to verify its functionality and the consistency of the MOORA calculations. After the testing stage, the system is implemented to support the proposal prioritization process at BAPPERIDA of Asahan Regency.

1) Problem Identification
   The problem identification stage was conducted to identify and understand the problems encountered in the evaluation and prioritization of regional research and innovation program proposals at BAPPERIDA of Asahan Regency. The proposal selection process is still largely conducted manually, which may result in differences in assessment, inefficiency, and difficulties in maintaining consistency in the decision-making process (Luneto & Syahrul, 2024). This stage was used to identify the requirements for a decision support system that can assist decision-makers in evaluating and ranking proposal alternatives.
2) Data Collection
   Data collection was conducted at BAPPERIDA of Asahan Regency to obtain relevant information related to the submission and evaluation of regional research and innovation program proposals. The collected data included proposal alternatives, evaluation criteria, criterion weights, and assessment values for each proposal. The proposal data were obtained from various proposing institutions or organizations. These data were used as the basis for applying the MOORA method and developing the proposed decision support system.
3) Data Analysis
   The collected data were analyzed quantitatively using the MOORA method. The analysis involved evaluating each proposal alternative according to the predetermined criteria, normalizing the assessment values, applying the criterion weights, and calculating the optimization value. The resulting optimization

values were used to rank the proposal alternatives according to their priority. The ranking results were then used as supporting information for decision-makers in determining the priority of regional research and innovation proposals.

4) System Design
The system design stage involved developing the conceptual and technical design of the web-based DSS. Unified Modeling Language (UML) diagrams, including use case diagrams, activity diagrams, and class diagrams, were used to describe the functional requirements, system activities, and structural relationships within the system (Nisa' *et al.*, 2024). The user interface design includes forms for managing criteria and proposal data, proposal evaluation forms, and displays for the ranking results. The system was developed using PHP and MySQL to support data management and the processing of proposal evaluation results.
5) System Testing
System testing was conducted to verify that the functions of the DSS operated according to the specified requirements. The testing included data input, proposal evaluation, MOORA calculations, and the presentation of ranking results. This process was also used to identify functional errors and verify that the calculation results produced by the system were consistent with the applied MOORA procedure (Kusmanto *et al.*, 2022). The testing results were used to identify and correct problems before the system was implemented.
System Implementation
6) The implementation stage was conducted after the system had undergone testing and the required corrections had been completed. The DSS was implemented as a web-based application using PHP and MySQL. The system supports the management of proposal data, evaluation criteria, assessment values, MOORA calculations, and proposal rankings. The system is intended to assist BAPPERIDA of Asahan Regency in conducting the proposal prioritization process in a more structured and consistent manner.

The prototyping approach was used in the development of the DSS. This approach involves developing an initial version of the system and refining it according to identified user requirements and feedback. The development process was used to ensure that the system functions corresponded to the requirements of the proposal evaluation process. In addition, a quantitative questionnaire was used to obtain user responses to the developed system. The questionnaire data were analyzed statistically to assess user responses to the system. The detailed procedure for the questionnaire, including the respondents, instrument, measurement scale, and calculation method, should be presented in a separate subsection. The MOORA method was used to analyze the proposal assessment data and generate the final ranking of the alternatives.

3.2 Unified Modeling Language (UML)

Unified Modeling Language (UML) is a standardized modeling language used to describe the structure and behavior of software systems. UML was developed by Grady Booch, Jim Rumbaugh, and Ivar Jacobson by combining several object-oriented modeling approaches used in software development (Abdul-kareem *et al.*, 2023). In this study, UML is used to model the proposed DSS and describe the interaction between users and the system. The UML diagrams used include use case diagrams, activity diagrams, and class diagrams. The use case diagram describes the interaction between system users and the system functions. The activity diagram illustrates the sequence of activities in the proposal evaluation and ranking process, while the class diagram describes the relationships among the data and system components.

