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Decision Support System for Selecting the Best Head of Study Program Applying the Multi-Objective Optimization Method on the Basis of Simple Ratio Analysis (MOOSRA)

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Abstract−The Head of Study Program plays an important role as the highest leader in the structure of a study program. The Head of Study Program is responsible for the smooth running of academic activities in the study program he leads. As a key element in higher education, the Head of Study Program must lead the managerial function by planning, implementing, and controlling the academic process and managing other supporting activities. The head of the study program who shows high performance, dedication, and integrity deserves an award as the best head of the study program. This assessment aims to ensure that the Head of Study Program is able to carry out his duties properly in accordance with the rules and demands, and advance the study program in accordance with its vision and mission. Therefore, a decision support system is needed as a solution to overcome this problem, by utilizing the MOOSRA method. MOOSRA begins by formulating a decision matrix consisting of alternatives, criteria or attributes, individual weights or significance coefficients of each criterion, and performance measurements of related alternatives. Normalization is then carried out to change the attribute values into the range 0–1. The assessment results show that the Head of Study Program with the highest ranking is alternative A7, with a value of 0.896358.

Keywords: Decision Support System; Selection; Best Head of Study Program; MOOSRA Method

1. INTRODUCTION

The Head of Study Program is the highest leader in the structure of a study program. The Head of Study Program is tasked with ensuring the smooth running of all academic activities in the study program he leads. As a key and strategic element in higher education, the Head of Study Program must lead and manage various managerial functions such as designing plans, running the academic process, supervising the implementation of the academic process, and holding various other supporting activities. In addition to managerial responsibilities, the Head of Study Program is also responsible for the activity or inactivity of the study program he leads [1].

As a key and strategic element in higher education, the Head of Study Program has the task of leading and managing various important aspects. These tasks include the preparation of strategic and operational plans for study programs, implementation of learning processes and academic activities, control and evaluation of the quality of academic processes, and coordination of other supporting activities such as research, community service, and human resource development. The Head of Study Program also plays a role in ensuring that study programs remain relevant to the development of science and industry needs, as well as maintaining accreditation and quality of education according to established standards.

The head of the study program has the responsibility to lead and carry out managerial functions, including planning, implementing, and controlling academic activities and managing the administration of supporting activities. Therefore, a head of a study program who demonstrates extraordinary performance, dedication, and integrity deserves to be awarded as the best head of the study program. As an important component in university management, the head of the study program plays a role in realizing the vision, mission, and objectives of the study program that are in line with the vision, mission, and objectives of the institution as a whole. The reward system is an important element and motivator that encourages the best performance and creates a conducive academic atmosphere, which ultimately accelerates the development of the scientific community today and in the future according to expectations [2].

The award system is expected to motivate the head of study program to be more accomplished and productive, so that the goals of developing the higher education system and national development in general can be achieved optimally. This award is given routinely by the Ministry of Research, Technology and Higher Education. The assessment of the Head of Study Program covers various aspects, such as leadership, ability to provide protection, communication, activeness, research, and dedication. This assessment aims to ensure that the Head of Study Program can carry out his/her duties properly in accordance with existing rules and demands, and advance the study program in accordance with its vision and mission. Therefore, a decision support system is needed as a solution to this problem [3].

Decision Support System (DSS) is a computerized system designed to solve problems and produce data used in decision making. The main components in DSS include Data Management, Model Management, Communication, and Knowledge Management. Some methods used in DSS include *Complex Proportional Assessment* (COPRAS), *Step-wise Weight Assessment Ratio Analysis Method* (SWARA), *Additive Ratio Assessment* (ARAS), *Rank Order Centroid* (ROC), *Preference Selection Index* (PSI), *Multi-Attributive Border Approximation area Comparison* (MABAC), *Multi Attribute*

