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Combination of Grey Relational Analysis (GRA) and Simplified Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA-S) in Determining the Best Staff

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Abstract

Problems in selecting the best staff often involve complex challenges such as difficulty finding candidates with good performance. The problems faced in the selection of the best are only based on the assessment of discipline and productivity of performance carried out by the staff, so the assessment process does not use aspects of criteria that are considered important in selecting the best staff. This study aims to determine the best staff based on predetermined criteria and in determining the selection of the best staff using the Gray Relational Analysis (GRA) decision model while in determining the weight of criteria using the Simplified Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA-S) model so that the weight of the resulting criteria is not based on assumptions from decision makers. The results of the best staff assessment ranking using the Gray Relational Analysis method and the Simplified Pivot Pairwise Relative Criteria Importance Assessment weighting method obtained the results, namely for Rank 1 obtained by Denis Irawan with a final Gray Relational Analysis value of 0.243014. The results of data processing in the TRITAM Model test for the best staff selection application were adjusted to the conclusion of the overall results of the TRITAM Model criteria for technology acceptance, the results were good at 82.56%.

Keywords: GRA; Election; PIPRECIA-S; Decision; TRITAM

1. INTRODUCTION

Information Systems are a core element of the digital age that has fundamentally changed the way we collect, manage, and utilize data. In the context of an increasingly connected modern society, information systems play a central role in supporting decision-making, optimizing business processes, and facilitating the rapid exchange of information[1]. Effective and sustainable management of information systems is a crucial element in achieving the strategic objectives of the organization. In an era where information is a valuable asset, timely and accurate decision making is key to achieving competitive advantage[2]. By managing information systems well, organizations can improve operational efficiency, speed up decision-making processes, and enable faster innovation[3]. In addition, sustainable management also includes data protection and security, which is important to mitigate risks and maintain stakeholder trust[4]. In addition, sustainable management also includes data protection and security, which is important to mitigate risks and maintain stakeholder trust[5].

The best staff is a valuable asset to any organization, both in the business and non-profit sectors. They are individuals who have exceptional skills, dedication, and commitment to their work. The presence of the best staff not only has a positive impact on organizational performance, but also plays an important role in creating a healthy and productive work culture[6]. Problems in selecting the best staff often involve complex challenges such as difficulty finding candidates with good performance. The problem faced by PT ABC is that the best selection process is only based on the assessment of discipline and productivity of performance carried out by these staff, so that the assessment process does not use aspects of criteria that are considered important in selecting the best staff. The best staff play an important role in the long-term growth and success of an organization and the strategies that companies can adopt to ensure they have the best team to meet the challenges of a changing and competitive world. Selecting the best staff is a complex challenge in human resource management. One of the problems is the mismatch between the skills possessed by prospective employees and the needs of available positions, which can result in suboptimal performance. In addition, bias and discrimination in the selection process can undermine the principles of equality and fairness. Rapid changes in the business and organizational environment, as well as changing needs, can also create uncertainty in the selection of the right staff. The difficulty in retaining the best staff after recruiting and training them is another problem that needs to be addressed. All of these issues emphasize the importance of developing a careful and sustainable staff selection strategy.

Decision Support System (DSS) is an important concept in the world of science and technology that has experienced rapid development in recent decades[7]. With the advancement of information technology, DSS has become a tool that not only helps in complex decision making, but also increases efficiency, productivity, and quality of decisions in various aspects of life. DSS has proven to be a very useful tool in dealing with uncertainty and complexity in decision making, both at the individual level and large organizations[8]. With a better understanding of DSS, it is expected to recognize its added value in various aspects of life and apply it effectively to improve the decision-making process in the future[9]. One method of decision making is Grey Relational Analysis (GRA).

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The Grey Relational Analysis (GRA) method is an analytical method used in science and engineering to measure and compare relationships between two or more data sets or variables that may have levels of uncertainty or noise[10]. The GRA method is one of the tools used in multi-criteria decision-making analysis that emerged from the Grey System Theory. This method is used to evaluate and compare alternatives based on several relevant criteria or factors. The GRA has gained popularity for its ability to handle uncertainty and limited information in decision-making[11]. The GRA method has a number of benefits that make it a useful tool in multi-criteria decision making across multiple contexts. In decision making the main problem is the weighting of criteria, giving weight in decision making is one of the important aspects that must be considered when a person or an organization has to decide among various alternatives or options available. Assigning relative weight or value to the criteria or factors used to evaluate alternatives is a key step in the weighted-based decision-making process. One weighting method is Simplified Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA-S).