3.3 MOORA Method and Calculation

The Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method is a multi-criteria decision-making method used to evaluate and rank alternatives based on several criteria. The method involves relatively simple mathematical calculations and can be applied to decision-making problems involving beneficial and non-beneficial criteria (Setiani *et al.*, 2023). Among several Multi-Criteria Decision-Making (MCDM) methods, such as AHP, SAW, and TOPSIS, MOORA is used in this study because it can evaluate multiple alternatives based on several criteria and can accommodate beneficial and non-beneficial criteria. Unlike AHP, MOORA does not require extensive pairwise comparisons. The method also uses normalization to make values from different criteria comparable. Therefore, MOORA is considered appropriate for the evaluation and prioritization of regional research and innovation program proposals. The MOORA calculation consists of several stages, including determining the criteria and assessment values, constructing the decision matrix, normalizing the matrix, applying criterion weights, calculating the optimization value, and ranking the alternatives.

1) Determining Criteria and Assessment Values

The first stage is to determine the criteria used to evaluate the regional research and innovation program proposals. Each proposal is assessed based on the predetermined criteria. The criteria used in this study include program relevance, level of innovation, implementation potential, resource readiness, and budget feasibility.

2) Constructing the Decision Matrix
The decision matrix contains the assessment values of each alternative with respect to each criterion. The decision matrix can be represented as:

$$X = \begin{bmatrix} x_{11} x_{12} x_{1n} \\ x_{21} x_{22} x_{2n} \\ x_{31} x_{32} x_{3n} \end{bmatrix} \quad (1)$$

Where xij represents the assessment value of alternative i with respect to criterion j, m represents the number of alternatives, and n represents the number of criteria.

3) Matrix Normalization
The decision matrix is normalized so that the values of different criteria can be compared on a common scale. The normalization formula is:

$$x^*ij = \frac{xij}{\sqrt{\sum_{i=1}^{m} x^2 ij}} \quad (2)$$

Where $xij*$ is the normalized value of alternative i for criterion j, while xjj is the original assessment value.

4) Optimization of Attributes
After normalization, the normalized values are used to calculate the optimization value. Beneficial criteria are maximized, whereas non-beneficial or cost criteria are minimized. The basic optimization formula is:

$$Y_i = \sum_{j=i}^{g} x^*ij - \sum_{j=g+1}^{n} x^*ij \quad (3)$$

Where g represents the number of beneficial criteria and $n - g$ represents the number of non-beneficial criteria. Yi represents the optimization value of alternative i. When criterion weights are applied, the formula becomes:

$$Y_i = \sum_{j=i}^{g} wjx^*ij - \sum_{j=g+1}^{n} wjx^*ij \quad (4)$$

Where wj represents the weight of criterion j. The resulting optimization values are then used to rank the alternatives. The ranking determines the priority order of the regional research and innovation program proposals.

4. Result and Discussion

4.1 System Analysis

4.1.1 Current System

The current selection process for leading regional research and innovation program proposals at the Asahan Regency BAPPERIDA Office is still conducted through several stages. First, districts or related institutions submit research and innovation program proposals to the Asahan Regency BAPPERIDA Office manually or through administrative documents. The submitted proposals are then received and verified by BAPPERIDA officers to ensure that the required documents are complete and meet the initial administrative requirements. After the verification process, the evaluation team assesses each proposal based on several aspects, including program relevance, level of innovation, implementation potential, resource readiness, and budget feasibility. The evaluation team and management then compare the submitted proposals through discussions based on the assessment results. Finally, management determines the proposals to be prioritized based on the results of the evaluation and discussion. The selected proposals are subsequently communicated to the respective proposing districts or institutions.

