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INTELLIGENT SYSTEM TO DETERMINE THE BEST LECTURER USING ADDITIVE RATIO ASSESSMENT ALGORITHM

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Abstract— *Lecturer performance assessment in the Informatics Study Program, Andalas University, faces the constraints of subjectivity in evaluating quantitative and qualitative data and the limitations of a systematic evaluation system, causing a lack of transparency and efficiency. This study aims to develop a decision support system using the Additive Ratio Assessment (ARAS) method to determine the best lecturers. The ARAS method includes five stages: defining the decision matrix, normalization, weighting, calculating the optimum function value, and ranking. The assessment is based on eight criteria, including last education, functional position, certification, number of publications, author order, publication index quality, research grants, and community service, each weighing 5%-20%. From the analysis of 11 alternative sequences, the five highest values obtained were A1 (0.113875), A4 (0.109785), A5 (0.104235), A8 (0.099005), and A3 (0.094715). The results show that the ARAS method can provide objective, efficient, and transparent decisions and be applied to web-based systems. This research offers an innovative contribution to decision-making with further development and research using comparative methods.*

Keywords: *andalas university, best lecturer, DSS, informatics, intelligent system.*

Intisari— *Penilaian kinerja dosen di Program Studi Informatika, Universitas Andalas, menghadapi kendala subjektivitas dalam evaluasi data kuantitatif dan kualitatif, serta keterbatasan sistem evaluasi yang sistematis, menyebabkan kurangnya transparansi dan efisiensi. Penelitian ini bertujuan untuk mengembangkan sistem pendukung keputusan menggunakan metode Additive Ratio Assessment (ARAS) untuk menentukan dosen terbaik. Metode ARAS mencakup lima tahap: penentuan matriks keputusan, normalisasi, pembobotan, penghitungan nilai fungsi optimum, dan pemeringkatan. Penilaian didasarkan pada 8 kriteria, termasuk pendidikan terakhir, jabatan fungsional, sertifikasi, jumlah publikasi, urutan penulis, kualitas indeks publikasi, hibah penelitian, dan pengabdian masyarakat, dengan bobot masing-masing antara 5%-20%. Dari analisis terhadap 11 alternatif urutan 5 nilai tertinggi diperoleh A1 (0.113875), A4 (0.109785), A5 (0.104235), A8 (0.099005), dan A3 (0.094715). Hasil menunjukkan metode ARAS mampu memberikan keputusan yang objektif, efisien, dan transparan, serta dapat diterapkan pada sistem berbasis web. Penelitian ini menawarkan kontribusi inovatif dalam pengambilan keputusan dengan pengembangan lebih lanjut dan penelitian selanjutnya dengan menggunakan perbandingan metode.*

Kata Kunci: *universitas andalas, dosen terbaik, spk, informatika, sistem cerdas.*

INTRODUCTION

Andalas University is one of the state universities located in the city of Padang, West Sumatra province. The university has fifteen faculties, and the main campus is in Limau Manis, Padang. There are also other campuses in Padang, Payakumbuh, and Dharmasraya. According to Indonesian Law No. 14 of 2005, Lecturers are professional educators and scientists with the main

task of transforming, developing, and disseminating science, technology, and art through education, research, and community service [1].

The interaction between lecturers and students indicates the program's success in the faculty or university. Lecturers are one of the main components in building the quality of students and university graduates. Good quality will provide good results as well. To improve the quality of each lecturer, there needs to be an award from the university to motivate lecturers to improve the quality given to students and society [2].

In this case, the problem that occurs is that no system evaluates the performance of lecturers in carrying out the trauma of higher education, so it affects the quality of carrying out the trauma of higher education. Therefore, it is necessary to evaluate performance to meet the goals, vision, and mission, especially in the Informatics study program. Performance appraisal involves measuring the success of an organization's operations based on predetermined strategic goals, standards, and criteria [3].

The application of this lecturer performance appraisal system is expected to help universities assess and evaluate the performance of lecturers by determining each criterion [4]. Lecturer performance appraisal is intended so that higher education institutions are able to maintain the quality of teaching staff or lecturers. This is done by higher education institutions to evaluate the performance of human resources, especially lecturers, and to measure the value of how far the lecturers contribute to the institution with the aim of increasing the productivity of lecturer performance.

The importance of performance appraisal concerns the contribution to the individual tasks of each lecturer and how responsible they are for their duties [5]. The education system's success depends on lecturers' competence, dedication, and quality, so it is necessary to implement an appropriate decision system in assessing lecturer performance [6].

In determining the best lecturer, it is necessary to have a criterion or limitation that can be a reference in selecting and ranking the best alternative in decision-making. The criteria are taken from the lecturer performance load (BKD), which will be expanded with several supporting sub-criteria. There are 4 main criteria, namely education and teaching activities, research activities, service activities, and supporting activities [7]. The assessment results are used as a basis for improvement and self-development of the assessed lecturer [8].

A decision support system is a computer-based information system that produces several alternative decisions to help solve problems using data and models. In this research, the method used is Additive Ratio Assessment (ARAS). This method is based on the principle of multi-criteria evaluation, which allows decision-makers to assess several alternatives based on a number of predetermined criteria [9]. ARAS is a multicriteria decision-making method based on ranking based on the level of utility by comparing the total index value of each alternative with the total index value of the optimal alternative [10].