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Utility Theory (MAUT), *Preference Ranking Organization Method For Enrichment Evaluation* (PROMETHEE I-II-III), *Elimination And Choice Expressing Reality* (ELECTRE I-II-III), and *The Extended Promethee* (EXPROM I&II) [4][5][6][7][8][9][10]. In this study, the author solves the problem using the MOOSRA method (*Multi-Objective Optimization on the Basis of Simple Ratio Analysis*). The MOOSRA methodology begins by formulating a decision matrix that typically includes four main parameters: alternatives, criteria or attributes, individual weights or significance coefficients of each criterion, and performance measures of the alternatives related to those criteria. In the multiattribute phase, normalization is required as a process to transform attribute values into the range 0–1 [11][12].
There are several related studies that are used as reference materials by the author in making this research, such as research in 2022 conducted by Zulfi Azhar et al., discussing the selection of the best E-Commerce using the Moosra method resulting in the best preference value of 3.26323 in alternative A1 [13], In 2023 research conducted by Elsa Fitria et al., discussing the selection of E-commerce in purchasing fashion products applying the Moosra method resulting in the best preference value of 2.11960 in alternative A1 [14], research conducted by Deby Lorensyah Rambe et al., discussing the Application of the Moosra Method and ROC Weighting in assessing the Performance of Chemistry Laboratory Assistants resulting in the best preference value of 207.92651 in alternative LK07 [15]. Research conducted by Rima Tamara Aldisa et al., discussing the acceptance of permanent lecturers using the Moora and Moosra methods resulting in the best preference value of 0.4742 using the Moora method and 28.1366 using the Moosra method in alternative A1 [16]. Research conducted by Elfrianti Fransiska Hutahaean et al., discussing the application of the Moosra method in recommendations for selecting candidates for the voting committee (PPS) produced the best value of 4.812 for alternative A1 [17].

Based on this research as a solution to solve the problems that the author studied with the multi-objective optimization method on the basis of simple ratio analysis (MOOSRA) as the best alternative value in selecting the best study program head. The purpose of this research is to make it easier for higher education institutions to choose the best study program head more accurately, it is hoped that this research will be a reference for readers and can help readers solve the problem of a Decision Support System with the same method in this research.

2. RESEARCH METHODOLOGY

2.1 Decision Support System

Decision Support System (DSS) is a computer-based information system designed to assist in decision making in various contexts and fields. This DSS is developed to support complex and unstructured decision making by collecting, processing, and analyzing relevant data. Decision support systems are specifically designed to assist management in making decisions related to semi-structured problems. This DSS is equipped with facilities to generate various alternatives that are used interactively by users [18][19].

2.2 Head of Study Program

As an academic official who has the main responsibility in organizing education, research, and community service at the study program level, the Head of Study Program leads, manages, and develops study programs to achieve the vision, mission, and academic goals set by the educational institution. The role of the Head of Study Program is very important in ensuring the smooth operation of study programs, meeting the established academic standards, and supporting the development of students and lecturers effectively [20][21].

2.3 *Multi-Objective Optimization on the basis of Simple Ratio Analysis* (MOOSRA)

Multi-Objective Optimization on the basis of Simple Ratio Analysis (MOOSRA) is a method decision making used to solve multi-objective optimization problems. MOOSRA is useful in complex decision situations where multiple conflicting criteria need to be considered. This method integrates simple ratio analysis principles to evaluate and rank alternatives based on their performance across multiple objectives. In carrying out a calculation using the Moosra method, there are four stages of calculation, namely as follows [22][23]:

1. Forming a decision matrix

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

2. Determining the normalization matrix

$$X^{*}ij = \frac{X_{ij}}{\sqrt{\sum_{i=j}^{m} Xij^{2}}} \quad (2)$$

3. Determining Preference Values
   If the weight interest is the same as the formula:

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$$Y_i = \frac{\sum_{j=1}^{g} X^*ij}{\sum_{j=g+1}^{n} X^*ij} \quad (3)$$

If the weight interests differ from the formula :