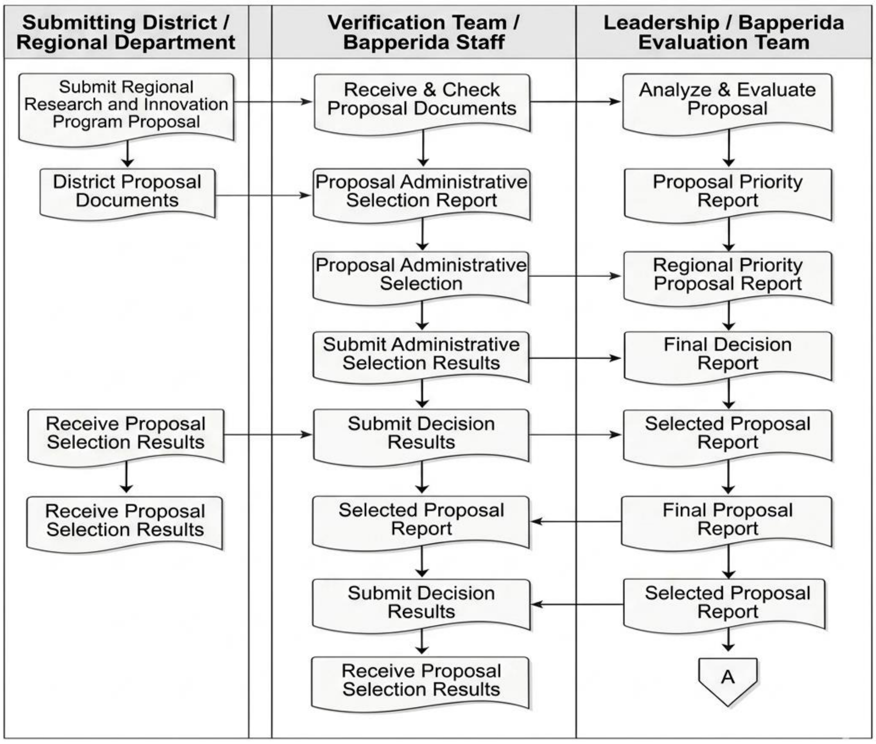


Figure 2. Current Information System Flow

Figure 2 illustrates the current information system flow for the selection of leading regional research and innovation program proposals at the Asahan Regency BAPPERIDA Office. The process begins with the submission of proposals by districts or related institutions. The submitted documents are received and verified by BAPPERIDA officers before being assessed by the evaluation team based on the established criteria. The evaluation results are then discussed by the evaluation team and management to compare the submitted proposals. Based on the assessment and discussion results, management determines the proposals to be prioritized and communicates the decision to the respective proposing districts or institutions.

4.1.2 Proposed System

The proposed system is designed to assist the selection process of leading regional research and innovation program proposals at the Asahan Regency BAPPERIDA Office by applying the MOORA method. The process begins with determining the alternatives in the form of regional research and innovation program proposals. The evaluation criteria are then determined, followed by the assignment of weights to each criterion according to its importance in the assessment process. The alternative values and criterion values are subsequently used to construct the decision matrix. The decision matrix is normalized to obtain comparable values for each criterion. The normalized values are then used to calculate the MOORA optimization value by considering the benefit and cost criteria. The resulting optimization values are used to rank the alternatives, and the highest-ranked alternative is determined as the priority proposal based on the assessment results.