The advantage of this method is that ARAS' strength lies in its ability to overcome the complexity of handling various quantitative and qualitative attributes. The method also considers the preferences and relative priorities of decision-makers, allowing flexibility in adjusting attribute weights according to their respective importance. By minimizing the need for pairwise comparisons, ARAS provides an efficient and effective solution for multi-attribute assessments, especially in uncertainty or limited information [11].

Several previous studies that serve as references for this research include the study conducted [12] about Satisfaction Analysis of Supplier Services Using the New Additive Ratio Assessment (ARAS) Method. The final result of the study was satisfaction with supplier services. Other research has also been conducted by [13] about the Selection of Tourism Objects in Berau Regency Using and obtained the study's final results that the ARAS method can provide alternative recommendations for the best tourist objects.

In previous research [14] on determining potential areas of clean water distribution shortages, the results obtained region 9 in the first rank because there are many customers, long distances from water sources, and frequent complaints of non-flowing water.

Other studies have also used the ARAS method [15]. It was found that collecting and analyzing alternative data according to the predetermined criteria weights resulted in the accuracy of the ARAS method reaching 99.95%, which is very close to the manual results. Research has also been conducted on [16]. It is concluded that the decision support system is an adaptive, interactive, flexible computer-based information system specifically developed to support the solution of unstructured management problems and improve the quality of decision-making. The research objective is to create a technology-based approach by applying the Additive Ratio Assessment method based on a Decision Support

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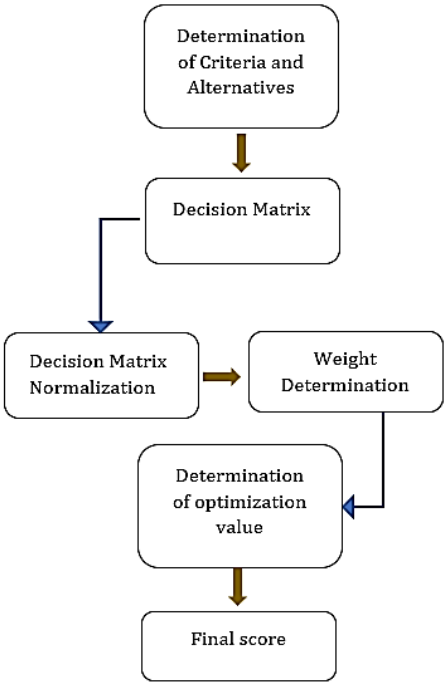
System. The ARAS method was chosen because it is able to determine effective final results based on multiple criteria. The application of the ARAS method consists of 5 stages: determining the decision matrix, normalizing the decision matrix, weighting the normalization results, determining the optimum function value, and ranking results.

MATERIALS AND METHODS

The research framework used in the study can be seen in Figure 1 below.



Source: (Research Results, 2024)

Figure 1. Research Flow Diagram

Figure 1 can be explained as follows:

1. Determining the criteria and alternatives is the initial step in the ARAS method. The initial step is to identify the criteria (Ci) that will be used as the basis for evaluation, and the alternative data (Ai) used is all lecturer data.
2. The decision matrix is a performance value in the form of a number for each alternative against each predetermined criterion.
3. Decision Matrix Normalization is equalizing the value scale of each criterion.
4. Weight Determination is the assignment of weight (Wj) to each criterion according to its level of importance.
5. Determining the optimization value is the utility value (Si) calculated for each alternative by adding the results of the normalization value multiplied by the criteria weight.
6. The final score is all alternatives ranked based on the Si value, with the highest score ranked first.

This flow diagram shows the step-by-step process of the ARAS method, starting from data collection to final evaluation and determination of the best alternative. This step ensures that the evaluation is conducted objectively and structured.

Determination of Criteria and Alternatives

Determining criteria and alternatives is a strategic first step in determining outstanding lecturers. This process involves identifying relevant evaluation criteria, such as Last Education, Functional Position, Lecturer Certification, Number of Publications, Order of Authors in Research, Publication Outputs, Research Grants, and Community Service. Each criterion is given an appropriate weight or level of importance to reflect its relative value. The criteria used in determining the Best Lecturer as shown in Table 1.

Table 1. Criteria

No	Criteria (C_i)
1	Last Education
2	Functional Position
3	Lecturer Certification
4	Number of Publication
5	Author in Research
6	Publication Index
7	Research Grant
8	Community Service

Source: (Research Results, 2024)

Table 2. Alternatives Data (A_i)

No	Data	Faculty	Study Program
1	Wyd	Information Technology	Informatics
2	Rep	Information Technology	Informatics
3	Der	Information Technology	Informatics
4	Bdy	Information Technology	Informatics
5	Mza	Information Technology	Informatics
6	Nrf	Information Technology	Informatics
7	Ltf	Information Technology	Informatics
8	Ang	Information Technology	Informatics
9	Afd	Information Technology	Informatics
10	Arf	Information Technology	Informatics
11	Ajd	Information Technology	Informatics

Source: (Research Results, 2024)

In Table 2, it can be explained that alternative data consisting of 11 candidates will be evaluated to determine the best lecturer in the Informatics Study Program at Andalas University. Each alternative is coded A_i, which represents each lecturer.