Simplified Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA-S) is a method used in multi-criteria analysis to evaluate and prioritize criteria based on their relative importance to each other[12]. This method helps in weight-based decision making by allowing decision makers to determine to what extent each criterion is more important than the other. The advantage of PIPRECIA-S is ease of use and understanding, it provides a simple yet effective way to evaluate and prioritize criteria in the context of multi-criteria decision making[13]. The criterion weighting assessment method is important for evaluating and prioritizing the criteria used to make decisions[14]. It involves comparing pairs of criteria to determine the degree of importance relative to each other. Often, there are one or more criteria that are used as a reference or pivot to compare other criteria. The decision maker will give relative weight to the criteria based on this comparison[15].

Previous research related to the research conducted, namely the GRA Method can solve decision making practically, because this method has a simple and easy-to-understand concept. The application of the GRA method in the built system begins with calculating the data to be tested against the subcriteria used. The results of the calculation are sorted from highest to lowest, and recommend a teacher admission system for the Brothers School Education Foundation[16]. Another research is the application of the GRA method in the system being developed starting with calculating data to be evaluated against predetermined subcriteria. The GRA method is known to have simple and easy-to-understand concepts, which allows it to be a practical tool in decision making. The calculation results are then sorted in tiers, with the highest placed at the top. The recommendations resulting from this ranking are in the form of a teacher admission system for the Brothers School Education Foundation[17].

Research on the selection of the best staff was conducted by Sitanjak, Zarlis, and Roslina (2021), namely the SMARTER and SAW Method is a decision-making method using multiplication to determine the value of a criterion, where the value of each criterion must be determined in advance with the weight of each criterion concerned. SMARTER and SAW are methods that can be used in making Decision Support Systems for selecting the best laboratory staff. Determination of ranking on the SMARTER and SAW methods based on the largest value as the best alternative[18]. Another study, Simplified Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA-S), is one of the methods in Multi-Criteria Decision Making (MCDM). It is an approach used to determine the importance or relative weight of various criteria used in decision making[19]. The PIPRECIA-S method helps in overcoming subjectivity in determining the weight of criteria and allows decision makers to systematically integrate their preferences in complex decision making. PIPRECIA-S can be performed iteratively, which means decision makers can revise pairwise comparisons if needed to achieve better consistency and accuracy in weight determination[15]. The PIPRECIA-S method helps in overcoming subjectivity in determining the weight of criteria and allows decision makers to systematically integrate their preferences in complex decision making. PIPRECIA-S can be performed iteratively, which means decision makers can revise pairwise comparisons if needed to achieve better consistency and accuracy in weight determination.

This study aims to determine the best staff based on predetermined criteria and in determining the selection of the best staff using the Gray Relational Analysis (GRA) decision model while in determining the weight of criteria using the Simplified Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA-S) model so that the weight of the resulting criteria is not based on the assumptions of a decision maker.

2. RESEARCH METHODOLOGY

2.1 Stages of Research

Research stages play a key role in directing the process of scientific investigation, this stage is a solid foundation for every research carried out[20]. This stage not only guides researchers in overcoming the challenges faced, but also ensures the reliability, validity, and integrity of research results. The stages of research carried out can be seen in Figure 1 below.

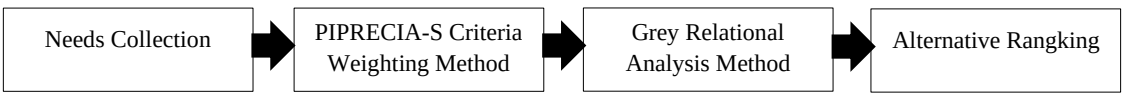

Figure 1. Stages of Research

The above research stages have 4 stages, in collecting these needs collecting data in selecting the best staff. This stage starts from determining the criteria used, namely discipline, productivity, innovation, cooperation, and

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communication in selecting the best staff and obtaining assessment data for each staff to be processed data in selecting the best staff using the GRA and PIPRECIA-S methods so that it will provide the best staff recommendations for decision makers.