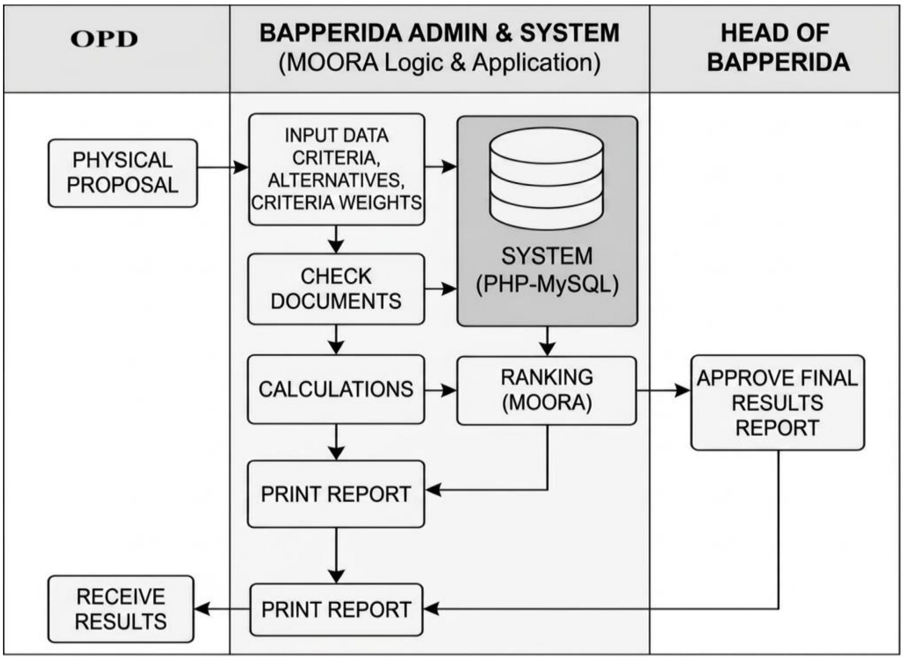


Figure 3. Proposed Information System Flow

Figure 3 illustrates the proposed information system flow for selecting leading regional research and innovation program proposals using the MOORA method. The process starts with the input of proposal alternatives and evaluation criteria, followed by the determination of criterion weights and the preparation of the decision matrix. The system then performs the normalization and MOORA calculation processes before producing the final ranking of the alternatives. The resulting ranking provides supporting information for BAPPERIDA in determining the priority regional research and innovation proposal.

4.1.3 Data Analysis and MOORA Calculation

The data analysis was conducted using ten regional research and innovation program proposal alternatives. Each alternative was assessed using five criteria: program relevance (C1), level of innovation (C2), implementation potential (C3), resource readiness (C4), and budget feasibility (C5). The MOORA calculation consisted of several stages, including determining the initial alternative data, converting qualitative assessments into numerical values, determining criterion weights, normalizing the decision matrix, calculating the weighted normalized matrix, and determining the final optimization values and ranking. The initial data consisted of ten proposal alternatives submitted by districts in Asahan Regency. Each proposal was assessed based on the five predetermined criteria. The initial assessment data are presented in Table 2.

Table 2. Initial Data

Code	District	C1	C2	C3	C4	C5
A1	Kisaran Timur	Highly Relevant	Good	Good	Good	Moderate
A2	Rawang Panca Arga	Relevant	Fair	Good	Fair	Low
A3	Rawang Panca Arga	Highly Relevant	Good	Very Good	Good	Moderate
A4	Sei Dadap	Relevant	Fair	Good	Good	Low
A5	Buntu Pane	Relevant	Good	Fair	Good	Moderate
A6	Bandar Pulau	Fairly Relevan	Fair	Good	Fair	Low
A7	Aek Kuasan	Highly Relevant	Very Good	Good	Good	Moderate
A8	Aek Kuasan	Highly Relevant	Good	Very Good	Good	Low
A9	Sei Kepayang	Relevant	Good	Good	Fair	Low
A10	Tanjung Balai	Relevant	Fair	Good	Good	Low

Table 2 presents the initial assessment of each alternative using qualitative categories, including Highly Relevant, Relevant, Fairly Relevant, Very Good, Good, Fair, and Low. These assessment categories represent the performance of each proposal according to the established criteria. The qualitative assessment results were converted into numerical values according to the predetermined assessment scale. The numerical values obtained from this conversion were used as input data for the MOORA calculation.

Table 3. Criteria Value Data for Alternatives

Code	District	C1 Program Relevance	C2 Level of Innovation	C3 Implementation Potential	C4 Source Readiness	C5 Budget Feasibility
A1	Kisaran Timur	5	4	4	4	3
A2	Rawang Panca Arga	4	3	4	3	2
A3	Rawang Panca Arga	5	4	5	4	3
A4	Sei Dadap	4	3	4	4	2
A5	Buntu Pane	4	4	3	4	3
A6	Bandar Pulau	3	3	4	3	2
A7	Aek Kuasan	5	5	4	4	3
A8	Aek Kuasan	5	4	5	4	2
A9	Sei Kepayang	4	4	4	3	2
A10	Tanjung Balai	4	3	4	4	2

Table 3 shows the numerical values assigned to each alternative for criteria C1 through C5. The values range from 2 to 5 according to the assessment categories presented in the initial data. The criterion weights were determined through expert judgment involving five evaluators from BAPPERIDA, consisting of planning officers, research coordinators, and innovation program managers. The weighting process was conducted through a Focus Group Discussion (FGD) to determine the relative importance of each criterion in supporting regional development priorities.