Decision Matrix

The following are the steps in calculating using ARAS [17]:

$$X=\begin{bmatrix} X_{01} & \cdots & X_{0j} & \cdots & X_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{i1} & \cdots & X_{ij} & \cdots & X_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{n1} & \cdots & X_{mj} & \cdots & X_{mn} \end{bmatrix}$$

$i=\overline{0,m};\ j=\overline{1,n};$ (1)

Description:
The decision matrix consists of *m* alternatives and *n* criteria (columns)[18].
m = number of alternatives
n = number of criteria
X_{ij} = criterion value of the alternative i
X_{oj} = the optimal value of the criterion j

If the optimum value of the criterion j (X_{oj}) is unknown, then:

$X_{oj} = \frac{\text{Max}}{1} X_{ij}$ if (Benefit) (2)

$X_{oj} = \frac{\text{Min}}{1} X_{ij}$ if (Cost) (3)

Benefit is the maximum value of being the best, while cost is the minimum value of being the best.

Normalization

$$X=\begin{bmatrix} X_{01} & \cdots & X_{0j} & \cdots & X_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{i1} & \cdots & X_{ij} & \cdots & X_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{n1} & \cdots & X_{mj} & \cdots & X_{mn} \end{bmatrix}$$

$i=\overline{o,m};\ j=\overline{1,n};$ (4)

If the proposed criteria is the maximum value, then the normalization is:

$$X_{ij} = \frac{X_{ij}}{\sum_{i=1}^{m} X_{ij}} \quad (5)$$

If the proposed criteria have a minimum value, then the normalization process has 2 stages as follows:

$$X_{ij} = \frac{1}{X*ij} \ ; \ X_{ij} = \frac{X_{ij}}{\sum_{i=1}^{m} X_{ij}} \quad (6)$$

Description:
X_{ij} = Normalization Value [19].

Weight Determination

$$D_{ij} = X_{ij} \text{ x } W_{ij} \quad (7)$$

Description:
D_{ij} denotes the normalized value weighted to i on criterion j, X_{ij} refers to the normalized value to i on criterion j, and W_{ij} is the weight to i on criterion j [20].

Optimization Value

$$S_i = \sum_{j=1}^{n} X_{ij} \ ; \quad i = o, m \quad (8)$$

Description:
S_i is the overall index value of the i alternative. The best is represented by the highest value and the poorest by the lowest. The final outcome is influenced by the proportionate relationship between the method and the weight and value of the criteria under study [21].

Final Score

The alternative with the highest K_i value is considered the most optimal. This value indicates the best preference according to the weight of the given criteria. This process produces a sequence of alternatives from the most suitable to the lowest so that more objective and precise decisions can be made [22].

$$K_i = \frac{S_i}{S_0} ; i = \overline{o,m} \quad (9)$$

RESULTS AND DISCUSSION

Determining the criteria and weights

In determining the ranking of each of the available alternative data, the process of assigning a weight value is first carried out. The weight value of each criterion can be determined in Table 3 below.

Table 3. Criteria and Weights

No	Criteria (C_i)	Score (%)
1	Last Education	10%
2	Functional Position	15%
3	Lecturer Certification	20%
4	Number of Article Publication	15%
5	Role in Research	15%
6	Publication Index	10%
7	Research Grant	10%
8	Community Service	5%

Source: (Research Results, 2024)

In Table 3, it is explained that the initials (Ci) of the criteria are given along with a description of each criterion. Then, the weight and variable values for each criterion are given. The last education criteria (C1) is shown in Table 4 below.

Table 4. C1 - Last Education

Variable	Criteria (C_i)	Score (%)
S3	Very Good	5
S2	Good	4

Source: (Research Results, 2024)

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In Table 4, the final education criteria have 2 variables: Doctoral education (S3) with a weighting value of 5 and Master (S2) with a weighting value of 4.

Table 5. C2 - Functional Position

Variable	Criteria (C_i)	Score (%)
Profesor	The Best	5
Lektor Kepala	Excellent	4
Lektor	Good	3
Asisten Ahli	Pretty good	2
Non Functional	Not Good Enough	1

Source: (Research Results, 2024)

In Table 5, the Functional Position criteria have 5 variables: Professor with a value of 5, Senior Lecturer with a value of 4, Lecturer with a value of 3, Assistant Expert with a value of 2, and non-functional with a value of 1.

Table 6. C3 – Lecturer Certification

Variable	Criteria (C_i)	Score (%)
Certification	Very Good	5
Not yet	Good	2

Source : (Research Results, 2024)

In Table 6, the Lecturer Certification criteria have 2 variables, namely Certified with a weight value of 5 and not yet certified with a weight value of 2.

Table 7. C4 – Number of Article Publications

Variable	Criteria (C_i)	Score (%)
4 Titles/Year	Very Good	5
3 Title/ Year	Good	4
2 Title/Year	Enough	3
1 Title/Year	Not Good	2

Source: (Research Results, 2024)

In Table 7, the Number of Article Publications criteria has 4 variables, namely having 4 publication titles/year with a weight value of 5, having 3 publication titles/year with a weight value of 4, having 2 publication titles/year with a weight value of 3 and only 1 publication title/year with a weight value of 2.