2.2 Simplified Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA-S) Method

Simplified Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA-S) is a method in multi-criteria decision making used to determine the importance or relative weight of various criteria used in decision making[21]. PIPRECIA-S is often used in a variety of multi-criteria decision-making contexts, helping decision makers to make better choices based on their preferences [22]. The stages in the PIPRECIA-S method are as follows.

a. Determine the relative significance for each criterion, except the first one using the following equation.

$$S_j = \begin{cases} 1 & if\ c_j > c_1 \\ 1 & if\ c_j = c_1 \\ 1 & if\ c_j < c_1 \end{cases} \quad (1)$$

b. Set the value of the coefficient using the following equation.

$$k_j = \begin{cases} 1 & if\ j = 1 \\ 2 - s_j & if\ j > 1 \end{cases} \quad (2)$$

c. Calculate the weight using the following equation.

$$q_j = \begin{cases} 1 & if\ j = 1 \\ \frac{1}{k_j} & if\ j > 1 \end{cases} \quad (3)$$

d. Calculates the relative final weight of all criteria using the following equation.

$$w_j = \frac{q_j}{\sum_{k=1}^{n} q_k} \quad (4)$$

Calculation of the final weight of the PIPRECIA-S method by dividing the weight of each criterion by adding up the total weight of the existing criteria.

2.2 Grey Relational Analysis (GRA) Method

The Grey Relational Analysis (GRA) method is an approach to multi-criteria analysis used to evaluate alternatives based on a number of different criteria[23]. This method is used to measure the level of relation or relationship between existing alternatives by calculating the gray relation coefficient (Gray Relational Coefficient)[24]. The stages of completion using the GRA method are as follows.

a. Data Normalization
Normalization is used to transform data at a uniform scale, thus allowing better comparisons between different variables. The normalization equation in GRA is as follows.

$$X_{norm} = \frac{X_i - X_{min}}{X_{max} - X_{min}} \quad (5)$$

b. Formation of Gray Relational Analysis Matrix
After normalization is carried out, then making the matrix gray relational analysis G is the result of the normalization matrix, namely:

$$G = \begin{bmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{mn} \end{bmatrix} \quad (6)$$

G: is the result of the normalization matrix
m: is an existing alternative
n: is an existing criterion
x_{ij}: is a normalization in measuring alternatives.

c. Results of Multiplication of GRA Matrix by Weights
The next stage is to determine the relative weight for each variable. This weight reflects the level of importance of each variable in the GRA analysis. Furthermore, the GRA method is to give a weighting to each criterion that refers to the level of importance of the criterion. The following is a formula for doing calculations:

$$V_{ij} = g_{i,j}.w_j \quad (7)$$

So that the following weighted normalization matrix results can be formed:

$$V = \begin{bmatrix} v_{1,1} & \cdots & v_{1,n} \\ \vdots & \ddots & \vdots \\ v_{m,1} & \cdots & v_{m,n} \end{bmatrix} \quad (8)$$

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d. Calculation of Grey Relational Analysis Value
In this stage, the gray relation value is calculated for each variable based on a matrix of gray relations and relative weights that have been determined using the following equation.

$$GRG_i = \frac{1}{n}\sum_{j=1}^{n} V_{ij} \quad (9)$$

GRG_i is the gray relation value (GRG) of the i-th variable to the reference variable.

3. RESULTS AND DISCUSSION

In the management of an organization or company, the selection of the best staff is one of the key aspects that affect operational success and goal achievement. The selection of the best staff often involves multi-criteria considerations in effective decision making. Based on the collection of needs, the criteria used are Discipline, Productivity, Innovation, Cooperation, and Communication which will be used in making decisions on selecting the best staff.

3.1 Criteria Weighting using PIPRECIA-S

In this stage, the weighting method will be carried out using the PIPRECIA-S model so that it will produce a weight of relevant criteria and not based on assumptions from decision makers. The level of importance of the criteria is taken care of, namely discipline, productivity, innovation, cooperation, and communication. The next stage uses the PIPRECIA-S method in generating the weight of the criteria used, the criteria weighting steps are as follows

a. Establish relative significance s_j of each criterion by using equations (1), The calculation results are as follows.

Table 1. Value Calculation S_j

Criteria Code	Criteria Name	Value s_j
C1	Discipline	1
C2	Productivity	1
C3	Innovation	0.8
C4	Collaborate	0.6
C5	Communication	0.4

b. Setting the value of the coefficient k_j Using equations (2), The calculation results are as follows.