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

2.4 Research Stages

In this research, the author carried out the following stages:

1. In the problem identification stage
   The author conducted an in-depth analysis of the problems related to the selection of the best Head of Study Program. This study also considers the most appropriate method to solve the problem, according to the solution needed in the context of this study.
2. Literature Study
   stage involves searching for and analyzing relevant data and information related to the problems discussed, including from journals, books and e-books that are in line with the focus of this research.
3. Application of MOOSRA Method
   At this stage, the MOOSRA method is implemented to perform calculations using data samples relevant to this research.
4. Research Report
   At this stage, the results of the report are presented covering all stages that have been carried out by the author. This report includes solutions to the problems identified, the results of using the selected methods, and the conclusions obtained from all of this research.

The research stages above can be described in Figure 1 below:

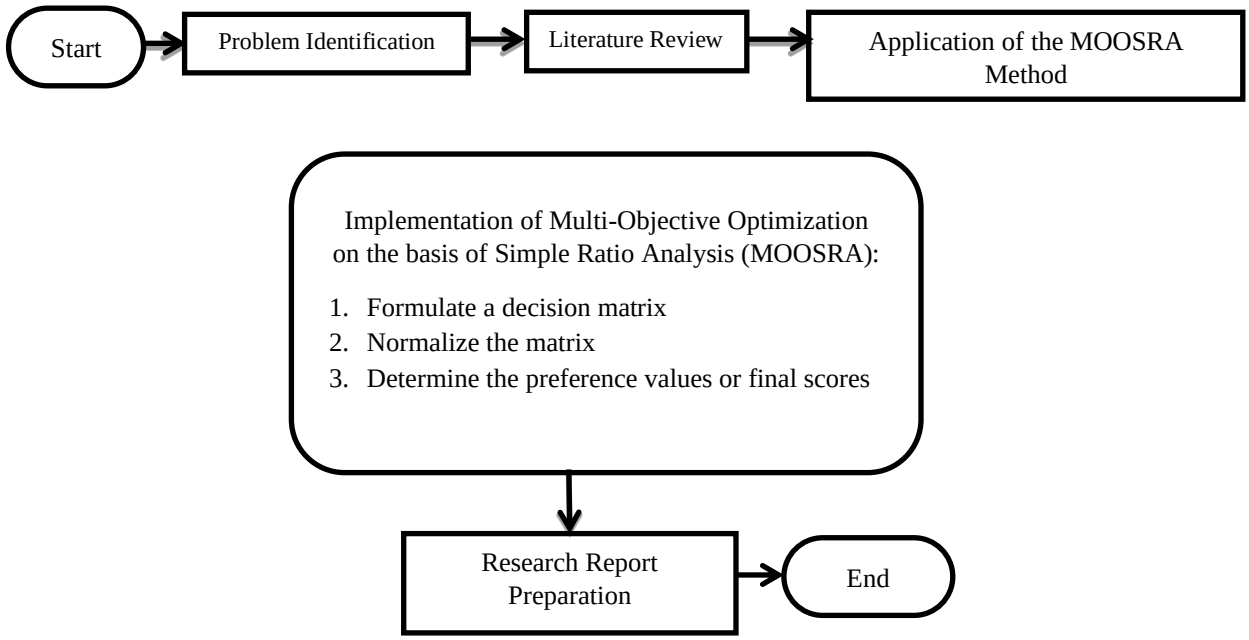

Figure 1. Research Stages

3. RESULTS AND DISCUSSION

The Head of Study Program is the highest position in the study program structure that is responsible for the managerial and academic aspects of the study program. The Head of Study Program needs to be actively involved in the development and progress of the study program to achieve goals in accordance with the vision and mission set by the university. The Head of Study Program is also expected to be able to communicate effectively with structural members of the study program and students under his management, to create a harmonious academic atmosphere. Therefore, high integrity is one of the important prerequisites in carrying out leadership in a study program.