Table 8. C5 – Role in Research

Variable	Criteria (C_i)	Score Weights (%)
1st Author	Very Good	5
2nd Author	Good	4
3-5	Enough	3

Source: (Research Results, 2024)

In Table 8, the Role in Research criteria has 3 variables: the first author with a weight value of 5, the second with a weight value of 4, and the third with a weight value of 3.

Table 9. C6 – Publication Index

Variable	Criteria (C_i)	Score (%)
International Journal (Scopus)	Very Good	5
Accredited Nasional (SINTA)	Good	4
National Journal	Enough	3

Source: (Research Results, 2024)

In Table 9, the Publication Index criteria have 3 variables, namely reputable research publications in International Journals that have been indexed by Scopus with a weight value of 5, have been indexed in national journals accredited by SINTA with a weight value of 4, and research publications are only indexed in unaccredited national journals with a weight value of 3.

Table 10. C7 – Research Grant

Variable	Criteria (C_i)	Score Weights (%)
Kemdikbud	Very Good	5
University	Good	4
Faculty	Enough	3

Source: (Research Results, 2024)

In Table 10, the Research Grant criteria have 3 variables: research grants provided by the Ministry of Education and Culture with a weighting value of 5, research grants provided by universities with a weighting value of 4, and research grants provided by faculties with a value of 3.

Table 11. C8 – Community Service

Variable	Criteria (C_i)	Score Weights (%)
National	Very Good	4
Local/Regional	Good	3

Source: (Research Results, 2024)

In Table 11, the Community Service criteria have 2 variables, namely community service carried out at the national level with a weighting value of 4 and at the local level with a weighting value of 3.

Furthermore, the steps taken in implementing the Additive Ratio Assessment algorithm to determine the best lecturer can be seen as follows.

Additive Ratio Assessment

Step 1 – Decision Matrix.

Table 12. Decision Matrix

(A_i)	C1	C2	C3	C4	C5	C6	C7	C8
A_0	5	3	5	5	5	5	5	5
A_1	5	3	5	5	5	5	5	5
A_2	4	3	5	3	3	4	3	5
A_3	4	3	5	3	4	4	4	4
A_4	4	3	5	5	5	4	5	5
A_5	4	3	5	5	4	4	4	5
A_6	4	1	2	1	3	4	3	4
A_7	4	1	2	1	3	4	3	4
A_8	4	3	5	4	4	4	4	4
A_9	4	1	2	1	3	4	3	4

(Ai)	C1	C2	C3	C4	C5	C6	C7	C8
A10	4	1	2	1	3	3	3	4
A11	4	1	2	1	3	3	3	4

Source: (Research Results, 2024)

In Table 12, it can be explained that there is Alternative data A0-A11, which is the data that will be evaluated. The number in A0 is the highest value of each criterion used because it refers to the benefit. Columns C1-C8 are the criteria that have been determined in this study. Values 1-5 indicate an assessment of each criterion that number 5 is a higher value and has better performance.

Step 2 - Normalize the decision matrix for all criteria.

$$X = \begin{bmatrix} 5 & 3 & 5 & 5 & 5 & 5 & 5 & 5 \\ 5 & 3 & 5 & 5 & 5 & 5 & 5 & 5 \\ 4 & 3 & 5 & 3 & 3 & 4 & 3 & 5 \\ 4 & 3 & 5 & 3 & 4 & 4 & 4 & 4 \\ 4 & 3 & 5 & 5 & 5 & 4 & 5 & 5 \\ 4 & 3 & 5 & 5 & 4 & 4 & 4 & 5 \\ 4 & 1 & 2 & 1 & 3 & 4 & 3 & 4 \\ 4 & 1 & 2 & 1 & 3 & 4 & 3 & 4 \\ 4 & 3 & 5 & 4 & 4 & 4 & 4 & 4 \\ 4 & 1 & 2 & 1 & 3 & 4 & 3 & 4 \\ 4 & 1 & 2 & 1 & 3 & 3 & 3 & 4 \\ 4 & 1 & 2 & 1 & 3 & 3 & 3 & 4 \end{bmatrix}$$

The above matrix is summed up for each criterion from top to bottom to get the results **(50, 26, 45, 35, 45, 48, 45, 53)**. Then normalize the matrix for all criteria (Ci). Furthermore, the results of the calculation of the decision matrix of the criteria obtained normalized (X_{ij})values as follows:

$$Xij = \begin{bmatrix} 0,1 & 0,1154 & 0,1111 & 0,1429 & 0,1111 & 0,1042 & 0,1111 & 0,0943 \\ 0,1 & 0,1154 & 0,1111 & 0,1429 & 0,1111 & 0,1042 & 0,1111 & 0,0943 \\ 0,08 & 0,1154 & 0,1111 & 0,0857 & 0,0667 & 0,0833 & 0,0667 & 0,0943 \\ 0,08 & 0,1154 & 0,1111 & 0,0857 & 0,0889 & 0,0833 & 0,0889 & 0,0755 \\ 0,08 & 0,1154 & 0,1111 & 0,1429 & 0,1111 & 0,0833 & 0,1111 & 0,0943 \\ 0,08 & 0,1154 & 0,1111 & 0,1429 & 0,0889 & 0,0833 & 0,0889 & 0,0943 \\ 0,08 & 0,0385 & 0,0444 & 0,0286 & 0,0667 & 0,0833 & 0,0667 & 0,0755 \\ 0,08 & 0,0385 & 0,0444 & 0,0286 & 0,0667 & 0,0833 & 0,0667 & 0,0755 \\ 0,08 & 0,1154 & 0,1111 & 0,1143 & 0,0889 & 0,0833 & 0,0889 & 0,0755 \\ 0,08 & 0,0385 & 0,0444 & 0,0286 & 0,0667 & 0,0833 & 0,0667 & 0,0755 \\ 0,08 & 0,0385 & 0,0444 & 0,0286 & 0,0667 & 0,0625 & 0,0667 & 0,0755 \\ 0,08 & 0,0385 & 0,0444 & 0,0286 & 0,0667 & 0,0625 & 0,0667 & 0,0755 \end{bmatrix}$$