Table 2. Value Calculation k_j

Criteria Code	Value s_j	Value k_j
C1	1	1
C2	1	1
C3	0.8	1.2
C4	0.6	1.4
C5	0.4	1.6

c. Calculating weights q_j Using equations (3), The calculation results are as follows.

Table 3. Value Calculation q_j

Criteria Code	Value s_j	Value k_j	Value q_j
C1	1	1	1
C2	1	1	1
C3	0.8	1.2	0.833
C4	0.6	1.4	0.714
C5	0.4	1.6	0.625

d. Calculate the relative final weight of criteria using (4), The calculation results are as follows.

$$w_1 = \frac{1}{1+1+0.833+0.714+0.625} = \frac{1}{4.172} = 0.24$$

$$w_2 = \frac{1}{1+1+0.833+0.714+0.625} = \frac{1}{4.172} = 0.24$$

$$w_3 = \frac{0{,}625}{1+1+0.833+0.714+0.625} = \frac{0.625}{4.172} = 0.2$$

$$w_4 = \frac{0{,}677}{1+1+0.833+0.714+0.6255} = \frac{0.667}{4{,}172} = 0.171$$

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$$w_5 = \frac{0{,}556}{1 + 1 + 0.833 + 0.714 + 0.625} = \frac{0.556}{4.172} = 0.15$$

Based on the calculation of the weighting of criteria using the PIPRECIA-S method, the weight of each criterion is obtained as shown in table 4 below

Table 4. Weight Data for Best Staff Selection Criteria

Criteria Code	Criterion Weights
C1	0.24
C2	0.24
C3	0.2
C4	0.171
C5	0.15

The result of the calculation of the criteria weight using the PIPRECIA-S weighting model for each criterion used and the total overall weight of the criterion is 1.

3.2 Staff Performance Appraisal Results

The results of the staff performance appraisal obtained are based on assessments conducted by companies with a value range of 1-10, and will select the 3 best staff who will receive awards from the company because of the contribution of the results of existing staff performance. The results of staff performance appraisal as shown in table 5 below.

Table 5. Best Staff Performance Appraisal Results

NIK	Staff Name	Criteria Code				
		C1	C2	C3	C4	C5
IDS-1901	Deni Fahri Akbar	9	7	8	7	8
IDS-1902	Denis Irawan	6	8	7	8	8
IDS-1903	Desita Setyowati	7	7	8	6	7
IDS-1904	Dwi Amanda Lestari	8	6	7	9	6
IDS-1905	M Yogi Syaputra	7	5	6	8	7
IDS-1906	M. Firdaus Efendi	5	7	7	8	8
IDS-1907	Nadia Ramadani	6	8	8	6	9
IDS-1908	Nadia Silvia	7	7	9	7	8
IDS-1909	Ria Safira	6	7	8	8	7
IDS-1910	Rini Dwi Lestari	8	6	7	8	8
Min		**5**	**5**	**6**	**6**	**6**
Max		**9**	**8**	**9**	**9**	**9**

The results of the staff performance assessment above will be used in data processing using the GRA and PIPRECIA-S methods so that it will produce the best staff recommendations.

3.3 Best Staff Selection Using GRA and PIPRECIA-S Methods

Based on the results of the staff performance appraisal, they will then determine the best staff using the gray relational analysis method. The first stage will normalize data based on the results of staff performance appraisals using the following equation (5):

$$X_{11} = \frac{X_{11} - X_{1min}}{X_{1max} - X_{1min}} = \frac{9-5}{9-5} = \frac{4}{4} = 1$$

$$X_{12} = \frac{X_{12} - X_{1min}}{X_{1max} - X_{1min}} = \frac{6-5}{9-5} = \frac{1}{4} = 0.25$$

$$X_{13} = \frac{X_{13} - X_{1min}}{X_{1max} - X_{1min}} = \frac{7-5}{9-5} = \frac{2}{4} = 0.5$$

$$X_{14} = \frac{X_{14} - X_{1min}}{X_{1max} - X_{1min}} = \frac{8-5}{9-5} = \frac{3}{4} = 0.75$$

$$X_{15} = \frac{X_{15} - X_{1min}}{X_{1max} - X_{1min}} = \frac{7-5}{9-5} = \frac{2}{4} = 0.5$$