Based on this, it is important to evaluate the performance of the Head of Study Program during one leadership period. This evaluation is carried out by the highest leadership elements in the university and must be carried out objectively and optimally. The goal is to ensure that the evaluation produces good results and can be accounted for to related parties, and is carried out without harming any party.

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Multi-Objective Optimization on the Basis of Simple Ratio Analysis (MOOSRA) is used to find solutions in selecting the Best of Head of Study Program by utilizing several alternative data samples that are considered to meet the established criteria. The process of describing and applying this data can be seen clearly as described below:

3.1 Alternative Determination

Alternatives are an important requirement in the process of selecting the best Head of Study Program, where each alternative must meet the established criteria. The following is alternative data for the Head of Study Program contained in Table 1 below:

Table 1. Alternative Data for Head of Study Program

Alternative	Lecturer Name
A_1	Imam Saputra, S.Kom, M.Kom
A_2	Guidio Leonardo Ginting, S.Kom, M.Kom
A_3	Taronisokhi Zebua, S.Kom, M.Kom
A_4	Fince Tinus Waruw, S..Kom, M.Kom
A_5	Kurnia Ulfa, SS, M.Hum
A_6	Efori Bu'ulolo, S.Kom, M.Kom
A_7	Putri Ramadhani, SS, M.Hum
A_8	Siti Nurhabibah Hutagalung, Msi

3.2 Determination of Criteria

In the process of selecting the best Head of Study Program, there are several criteria that have been met, as listed in Table 2 and Table 3 below:

Table 2. Criteria Data

Criteria	Information	Type	Weight
C_1	Leadership	Benefit	0.25
C_2	Protecting	Benefits	0.20
C_3	Communication	Benefits	0.20
C_4	Activity	Benefits	0.15
C_5	Study	Benefits	0.10
C_6	Devotion	Cost	0.10

Table 3. Alternative Data and Criteria Data

Alternative	(C_1)	(C_2)	(C_3)	(C_4)	(C_5)	(C_6)
A_1	Very good	Good	Very good	Very good	Good	Good
A_2	Good	Good	Good	Enough	Good	Very good
A_3	Good	Enough	Enough	Very good	Good	Good
A_4	Good	Good	Good	Enough	Good	Good
A_5	Enough	Good	Enough	Enough	Enough	Good
A_6	Good	Good	Good	Good	Very good	Enough
A_7	Enough	Good	Bad	Enough	Enough	Very good
A_8	Enough	Enough	Enough	Enough	Good	Bad

To complete a method, data that is not in the form of a numeric value needs to be converted into a numeric value. This is necessary so that the calculation process can be carried out correctly. The following are the parameters that have been formed in Table 4 below:

Table 4. Value Description Criteria

No	Information	Type
1	Very good	1
2	Good	0.8
3	Pretty good	0.6
4	Bad	0.4
5	Very bad	0.2

After adjusting the values, the following are the numerical values of each alternative in Table 5 as follows:

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Table 5. Alternative Values Against Criteria

Alternative	(C_1)	(C_2)	(C_3)	(C_4)	(C_5)	(C_6)
Imam Saputra, M.Kom	1	0.8	1	1	0.8	0.8
Guidio Leonardo Ginting, M.Kom	0.8	0.8	0.8	0.6	0.8	1
Taronisokhi Zebua, M.Kom	0.8	0.6	0.6	1	0.8	0.8
Professor Tinus Waruw, M.Kom	0.8	0.8	0.8	0.6	0.8	0.8
Kurnia Ulfa, SS, M.Hum	0.6	0.6	0.6	0.6	0.6	0.8
Efori Bu'ulolo, S.Kom, M.Kom	0.8	0.8	0.8	0.8	1	0.6
Putri Ramadhani, SS, M.Hum	0.6	0.8	0.4	0.6	0.6	1
Siti Nurhabibah Hutagalung, Msi	0.6	0.6	0.6	0.6	0.8	0.4