Table 4. Criteria Weights

Kriteria	Bobot
C1 Relevance	0.25
C2 Innovation	0.20
C3 Implementation	0.20
C4 Resource Readiness	0.15
C5 Budget Feasibility	0.20

The weights assigned to C1, C2, C3, C4, and C5 were 0.25, 0.20, 0.20, 0.15, and 0.20, respectively. The total weight of all criteria is 1.00. The normalization process was performed using the vector normalization procedure in the MOORA method. Each criterion value was divided by the square root of the sum of squared values for the corresponding criterion. This process converts the original values into normalized values that can be compared across alternatives.

$$x^{*}11 = \frac{5}{\sqrt{5^2 + 4^2 + 5^2 + 4^2 + 4^2 + 3^2 + 5^2 + 5^2 + 4^2 + 4^2}}$$

Table 5. Normalized Decision Matrix

Code	C1	C2	C3	C4	C5
A1	0.3637	0.3369	0.3059	0.3393	0.3873
A2	0.2910	0.2526	0.3059	0.2545	0.2582
A3	0.3637	0.3369	0.3824	0.3393	0.3873
A4	0.2910	0.2526	0.3059	0.3393	0.2582
A5	0.2910	0.3369	0.2294	0.3393	0.3873
A6	0.2182	0.2526	0.3059	0.2545	0.2582
A7	0.3637	0.4211	0.3059	0.3393	0.3873
A8	0.3637	0.3369	0.3824	0.3393	0.2582
A9	0.2910	0.3369	0.3059	0.2545	0.2582
A10	0.2910	0.2526	0.3059	0.3393	0.2582

After normalization, each normalized value was multiplied by its corresponding criterion weight. This calculation reflects the relative contribution of each criterion to the final MOORA score. For example, the weighted normalized value of alternative A1 for criterion C1 is:
For criterion C2:

$$v_{11} = 0.3637 \times 0.25 = 0.0909$$

$v_{12} = 0.3369 \times 0.20 = 0.0674$

Table 6. Weighted Normalized Matrix

Code	C1	C2	C3	C4	C5
A1	0.0909	0.0674	0.0612	0.0509	0.0775
A2	0.0727	0.0505	0.0612	0.0382	0.0516
A3	0.0909	0.0674	0.0765	0.0509	0.0775
A4	0.0727	0.0505	0.0612	0.0509	0.0516
A5	0.0727	0.0674	0.0459	0.0509	0.0775
A6	0.0546	0.0505	0.0612	0.0382	0.0516
A7	0.0909	0.0842	0.0612	0.0509	0.0775
A8	0.0909	0.0674	0.0765	0.0509	0.0516
A9	0.0727	0.0674	0.0612	0.0382	0.0516
A10	0.0727	0.0505	0.0612	0.0509	0.0516

The final MOORA optimization value was calculated by adding the weighted normalized values of the benefit criteria and subtracting the weighted normalized values of the cost criteria. The resulting optimization values for all alternatives are presented in Table 7.

Table 7. MOORA Optimization Results

Code	Benefit	Cost	Yi
A1	0.2704	0.0775	0.1929
A2	0.2226	0.0516	0.1710
A3	0.2857	0.0775	0.2082
A4	0.2353	0.0516	0.1837
A5	0.2369	0.0775	0.1594
A6	0.2045	0.0516	0.1528
A7	0.2872	0.0775	0.2097
A8	0.2856	0.0516	0.2340
A9	0.2394	0.0516	0.1878
A10	0.2353	0.0516	0.1837

The final ranking of the alternatives was determined based on their MOORA optimization values. The ranking results are presented in Table 8.