$$X_{21} = \frac{X_{21} - X_{2min}}{X_{2max} - X_{2min}} = \frac{7-5}{8-5} = \frac{2}{3} = 0.67$$

$$X_{22} = \frac{X_{22} - X_{2min}}{X_{2max} - X_{2min}} = \frac{8-5}{8-5} = \frac{3}{3} = 1$$

$$X_{23} = \frac{X_{23} - X_{2min}}{X_{2max} - X_{2min}} = \frac{7-5}{8-5} = \frac{2}{3} = 0.67$$

$$X_{16} = \frac{X_{16} - X_{1min}}{X_{1max} - X_{1min}} = \frac{6-5}{9-5} = \frac{1}{4} = 0.25$$

$$X_{17} = \frac{X_{17} - X_{1min}}{X_{1max} - X_{1min}} = \frac{6-5}{9-5} = \frac{1}{4} = 0.25$$

$$X_{18} = \frac{X_{17} - X_{1min}}{X_{1max} - X_{1min}} = \frac{7-5}{9-5} = \frac{2}{4} = 0.5$$

$$X_{19} = \frac{X_{19} - X_{1min}}{X_{1max} - X_{1min}} = \frac{6-5}{9-5} = \frac{1}{4} = 0.25$$

$$X_{110} = \frac{X_{110} - X_{1min}}{X_{1max} - X_{1min}} = \frac{8-5}{9-5} = \frac{3}{4} = 0.75$$

$$X_{26} = \frac{X_{26} - X_{2min}}{X_{2max} - X_{2min}} = \frac{7-5}{8-5} = \frac{2}{3} = 0.67$$

$$X_{27} = \frac{X_{27} - X_{2min}}{X_{2max} - X_{2min}} = \frac{8-5}{8-5} = \frac{3}{3} = 1$$

$$X_{28} = \frac{X_{28} - X_{2min}}{X_{2max} - X_{2min}} = \frac{7-5}{8-5} = \frac{2}{3} = 0.67$$

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$X_{24} = \frac{X_{24}-X_{2min}}{X_{2max}-X_{2min}} = \frac{6-5}{8-5} = \frac{1}{3} = 0.33$

$X_{25} = \frac{X_{25}-X_{2min}}{X_{2max}-X_{2min}} = \frac{5-5}{8-5} = \frac{0}{3} = 0$

$X_{31} = \frac{X_{31}-X_{3min}}{X_{3max}-X_{3min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{32} = \frac{X_{32}-X_{3min}}{X_{3max}-X_{3min}} = \frac{7-6}{9-6} = \frac{1}{3} = 0.33$

$X_{33} = \frac{X_{33}-X_{3min}}{X_{3max}-X_{3min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{34} = \frac{X_{34}-X_{3min}}{X_{3max}-X_{3min}} = \frac{7-6}{9-6} = \frac{1}{3} = 0.33$

$X_{35} = \frac{X_{35}-X_{3min}}{X_{3max}-X_{3min}} = \frac{6-6}{9-6} = \frac{0}{3} = 0$

$X_{41} = \frac{X_{41}-X_{4min}}{X_{4max}-X_{4min}} = \frac{7-6}{9-6} = \frac{1}{3} = 0.33$

$X_{42} = \frac{X_{42}-X_{4min}}{X_{4max}-X_{4min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{43} = \frac{X_{43}-X_{4min}}{X_{4max}-X_{4min}} = \frac{6-6}{9-6} = \frac{0}{3} = 0$

$X_{44} = \frac{X_{44}-X_{4min}}{X_{4max}-X_{4min}} = \frac{9-6}{9-6} = \frac{3}{3} = 1$

$X_{45} = \frac{X_{45}-X_{4min}}{X_{4max}-X_{4min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0{,}67$

$X_{51} = \frac{X_{51}-X_{5min}}{X_{5max}-X_{5min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{52} = \frac{X_{52}-X_{5min}}{X_{5max}-X_{5min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{53} = \frac{X_{53}-X_{5min}}{X_{5max}-X_{5min}} = \frac{7-6}{9-6} = \frac{1}{3} = 0.33$

$X_{54} = \frac{X_{54}-X_{5min}}{X_{5max}-X_{5min}} = \frac{6-6}{9-6} = \frac{0}{3} = 0$

$X_{55} = \frac{X_{55}-X_{5min}}{X_{5max}-X_{5min}} = \frac{7-6}{9-6} = \frac{1}{3} = 0.33$