3.3 Application of the MOOSRA Method

The following are the steps for calculating data for suitability assessment using the *Multi-Objective Optimization on the basis of Simple Ratio Analysis* (MOOSRA) method:

1. Creating a normalization matrix

$$X_{ij} = \begin{bmatrix} 1 & 0{,}8 & 1 & 1 & 0{,}8 & 0{,}8 \\ 0{,}8 & 0{,}8 & 0{,}8 & 0{,}6 & 0{,}8 & 1 \\ 0{,}8 & 0{,}6 & 0{,}6 & 1 & 0{,}8 & 0{,}8 \\ 0{,}8 & 0{,}8 & 0{,}8 & 0{,}6 & 0{,}8 & 0{,}8 \\ 0{,}6 & 0{,}6 & 0{,}6 & 0{,}6 & 0{,}6 & 0{,}8 \\ 0{,}8 & 0{,}8 & 0{,}8 & 0{,}8 & 1 & 0{,}6 \\ 0{,}6 & 0{,}8 & 0{,}4 & 0{,}6 & 0{,}6 & 1 \\ 0{,}6 & 0{,}6 & 0{,}6 & 0{,}6 & 0{,}8 & 0{,}4 \end{bmatrix}$$

2. Matrix normalization
   Then form a normalized matrix using the equation
   For Criteria C1

$$C1 = \sqrt{1^2 + 0{,}8^2 + 0{,}8^2 + 0{,}8^2 + 0{,}6^2 + 0{,}8^2 + 0{,}6^2 + 0{,}6^2} = 2{,}154065$$

$$X_{11} = \frac{1}{2{,}154065} = 0{,}464238$$

$$X_{21} = \frac{0{,}8}{2{,}154065} = 0{,}371390$$

$$X_{31} = \frac{0{,}8}{2{,}154065} = 0.371390$$

$$X_{41} = \frac{0{,}8}{2{,}154065} = 0{,}371390$$

$$X_{51} = \frac{0{,}6}{2{,}154065} = 0{,}278543$$

$$X_{61} = \frac{0{,}8}{2{,}154065} = 0{,}371390$$

$$X_{71} = \frac{0{,}6}{2{,}154065} = 0{,}278543$$

$$X_{81} = \frac{0{,}6}{2{,}154065} = 0{,}278543$$

   For Criteria C2

$$C2 = \sqrt{0{,}8^2 + 0{,}8^2 + 0{,}6^2 + 0{,}8^2 + 0{,}6^2 + 0{,}8^2 + 0{,}8^2 + 0{,}6^2} = 2{,}068816$$

$$X_{12} = \frac{0{,}8}{2{,}068816} = 0{,}386694$$

$$X_{22} = \frac{0{,}8}{2{,}068816} = 0{,}386694$$

$$X_{32} = \frac{0{,}6}{2{,}068816} = 0.290020$$

$$X_{42} = \frac{0{,}8}{2{,}068816} = 0{,}386694$$

$$X_{52} = \frac{0{,}6}{2{,}068816} = 0{,}290020$$

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$X_{62} = \frac{0,8}{2,068816} = 0,386694$

$X_{72} = \frac{0,8}{2,068816} = 0,386694$

$X_{82} = \frac{0,6}{2,068816} = 0,290020$

For Criteria C3

$C3 = \sqrt{1^2 + 0,8^2 + 0,6^2 + 0,8^2 + 0,6^2 + 0,8^2 + 0,4^2 + 0,6^2} = 2,039607$