Step 3 - Determine the normalized weights by multiplying the normalized matrix in step 2. The weights used for multiplication in step 3 are (0.1), (0.15), (0.2), (0.15), (0.15), (0.1), (0.10), (0.05). The results of all criteria that can be obtained to form a matrix are as follows:

$$Dij = \begin{bmatrix} 0,01 & 0,0173 & 0,0222 & 0,0214 & 0,0166 & 0,0104 & 0,0111 & 0,0047 \\ 0,01 & 0,0173 & 0,0222 & 0,0214 & 0,0166 & 0,0104 & 0,0111 & 0,0047 \\ 0,008 & 0,0173 & 0,0222 & 0,0128 & 0,0100 & 0,0083 & 0,0088 & 0,0047 \\ 0,008 & 0,0173 & 0,0222 & 0,0128 & 0,0133 & 0,0083 & 0,0088 & 0,0037 \\ 0,008 & 0,0173 & 0,0222 & 0,0214 & 0,0166 & 0,0083 & 0,0111 & 0,0047 \\ 0,008 & 0,0173 & 0,0222 & 0,0214 & 0,0133 & 0,0083 & 0,0088 & 0,0047 \\ 0,008 & 0,0057 & 0,0088 & 0,0042 & 0,0100 & 0,0083 & 0,0066 & 0,0037 \\ 0,008 & 0,0057 & 0,0088 & 0,0042 & 0,0100 & 0,0083 & 0,0066 & 0,0037 \\ 0,008 & 0,0173 & 0,0222 & 0,0171 & 0,0133 & 0,0083 & 0,0088 & 0,0037 \\ 0,008 & 0,0057 & 0,0088 & 0,0042 & 0,0100 & 0,0083 & 0,0066 & 0,0037 \\ 0,008 & 0,0057 & 0,0088 & 0,0042 & 0,0100 & 0,0062 & 0,0066 & 0,0037 \\ 0,008 & 0,0057 & 0,0088 & 0,0042 & 0,0100 & 0,0062 & 0,0066 & 0,0037 \end{bmatrix}$$

Step 4 - Determine the optimum function value by summing the criteria values for each alternative from the matrix multiplication results with weights. The results of the calculation to determine the optimum function value (S_i) are as follows:

$$S_i = \begin{bmatrix} 0,113875 \\ 0,113875 \\ 0,090105 \\ 0,094715 \\ 0,109785 \\ 0,104235 \\ 0,055725 \\ 0,055725 \\ 0,099005 \\ 0,055725 \\ 0,053645 \\ 0,053645 \end{bmatrix}$$

Step 5 - Determine the highest ranking level of each alternative. Table 13 shows the ranking results of each data.

Table 13. Rangking Level

Data (Ai)	Score (Ki)	Rangking Level
A0	0,113875	-
A1	0,113875	1
A2	0,090105	6
A3	0,094715	5
A4	0,109785	2
A5	0,104235	3
A6	0,055725	7
A7	0,055725	8
A8	0,099005	4
A9	0,055725	9
A10	0,053645	10
A11	0,053645	11

Source: (Research Results, 2024)

Table 14. Final Score

Data (Ai)	Score (Ki)	Ranking	Name	Results
A1	0,113875	1	Wyd	Best
A4	0,109785	2	Bdy	Best
A5	0,104235	3	Mza	Best
A8	0,099005	4	Ang	Best
A3	0,094715	5	Der	Best
A2	0,090105	6	Rep	-
A6	0,055725	7	Nrf	-
A7	0,055725	8	Ltf	-
A9	0,055725	9	Afd	-
A10	0,053645	10	Arf	-
A11	0,053645	11	Ajd	-

Source: (Research Results, 2024)

In Table 14, it can be seen that the final results of the calculation using the ARAS method obtained 5 data in order 1-5 have the highest value, namely 0.113875, 0.109785, 0.104235, 0.099005, 0.094715 with the best results. Furthermore, the ARAS algorithm will be implemented on a web-based system to prove the suitability between manual calculations and the developed system.