$X_{29} = \frac{X_{28}-X_{2min}}{X_{2max}-X_{2min}} = \frac{7-5}{8-5} = \frac{2}{3} = 0{,}67$

$X_{210} = \frac{X_{210}-X_{2min}}{X_{2max}-X_{2min}} = \frac{6-5}{8-5} = \frac{1}{3} = 0.33$

$X_{36} = \frac{X_{36}-X_{3min}}{X_{3max}-X_{3min}} = \frac{7-6}{9-6} = \frac{1}{3} = 0.33$

$X_{37} = \frac{X_{37}-X_{3min}}{X_{3max}-X_{3min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{38} = \frac{X_{38}-X_{3min}}{X_{3max}-X_{3min}} = \frac{9-6}{9-6} = \frac{3}{3} = 1$

$X_{39} = \frac{X_{39}-X_{3min}}{X_{3max}-X_{3min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{310} = \frac{X_{310}-X_{3min}}{X_{3max}-X_{3min}} = \frac{7-6}{9-6} = \frac{1}{3} = 0.33$

$X_{46} = \frac{X_{46}-X_{4min}}{X_{4max}-X_{4min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{47} = \frac{X_{47}-X_{4min}}{X_{4max}-X_{4min}} = \frac{6-6}{9-6} = \frac{0}{3} = 0$

$X_{48} = \frac{X_{48}-X_{4min}}{X_{4max}-X_{4min}} = \frac{7-6}{9-6} = \frac{1}{3} = 0.33$

$X_{49} = \frac{X_{49}-X_{4min}}{X_{4max}-X_{4min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{410} = \frac{X_{410}-X_{4min}}{X_{4max}-X_{4min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{56} = \frac{X_{56}-X_{5min}}{X_{5max}-X_{5min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{57} = \frac{X_{57}-X_{5min}}{X_{5max}-X_{5min}} = \frac{9-6}{9-6} = \frac{3}{3} = 1$

$X_{58} = \frac{X_{58}-X_{5min}}{X_{5max}-X_{5min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

$X_{59} = \frac{X_{59}-X_{5min}}{X_{5max}-X_{5min}} = \frac{7-6}{9-6} = \frac{1}{3} = 0.33$

$X_{510} = \frac{X_{510}-X_{5min}}{X_{5max}-X_{5min}} = \frac{8-6}{9-6} = \frac{2}{3} = 0.67$

From the normalization results that have been carried out then make a gray relational analysis matrix using equation (6), the results of the gray relational analysis matrix normalization are as follows.

$$G = \begin{bmatrix} 1 & 0.67 & 0.67 & 0.33 & 0.67 \\ 0.25 & 1 & 0.33 & 0.67 & 0.67 \\ 0.5 & 0.67 & 0.67 & 0 & 0.33 \\ 0.75 & 0.33 & 0.33 & 1 & 0 \\ 0.5 & 0 & 0 & 0.67 & 0.33 \\ 0.25 & 0.67 & 0.33 & 0.67 & 0.67 \\ 0.25 & 1 & 0.67 & 0 & 1 \\ 0.5 & 0.67 & 1 & 0.33 & 0.67 \\ 0.25 & 0.67 & 0.67 & 0.67 & 0.33 \\ 0.75 & 0.33 & 0.33 & 0.67 & 0.67 \end{bmatrix}$$

Furthermore, after obtaining the results of the gray relational analysis matrix normalization, the results of the gray relational analysis matrix normalization will be calculated with the weight of each criterion using equation (7), the result of multiplication between the matrix and the weight of the criteria as follows.