$X_{13} = \frac{1}{2,039607} = 0,490290$

$X_{23} = \frac{0,8}{2,039607} = 0,392232$

$X_{33} = \frac{0,6}{2,039607} = 0.294174$

$X_{43} = \frac{0,8}{2,039607} = 0,392232$

$X_{53} = \frac{0,6}{2,039607} = 0,294174$

$X_{63} = \frac{0,8}{2,039607} = 0,392232$

$X_{73} = \frac{0,4}{2,039607} = 0,196116$

$X_{83} = \frac{0,6}{2,039607} = 0,294174$

For Criteria C4

$C4 = \sqrt{1^2 + 0,6^2 + 1^2 + 0,6^2 + 0,6^2 + 0,8^2 + 0,6^2 + 0,6^2} = 2,107130$

$X_{14} = \frac{1}{2,107130} = 0,474579$

$X_{24} = \frac{0,6}{2,107130} = 0,287747$

$X_{34} = \frac{1}{2,107130} = 0.474579$

$X_{44} = \frac{0,6}{2,107130} = 0,287747$

$X_{54} = \frac{0,6}{2,107130} = 0,287747$

$X_{64} = \frac{0,8}{2,107130} = 0,379663$

$X_{74} = \frac{0,6}{2,107130} = 0,287747$

$X_{84} = \frac{0,6}{2,107130} = 0,287747$

For Criteria C5

$C5 = \sqrt{0,8^2 + 0,8^2 + 0,8^2 + 0,8^2 + 0,6^2 + 1^2 + 0,6^2 + 0,8^2} = 2,218107$

$X_{15} = \frac{0,8}{2,218107} = 0,360667$

$X_{25} = \frac{0,8}{2,218107} = 0,360667$

$X_{35} = \frac{0,8}{2,218107} = 0.360667$

$X_{45} = \frac{0,8}{2,218107} = 0,360667$

$X_{55} = \frac{0,6}{2,218107} = 0,270500$

$X_{65} = \frac{1}{2,218107} = 0,450834$

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$X_{75} = \frac{0,6}{2,218107} = 0,270500$

$X_{85} = \frac{0,8}{2,218107} = 0,360667$

For Criteria C6

$C6 = \sqrt{0,8^2 + 1^2 + 0,8^2 + 0,8^2 + 0,8^2 + 0,6^2 + 1^2 + 0,4^2} = 2,253885$

$X_{16} = \frac{0,8}{2,253885} = 0,354942$

$X_{26} = \frac{1}{2,253885} = 0,443678$

$X_{36} = \frac{0,8}{2,253885} = 0.354942$

$X_{46} = \frac{0,8}{2,253885} = 0,354942$

$X_{56} = \frac{0,8}{2,253885} = 0,354942$

$X_{66} = \frac{0,6}{2,253885} = 0,266207$

$X_{76} = \frac{1}{2,253885} = 0,443678$

$X_{86} = \frac{0,4}{2,253885} = 0,177471$

After performing normalization, the results obtained for the normalized matrix are as follows:

Table 6. Matrix Normalization Data

Alternative	(C 1)	(C 2)	(C 3)	(C 4)	(C 5)	(C 6)
Imam Saputra, M.Kom	0.464238	0.386694	0.490290	0.474579	0.360667	0.490290
Guidio Leonardo Ginting, M.Kom	0.371390	0.386694	0.392232	0.287747	0.360667	0.392232
Taronisokhi Zebua, M.Kom	0.371390	0.290020	0.294174	0.474579	0.360667	0.294174
Professor Tinus Waruwu, M.Kom	0.371390	0.386694	0.392232	0.287747	0.360667	0.392232
Kurnia Ulfa, SS, M.Hum	0.278543	0.290020	0.294174	0.287747	0.270500	0.294174
Efori Bu'ulolo, S.Kom, M.Kom	0.371390	0.386694	0.392232	0.379663	0.450834	0.392232
Putri Ramadhani, SS, M.Hum	0.278543	0.386694	0.196116	0.287747	0.270500	0.196116
Siti Nurhabibah Hutagalung, Msi	0.278543	0.290020	0.294174	0.287747	0.360667	0.294174

3. After normalizing the values, the next step is to determine the ranking by multiplying the weights of each alternative value. Then, the results are divided between benefits and costs, where the profit value that has been added after multiplying the weights is divided by the cost value after multiplying the weights.