Table 8. Final Ranking of Alternatives

Rank	Code	District	Yi
1	A8	Aek Kuasan	0.2340
2	A7	Aek Kuasan	0.2097
3	A3	Rawang Panca Arga	0.2082
4	A1	Kisaran Timur	0.1929
5	A9	Sei Kepayang	0.1878
6	A4	Sei Dadap	0.1837
7	A10	Tanjung Balai	0.1837
8	A2	Rawang Panca Arga	0.1710
9	A5	Buntu Pane	0.1594
10	A6	Bandar Pulau	0.1528

Based on Table 8, A8 was ranked first with a score of 0.2340, followed by A7 with 0.2097 and A3 with 0.2082. A6 was ranked tenth with a score of 0.1528. A sensitivity analysis was conducted by varying each criterion weight by ±10%. Based on the analysis reported in this study, alternative A8 remained in the first position under all tested scenarios.

Table 9. Sensitivity Analysis Results

Scenario	Changed Criterion	Weight Change	Rank 1	MOORA Score
S1	C1	+10%	A8	—
S2	C1	−10%	A8	—
S3	C2	+10%	A8	—
S4	C2	−10%	A8	—
S5	C3	+10%	A8	—
S6	C3	−10%	A8	—
S7	C4	+10%	A8	—

S8	C4	−10%	A8	—
S9	C5	+10%	A8	—
S10	C5	−10%	A8	—

The complete results of each sensitivity scenario should be presented to show the changes in criterion weights, optimization values, and rankings.

4.1.4 System Implementation

The main page is displayed after the administrator successfully enters the correct username and password. The page contains five menus that provide access to the functions available in the Decision Support System.

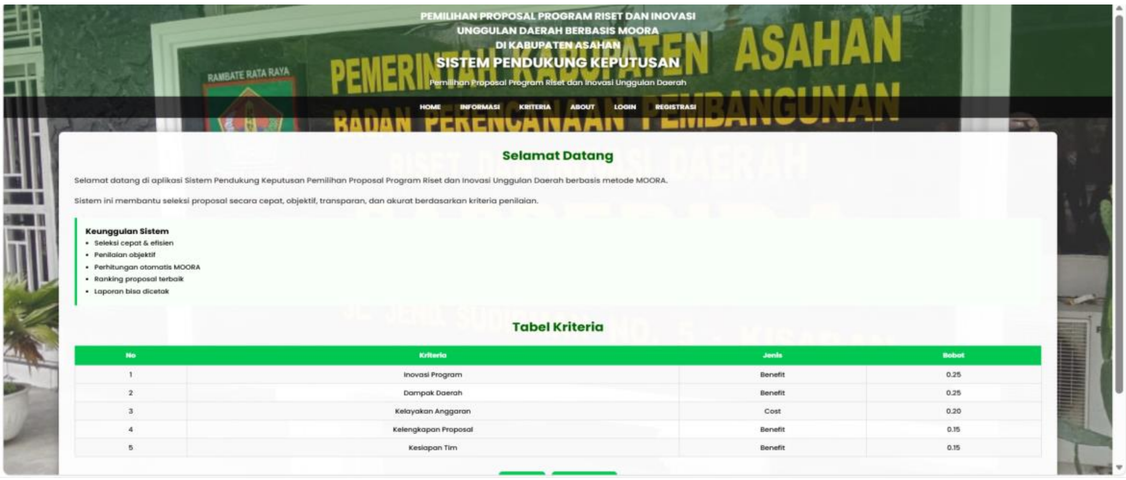
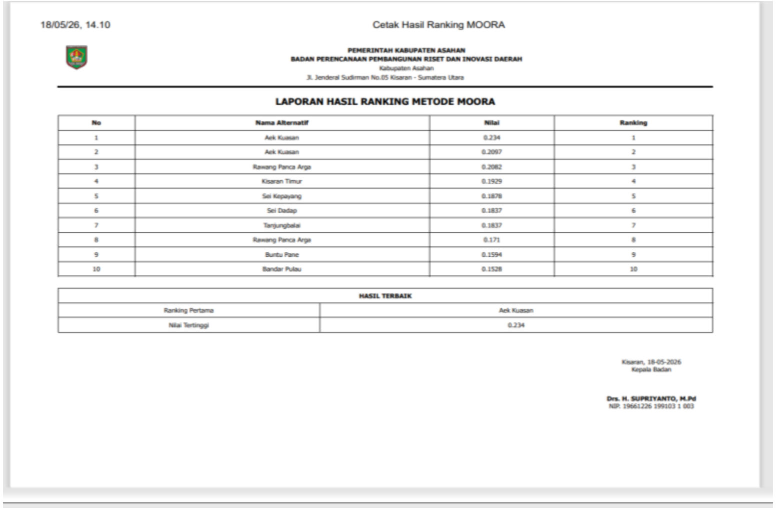