$V_{11} = g_{11}.w_1 = 1 * 0.24 = 0.24$

$V_{21} = g_{21}.w_2 = 0.67 * 0.24 = 0.1608$

$V_{31} = g_{31}.w_3 = 0.67 * 0.2 = 0.134$

$V_{41} = g_{41}.w_4 = 0.33 * 0.171 = 0.24$

$V_{51} = g_{51}.w_5 = 0.67 * 0.15 = 0.05643$

$V_{13} = g_{13}.w_1 = 0.5 * 0.24 = 0.12$

$V_{23} = g_{23}.w_2 = 0.67 * 0.24 = 0.156$

$V_{33} = g_{33}.w_3 = 0.67 * 0.2 = 0.13$

$V_{12} = g_{12}.w_1 = 0.25 * 0.24 = 0.1$

$V_{22} = g_{22}.w_2 = 1 * 0.24 = 0.24$

$V_{32} = g_{32}.w_3 = 0.33 * 0.2 = 0.66$

$V_{42} = g_{42}.w_4 = 0.67 * 0.171 = 0.11457$

$V_{52} = g_{52}.w_5 = 0.67 * 0.15 = 0.1005$

$V_{14} = g_{14}.w_1 = 0.75 * 0.24 = 0.18$

$V_{24} = g_{24}.w_2 = 0.33 * 0.24 = 0.0792$

$V_{34} = g_{34}.w_3 = 0.33 * 0.2 = 0.66$

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$V_{43} = g_{43}.w_4 = 0 * 0{,}171 = 0$
$V_{44} = g_{44}.w_4 = 1 * 0.171 = 0.171$
$V_{53} = g_{53}.w_5 = 0.33 * 0{,}15 = 0{,}0495$
$V_{54} = g_{54}.w_5 = 0 * 0.15 = 0$
$V_{15} = g_{15}.w_1 = 0.5 * 0.24 = 0.12$
$V_{16} = g_{16}.w_1 = 0.25 * 0.24 = 0.06$
$V_{25} = g_{25}.w_2 = 0 * 0.24 = 0$
$V_{26} = g_{26}.w_2 = 0.67 * 0.24 = 0.1608$
$V_{35} = g_{35}.w_3 = 0 * 0.2 = 0$
$V_{36} = g_{36}.w_3 = 0.33 * 0.2 = 0.66$
$V_{45} = g_{45}.w_4 = 0.67 * 0.171 = 0.11457$
$V_{46} = g_{46}.w_4 = 0.67 * 0.171 = 0.11457$
$V_{55} = g_{55}.w_5 = 0.33 * 0.15 = 0.0495$
$V_{56} = g_{56}.w_5 = 0.67 * 0.15 = 0.1005$
$V_{17} = g_{17}.w_1 = 0.25 * 0.24 = 0.06$
$V_{18} = g_{18}.w_1 = 0.5 * 0.24 = 0.12$
$V_{27} = g_{27}.w_2 = 1 * 0.24 = 0.24$
$V_{28} = g_{28}.w_2 = 0.67 * 0.24 = 0.1608$
$V_{37} = g_{37}.w_3 = 0.67 * 0.2 = 0.134$
$V_{38} = g_{38}.w_3 = 1 * 0.2 = 0.2$
$V_{47} = g_{47}.w_4 = 0 * 0.171 = 0$
$V_{48} = g_{48}.w_4 = 0.33 * 0.171 = 0.05643$
$V_{57} = g_{57}.w_5 = 1 * 0.15 = 0.15$
$V_{58} = g_{58}.w_5 = 0.67 * 0.15 = 0.1005$
$V_{19} = g_{19}.w_1 = 0.25 * 0.24 = 0.06$
$V_{110} = g_{110}.w_1 = 0.75 * 0.24 = 0.18$
$V_{29} = g_{29}.w_2 = 0.67 * 0.24 = 0.24$
$V_{210} = g_{210}.w_2 = 0.33 * 0.24 = 0.0792$
$V_{39} = g_{39}.w_3 = 0.67 * 0.2 = 0.134$
$V_{310} = g_{310}.w_3 = 0.33 * 0.2 = 0.66$
$V_{49} = g_{49}.w_4 = 0{,}67 * 0.171 = 0$
$V_{410} = g_{410}.w_4 = 0.67 * 0.171 = 0.11457$
$V_{59} = g_{59}.w_5 = 0.33 * 0.15 = 0.15$
$V_{510} = g_{510}.w_5 = 0.67 * 0.15 = 0.1005$

From the results of weight multiplication that has been carried out next, make a gray relational analysis weighted normalization matrix using equation (8), the results of the gray relational analysis weighted normalization matrix are as follows.

$$V = \begin{bmatrix} 0.24 & 0.1608 & 0.134 & 0.24 & 0.05643 \\ 0.1 & 0.24 & 0.66 & 0.11457 & 0.1005 \\ 0.12 & 0.156 & 0.13 & 0 & 0.0495 \\ 0.18 & 0.0792 & 0.66 & 0.171 & 0 \\ 0.12 & 0 & 0 & 0.11457 & 0.0495 \\ 0.06 & 0.1608 & 0.66 & 0.11457 & 0.1005 \\ 0.06 & 0.24 & 0.134 & 0 & 0.15 \\ 0.12 & 0.1608 & 0.2 & 0.05643 & 0.1005 \\ 0.06 & 0.24 & 0.134 & 0 & 0.15 \\ 0.18 & 0.0792 & 0.66 & 0.11457 & 0.1005 \end{bmatrix}$$

Next, calculating the gray relation value is calculated for each variable based on a matrix of gray relations and relative weights that have been determined using the following equation (9).