$Y1 = \frac{(0,464238\ x\ 0,25)+(0,386694\ x\ 0,20)+(0,490290\ x\ 0.20)+(0,474579x0,15)+(0,360667x0,10)}{(0,490290+0,10)} = \frac{0,398709}{0,590290} = 0,675445$

$Y2 = \frac{(0,371390\ x\ 0,25)+(0,386694\ x\ 0,20)+(0,392232x0.20)+(0,287747x0,15)+(0,360667x0,10)}{(0,392232+0,10)} = \frac{0,327861}{0,492232} = 0,666070$

$Y3 = \frac{(0,371390\ x\ 0,25)+(0,290020\ x\ 0,20)+(0,294174x0.20)+(0,474579x0,15)+(0,360667x0,10)}{(0,294174+0,10)} = \frac{0,316939}{0,394174} = 0,804058$

$Y4 = \frac{(0,371390\ x\ 0,25)+(0,386694\ x\ 0,20)+(0,392232x0.20)+(0,287747x0,15)+(0,360667x0,10)}{(0,392232+0,10)} = \frac{0,327861}{0,492232} = 0,666070$

$Y5 = \frac{(0,278543\ x\ 0,25)+(0,290020\ x\ 0,20)+(0,294174x0.20)+(0,287747x0,15)+(0,270500x0,10)}{(0,294174+0,10)} = \frac{0,256664}{0,394174} = 0,651143$

$Y6 = \frac{(0,371390\ x\ 0,25)+(0,386694\ x\ 0,20)+(0,392232x0.20)+(0,379663x0,15)+(0,450834x0,10)}{(0,392232+0,10)} = \frac{0,327861}{0,492232} = 0,666070$

$Y7 = \frac{(0,278543\ x\ 0,25)+(0,386694\ x\ 0,20)+(0,196116x0.20)+(0,287747x0,15)+(0,360667x0,10)}{(0,196116+0,10)} = \frac{0,265426}{0,296116} = 0,896358$

$Y8 = \frac{(0,371390\ x\ 0,25)+(0,290020\ x\ 0,20)+(0,294174x0.20)+(0,474579x0,15)+(0,360667x0,10)}{(0,294174+0,10)} = \frac{0,316939}{0,394174} = 0,804058$

4. Y Value Ranking
The final step in the resolution process is to perform ranking to determine the best alternative using the MOOSRA method. The following is Table 7 which shows the ranking results:

Table 7. Ranking Results

Alternative	Lecturer Name	Results	Ranking
A_1	Imam Saputra, M.Kom	0.675445	3
A_2	Guidio Leonardo Ginting, M.Kom	0.666070	4
A_3	Taronisokhi Zebua, M.Kom	0.804058	2
A_4	Professor Tinus Waruw, M.Kom	0.666070	4
A_5	Kurnia Ulfa, SS, M.Hum	0.651143	5
A_6	Efori Bu'ulolo, S.Kom, M.Kom	0.666070	4
A_7	Putri Ramadhani, SS, M.Hum	0.896358	1
A_8	Siti Nurhabibah Hutagalung, Msi	0.804058	2

From the application of the MOOSRA method, the selection of the best study program head was obtained with the highest alternative, namely alternative A7 in the name of Putri Ramadhani, SS, M.Hum with a value of 0.896358.

4. CONCLUSION

Based on the results of the research and discussion that have been presented, it can be concluded that the assessment process in selecting the best Head of Study Program using the Decision Support System produces an objective, optimal, and accountable evaluation. The application of the MOOSRA method in the Decision Support System to evaluate the performance of the best Head of Study Program is able to provide an in-depth analysis of each Head of Study Program. The assessment results show that the Head of Study Program with the highest ranking is alternative A1, with a value of 0.896358.

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