Figure 4. Main Page

Figure 4 shows the main page interface of the Decision Support System for selecting leading regional research and innovation program proposals. The page provides access to the main functions of the system through the available menus. The calculation result page displays the calculation process using the MOORA method and provides the resulting ranking of the alternatives.

Figure 5. Calculation Result Page

Figure 5 shows the calculation result page of the system. The page displays the results of the MOORA calculation and the ranking of alternatives based on their respective optimization values. The print result page displays the final calculation results generated by the system and provides the output in a format that can be printed.



18/05/26, 14.10 Cetak Hasil Ranking MOORA

PEMERINTAH KABUPATEN ASAHAN
BADAN PERENCANAAN PEMBANGUNAN RISET DAN INOVASI DAERAH
Kabupaten Asahan
Jl. Jenderal Sudirman No.05 Kisaran - Sumatera Utara

LAPORAN HASIL RANKING METODE MOORA

No	Nama Alternatif	Nilai	Ranking
1	Aek Kuasan	0.234	1
2	Aek Kuasan	0.2097	2
3	Rawang Panca Arga	0.2082	3
4	Kisaran Timur	0.1929	4
5	Sei Kepayang	0.1878	5
6	Sei Dadap	0.1837	6
7	Tanjungbalai	0.1837	7
8	Rawang Panca Arga	0.171	8
9	Buntu Pane	0.1594	9
10	Bandar Pulau	0.1528	10

HASIL TERBAIK	
Ranking Pertama	Aek Kuasan
Nilai Tertinggi	0.234

Kisaran, 18-05-2026
Kepala Badan

Drs. H. SUPRIYANTO, M.Pd
NIP. 19661226 199103 1 003

Figure 6. Print Result Page

Figure 6 shows the print result page containing the calculation results generated by the system. This page provides a documented output of the ranking results produced by the MOORA method.

4.2 Discussion

The results indicate that alternative A8, representing the Gunting Saga proposal from Aek Kuasan, obtained the highest MOORA score of 0.2340. Based on the assessment data, A8 received relatively high scores for program relevance, level of innovation, implementation potential, and resource readiness. The combination of these assessment results contributed to its position as the highest-ranked alternative. This result indicates that A8 performed relatively well across the criteria considered in the decision-making process. Alternative A7 ranked second with a score of 0.2097, followed by A3 with a score of 0.2082. The relatively small difference between A7 and A3 indicates that both alternatives had similar overall performance based on the criteria and weights applied in the MOORA calculation. Meanwhile, A6 obtained the lowest score of 0.1528 and was ranked tenth. The difference between the highest and lowest scores indicates that the assessment criteria produced different levels of overall performance among the proposed programs.

The results also show that the MOORA method combines the performance of each alternative across several criteria into a single optimization value. Therefore, the final ranking is not determined by one criterion alone but by the combined performance of each alternative according to the criteria and weights established in the study. This allows decision-makers to compare proposals using a consistent calculation procedure. The findings of this study are in line with previous research that has applied the MOORA method to multi-criteria decision-making problems. Mubaroq *et al.* (2023) applied the MOORA method to determine the most developed village, while Yogi *et al.* (2024) applied the method to a selection problem based on several assessment criteria. These studies show that MOORA can be used to evaluate and rank alternatives by considering multiple criteria simultaneously.

The present study applies MOORA to a different decision-making context, namely the prioritization of regional research and innovation program proposals within a local government planning agency. The criteria used in this study include program relevance, level of innovation, implementation potential, resource readiness, and budget feasibility. These criteria are related to the characteristics of regional research and innovation proposals and provide a basis for comparing alternatives according to the assessment requirements established by BAPPERIDA. The difference in application context represents a practical contribution of this study. While previous studies have focused on areas such as village classification and other selection problems, this study applies MOORA to the prioritization of regional research and innovation proposals. The method therefore provides a quantitative approach that can be adapted to the assessment requirements of regional government institutions.