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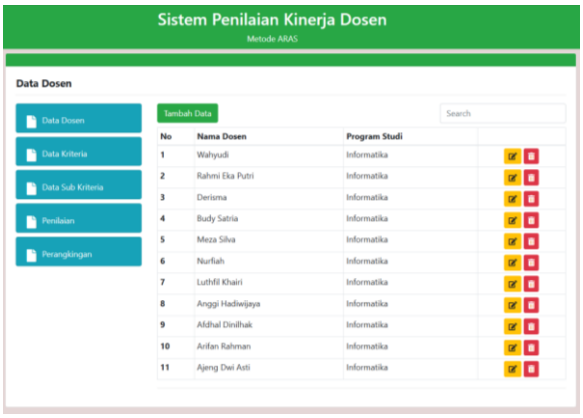
Implementation of the application

The results of the implementation into a system can be seen in Figures 2, 3, 4, 5, 6, 7, 8 and 9 below:



Source: (Research Results, 2024)

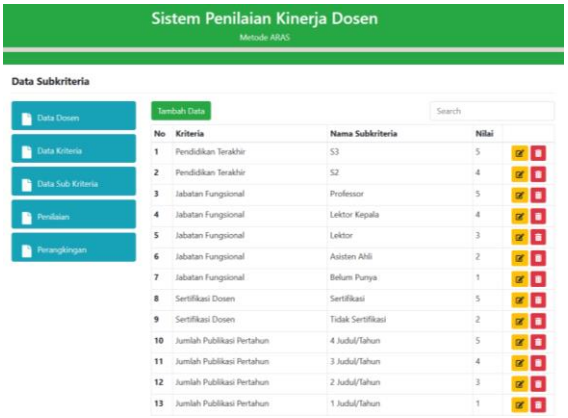
Figure 2. Lecturer Data

In Figure 2, it can be explained that there is a Lecturer Data menu containing alternative data information totaling 11 lecturers in the Informatics Study Program. The data menu feature in this system functions to add lecturer names and study programs as needed in processing alternative data. In addition, there are 2 menus, namely the menu to delete lecturer data and the menu to change lecturer data.

Source: (Research Results, 2024)

Figure 3. Criteria data and weight values

In Figure 3, it can be explained that there is a Criteria Data menu containing information on eight predetermined criteria such as Last education with a weight of 10%, functional position at 15%, lecturer certification at 15%, number of publications per year 15%, author order in research 15%, research publication index 10%, research grants 10% and community service 5%. This system's Criteria Data menu feature adds criteria and weights according to research needs. In addition, there are 2 menus: the menu to delete criteria data and the menu to change criteria data.



Source: (Research Results, 2024)

Figure 4. Sub-criteria Data

In Figure 4, it can be explained that there is a Sub Data Criteria menu containing 24 components such as the last education S3 weighted value 5 and S2 weighted value 4. Functional positions such as professor weighted value 5, senior lecturer 4, lecturer 3, expert assistant 2 and not having a functional position yet the value is 1. Lecturer certification if certified the value is 5 and not certified the value is 2. The number of publications per year if there are 4 titles/year the value is 5, 3 titles/year the value is 4, 2 titles/year the value is 3 and 1 title/year the value is 1. In the order of authors in the research, if author 1, the value is 5, and if author 2, the value is 4, and if author 3 or more, the value is 3. The research publication index in the International Journal Scopus the value is 5; if indexed by an accredited national journal, the value is 4, and in a national journal, the value is 3. If funded by the Ministry of Education and Culture, research grants will be given a value of 5, a university-level value of 4, and a faculty-level value of 3. Finally, the sub-criteria on community service, if the national level is given a value of 5, and if the local level is given a value of 4. This system's Sub-criteria Data menu feature functions to add components and weights according to research needs. In addition, there are 2 menus: the menu to delete criteria data and the menu to change criteria data.

In Figure 5, it can be explained that there is a display of assessment results for each alternative data. The values that appear in Figure 5 have been adjusted to Table 12, namely the Decision Matrix.

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Source: (Research Results, 2024)

Figure 5. Matrix Values in Alternative Data

Normalisasi Matriks

Alternatif	C1	C2	C3	C4	C5	C6	C7	C8
A0	0.1	0.1154	0.1111	0.1429	0.1111	0.1042	0.1111	0.0943
A1	0.1	0.1154	0.1111	0.1429	0.1111	0.1042	0.1111	0.0943
A2	0.08	0.1154	0.1111	0.0857	0.0667	0.0833	0.0667	0.0943
A3	0.08	0.1154	0.1111	0.0857	0.0889	0.0833	0.0889	0.0755
A4	0.08	0.1154	0.1111	0.1429	0.1111	0.0833	0.1111	0.0943
A5	0.08	0.1154	0.1111	0.1429	0.0889	0.0833	0.0889	0.0943
A6	0.08	0.0385	0.0444	0.0286	0.0667	0.0833	0.0667	0.0755
A7	0.08	0.0385	0.0444	0.0286	0.0667	0.0833	0.0667	0.0755
A8	0.08	0.1154	0.1111	0.1143	0.0889	0.0833	0.0889	0.0755
A9	0.08	0.0385	0.0444	0.0286	0.0667	0.0833	0.0667	0.0755
A10	0.08	0.0385	0.0444	0.0286	0.0667	0.0625	0.0667	0.0755
A11	0.08	0.0385	0.0444	0.0286	0.0667	0.0625	0.0667	0.0755

Source: (Research Results, 2024)

Figure 6. Matrix Normalization View

In Figure 6, it can be explained that there is a display of the results of matrix normalization on each alternative data with 8 criteria. The values that appear in Figure 6 have been adjusted based on the results of matrix normalization in the second stage of the ARAS Algorithm calculation.

Bobot Matriks

Alternatif	C1	C2	C3	C4	C5	C6	C7	C8
A0	0.01	0.01731	0.02222	0.021435	0.016665	0.01042	0.01111	0.004715
A1	0.01	0.01731	0.02222	0.021435	0.016665	0.01042	0.01111	0.004715
A2	0.008	0.01731	0.02222	0.012855	0.010005	0.00833	0.00667	0.004715
A3	0.008	0.01731	0.02222	0.012855	0.013335	0.00833	0.00889	0.003775
A4	0.008	0.01731	0.02222	0.021435	0.016665	0.00833	0.01111	0.004715
A5	0.008	0.01731	0.02222	0.021435	0.013335	0.00833	0.00889	0.004715
A6	0.008	0.005775	0.00888	0.00429	0.010005	0.00833	0.00667	0.003775
A7	0.008	0.005775	0.00888	0.00429	0.010005	0.00833	0.00667	0.003775
A8	0.008	0.01731	0.02222	0.017145	0.013335	0.00833	0.00889	0.003775
A9	0.008	0.005775	0.00888	0.00429	0.010005	0.00833	0.00667	0.003775
A10	0.008	0.005775	0.00888	0.00429	0.010005	0.00625	0.00667	0.003775
A11	0.008	0.005775	0.00888	0.00429	0.010005	0.00625	0.00667	0.003775

Source: (Research Results, 2024)

Figure 7. Weighting Display On Matrix Values

In Figure 7, it can be explained that there is a display of the weighting results on the matrix values. The values that appear in Figure 7 have been adjusted based on the weighting results in the third stage of the ARAS Algorithm calculation.

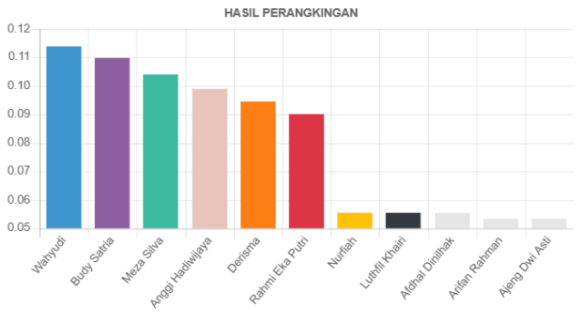
Nilai Fungsi Optimalisasi

Alternatif	C1	C2	C3	C4	C5	C6	C7	C8	S
A0	0.01	0.01731	0.02222	0.021435	0.016665	0.01042	0.01111	0.004715	0.113875
A1	0.01	0.01731	0.02222	0.021435	0.016665	0.01042	0.01111	0.004715	0.113875
A2	0.008	0.01731	0.02222	0.012855	0.010005	0.00833	0.00667	0.004715	0.090105
A3	0.008	0.01731	0.02222	0.012855	0.013335	0.00833	0.00889	0.003775	0.094715
A4	0.008	0.01731	0.02222	0.021435	0.016665	0.00833	0.01111	0.004715	0.109785
A5	0.008	0.01731	0.02222	0.021435	0.013335	0.00833	0.00889	0.004715	0.104235
A6	0.008	0.005775	0.00888	0.00429	0.010005	0.00833	0.00667	0.003775	0.055725
A7	0.008	0.005775	0.00888	0.00429	0.010005	0.00833	0.00667	0.003775	0.055725
A8	0.008	0.01731	0.02222	0.017145	0.013335	0.00833	0.00889	0.003775	0.099005
A9	0.008	0.005775	0.00888	0.00429	0.010005	0.00833	0.00667	0.003775	0.055725
A10	0.008	0.005775	0.00888	0.00429	0.010005	0.00625	0.00667	0.003775	0.053645
A11	0.008	0.005775	0.00888	0.00429	0.010005	0.00625	0.00667	0.003775	0.053645

Source: (Research Results, 2024)

Figure 8. Display Optimization Function Values

Figure 8 shows a display of the optimization function values in column S. The resulting values have been adjusted based on the results obtained in the fourth stage of the ARAS Algorithm calculation.



Source: (Research Results, 2024)

Figure 9. Ranking by graph

In Figure 9, it can be explained that there is a graphic image of the final assessment results that have been obtained. The ranking results show that there are 5 lecturers who get the highest scores based on Table 14. Score Assessment.

Black Box Testing

Testing based on user interaction with the application's interface and menus is known as "black box" testing. This type of testing is conducted with an end-user experience in mind [23]. Black box testing results can be seen in Tables 15 and 16 below.