The ranking generated by the MOORA-based Decision Support System can provide BAPPERIDA with structured information for comparing regional research and innovation proposals. The system processes proposal assessment data according to predetermined criteria and weights, reducing the need for manual calculations and providing a consistent procedure for generating the ranking. The system is intended to support rather than replace the role of decision-makers. The ranking results can be considered together with other factors, such as administrative requirements, technical feasibility, funding considerations, and regional policy priorities. In this way, the system can provide quantitative information that supports the evaluation process while the final decision remains with the authorized decision-makers at BAPPERIDA.

The proposed system can also provide a clearer record of the calculation process. Each alternative is assessed according to the same criteria and processed using the same calculation procedure, allowing the resulting ranking to be traced from the initial assessment data to the final MOORA score. This can support a more organized proposal evaluation process within the institution. The sensitivity analysis was conducted to examine the stability of the ranking when changes were made to the criterion weights. The analysis involved varying the criterion weights by ±10% to determine whether changes in the relative importance of the criteria would affect the position of the alternatives. Based on the results reported in this study, alternative A8 remained in the first position under the tested scenarios. The consistency of A8 in the first position indicates that the resulting ranking was relatively stable under the weight changes examined in the analysis. However, the sensitivity analysis should be supported by the complete results for each scenario, including the adjusted criterion weights, resulting MOORA scores, and alternative rankings. These results are necessary to allow the stability of the ranking to be verified quantitatively.

This study contributes to the application of a MOORA-based Decision Support System for prioritizing regional research and innovation program proposals at the Asahan Regency BAPPERIDA Office. The developed approach provides a structured procedure for entering proposal data, assigning criterion weights, processing assessment values, calculating MOORA optimization values, and generating the final ranking of alternatives. The study also has several limitations. The resulting ranking depends on the criteria, criterion weights, and assessment scores used in the decision-making model. Changes in these components may produce different ranking results. In addition, the assessment scores depend on the evaluation process conducted by the designated evaluators. Therefore, the results of the system should be interpreted as decision-support information rather than as an automatic determination of which proposal must be selected. The MOORA-based Decision Support System provides a structured quantitative approach for supporting the prioritization of regional research and innovation proposals. Its use can help BAPPERIDA organize the assessment process and compare proposals based on predetermined criteria, while the final selection remains subject to institutional considerations and decision-making authority.

5. Conclusion and Recommendations

This study implemented the Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method in a Decision Support System for prioritizing regional research and innovation program proposals at the Asahan Regency BAPPERIDA Office. The results show that the method can be used to rank alternatives based on predetermined criteria and criterion weights. Among the ten alternatives evaluated, Alternative A8, representing the Gunting Saga proposal from Aek Kuasan, obtained the highest MOORA score of 0.2340 and was ranked first. The developed Decision Support System provides a structured procedure for entering proposal data, assigning criterion weights, processing assessment values, and generating the ranking of alternatives. The system can therefore support BAPPERIDA in comparing regional research and innovation proposals and provide quantitative information for consideration during the selection process. However, the system does not replace institutional decision-making, as the final selection may also require consideration of administrative, technical, financial, and policy factors.

This study has several limitations. The evaluation model uses five criteria, and the criterion weights and assessment scores depend on the judgments of the designated evaluators. Changes in the criteria, weights, or assessment scores may therefore affect the resulting ranking. In addition, the study does not yet evaluate whether the ranking produced by the system corresponds to the actual outcomes of the selected programs. Future research can compare MOORA with other Multi-Criteria Decision Making (MCDM) methods, such as TOPSIS and AHP, to examine differences in ranking results. Further studies can also use a larger number of criteria and evaluate the relationship between the ranking results and the actual implementation outcomes of regional research and innovation programs. Such evaluations would provide additional evidence regarding the usefulness of the proposed decision support system in regional program prioritization.

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