Table 15. Form Login Testing

No	Test Scenario	Expected results	Testing Results	Conclusion
1	The user and Password are filled in correctly	To the main page	Success	Valid
2	The user entered the correct	To the main page	Failed to enter the	Invalid

Accredited Rank 2 (Sinta 2) based on the Decree of the Dirjen Penguatan RisBang Kemenristekdikti No.225/E/KPT/2022, December 07, 2022. Published by LPPM Universitas Nusa Mandiri

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	characters, but the password was incorrect		main page	
3	The user entered the username with the wrong code, but the password was correct	To the main page	Failed to enter the main page	Invalid
4	The user entered the username with the wrong code, and the password is incorrect.	To the main page	Failed to enter the main page	Invalid

Source: (Research Results, 2024

Table 16. Main Page Testing

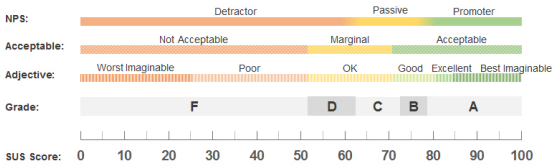
No	Test Scenario	Expected results	Testing Result	Conclusion
1	Add data	Display Lecturer Data	Success	Valid
2	Add data	Display Criteria and Weight Data	Success	Valid
3	Add data	Display Sub Criteria Data	Success	Valid
4	Assessment	Displays all lecturer data, selected criteria, and scores	Success	Valid
5	Rankings	Display assessment and ranking results	Success	Valid
6	Print PDF report	PDF document downloaded successfully	Success	Valid

Source: (Research Results, 2024

Based on the test results using BlackBox testing in Table 15 and Table 16, it is concluded that each form in the application has been tested with a predetermined scenario and then gets the expected and valid results.

System Usability Scale (SUS) Testing

System Usability Scale is a method to measure the usability and usefulness of an application [24]. The System Usability Scale assessment uses 3 components, namely Acceptable, Grade Scale, and Adjective [25], which can be seen in Figure 6 below.



Source: (Research Results, 2024)

Figure 6. System Usability Scale

Respondents are asked 10 questions per statement tool on a 1-5 response scale when testing with the System Usability Scale method. The assessment scale used was Likert, where the values were 1 (strongly disagree), 2 (disagree), 3 (unclear), 4 (agree), and 5 (strongly agree).

Table 17. SUS Instrument

No	Questions
1	I think I will use this system again
2	I don't find this system easy to use
3	I find the system easy to use
4	I feel that I need help from other people or technicians using this system
5	I feel that the features of this system are working properly
6	I feel that there are many inconsistencies in this system
7	I feel that others will understand how to use this system quickly
8	I find this system confusing
9	I feel there are no obstacles to using this system
10	I need to familiarize myself first before using this system

Source: (Research Results, 2024)

Based on Table 17, the calculation rules of the SUS method can be seen as follows: Odd questions consisting of 1, 3, 5, 7, 9 will be reduced by 1 from the value given by the respondent. Even questions consisting of 2, 4, 6, 8, 10 will reduce the value of 5 from the value given by the respondent. After all the values have been answered, they will be multiplied by 2.5 to get a value of 0-100. The results of the respondents' answers can be seen in Table 18.

Table 18. Respondent Assessment Results

R	1	2	3	4	5	6	7	8	9	10
1	3	3	4	3	4	3	4	3	4	1
2	4	4	4	4	4	4	4	4	4	1
3	3	3	3	3	3	3	3	3	3	1
4	1	3	3	4	2	2	3	3	3	3
5	3	1	3	3	4	3	4	3	1	1
6	4	3	4	4	3	3	3	3	3	1

R	1	2	3	4	5	6	7	8	9	10
7	4	4	4	4	4	4	4	4	4	4
8	3	3	4	4	4	3	4	3	3	1
9	3	3	3	4	3	3	3	3	3	1
10	1	3	3	4	3	1	3	3	1	1

Source: (Research Results, 2024)

Table 19. Score Calculation

R	Total	Results	Average
1	32 x 2,5	80	
2	37 x 2,5	92,5	
3	28 x 2,5	70	
4	27 x 2,5	67,5	
5	26 x 2,5	65	**762,5/10 = 76,25**
6	31 x 2,5	77,5	
7	40 x 2,5	100	
8	32 x 2,5	80	
9	29 x 2,5	72,5	
10	23 x 2,5	57,5	

Source: (Research Results, 2024)

Based on the results of system testing using the System Usability Scale method in Table 19, the average value obtained is 76.25. The NPS value is in the Passive category, meaning that users are quite satisfied with the system. The Acceptable value is in the Acceptable category, meaning that the system is in accordance with needs and can be accepted by users. The Adjective value is in the Good category, meaning that the user experience with the system is good, then the Grade value is in category B, meaning a Good assessment. The results of this test are that respondents assess qualitatively, the level of acceptance and user loyalty can be accepted for further use and can be improved in terms of developing the appearance and features of the application.

CONCLUSION

Based on the results of research that has been conducted to determine the best lecturer on 11 alternative data and 8 criteria using the Additive Ratio Assessment method, it is concluded that the results of the analysis show that the best lecturer who has the highest value based on a combination of predetermined criteria is successfully achieved by lecturers with alternative data A1 with a value of 0.113875, A4 with a value of 0.109785, A5 with a value of 0.104235, A8 with a value of 0.099005, A3 with a value of 0.094715. The ARAS method is proven to be effectively able to produce objective decisions by looking at the weights and preference values of each assessment criterion. This study's results significantly contribute to developing the best lecturer performance assessment system by prioritizing transparency and objectivity to get more structured, efficient, and accountable results in assessing the best lecturers. Further research is recommended to expand the number of alternatives assessed, both from among lecturers and other elements related to the academic environment. In addition, this research can be developed by using other methods for comparison and validation of results and considering external factors that affect lecturer performance that have not been explored in this study.

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