$GRG_1 = \frac{1}{5}(V_{11} + V_{21} + V_{31} + V_{41} + V_{51})$
$GRG_1 = \frac{1}{5}(0.24 + 0.1608 + 0.134 + 0.24 + 0.05643)$
$GRG_1 = \frac{1}{5}(0.83123) = 0.166246$
$GRG_2 = \frac{1}{5}(V_{21} + V_{22} + V_{23} + V_{24} + V_{25})$
$GRG_2 = \frac{1}{5}(0.1 + 0.24 + 0.66 + 0.11457 + 0.1005)$
$GRG_2 = \frac{1}{5}(1.21507) = 0.243014$
$GRG_3 = \frac{1}{5}(V_{31} + V_{32} + V_{33} + V_{34} + V_{35})$
$GRG_3 = \frac{1}{5}(0.12 + 0.156 + 0.13 + 0 + 0.0495)$
$GRG_3 = \frac{1}{5}(0.4555) = 0.0911$
$GRG_4 = \frac{1}{5}(V_{41} + V_{42} + V_{43} + V_{44} + V_{45})$
$GRG_4 = \frac{1}{5}(0.18 + 0.0792 + 0{,}66 + 0{,}171 + 0)$
$GRG_4 = \frac{1}{5}(1.0902) = 0.21804$

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$GRG_5 = \frac{1}{5}(V_{51} + V_{52} + V_{53} + V_{54} + V_{55})$

$GRG_5 = \frac{1}{5}(0.12 + 0 + 0 + 0.11457 + 0.0495)$

$GRG_5 = \frac{1}{5}(0.28407) = 0.056814$

$GRG_6 = \frac{1}{5}(V_{61} + V_{62} + V_{63} + V_{64} + V_{65})$

$GRG_6 = \frac{1}{5}(0.06 + 0.1608 + 0.66 + 0.11457 + 0.1005)$

$GRG_6 = \frac{1}{5}(1.09587) = 0.219174$

$GRG_7 = \frac{1}{5}(V_{71} + V_{72} + V_{73} + V_{74} + V_{75})$

$GRG_7 = \frac{1}{5}(0.06 + 0.24 + 0.134 + 0 + 0.15)$

$GRG_7 = \frac{1}{5}(0.586) = 0.1168$

$GRG_8 = \frac{1}{5}(V_{71} + V_{72} + V_{73} + V_{74} + V_{75})$

$GRG_8 = \frac{1}{5}(0.12 + 0.1608 + 0.2 + 0.05643 + 0.1005)$

$GRG_8 = \frac{1}{5}(0.63773) = 0.127546$

$GRG_9 = \frac{1}{5}(V_{91} + V_{92} + V_{93} + V_{94} + V_{95})$

$GRG_9 = \frac{1}{5}(0.06 + 0.24 + 0.134 + 0 + 0.15)$

$GRG_9 = \frac{1}{5}(0.586) = 0.1168$

$GRG_{10} = \frac{1}{5}(V_{101} + V_{102} + V_{103} + V_{104} + V_{105})$

$GRG_{10} = \frac{1}{5}(0.18 + 0.0792 + 0.66 + 0.11457 + 0.1005)$

$GRG_{10} = \frac{1}{5}(1.13427) = 0.226854$

Aware of the calculation of the final value using the Gray Relational Analysis method and the Simplified Pivot Pairwise Relative Criteria Importance Assessment weighting method, the best staff ranking results can be seen in the following table 5.

Table 5. Best Staff Performance Appraisal Ranking Results

NIK	Staff Name	GRA Final Grades	Ranking
IDS-1902	Denis Irawan	0.243014	1
IDS-1910	Rini Dwi Lestari	0.226854	2
IDS-1906	M. Firdaus Efendi	0.219174	3
IDS-1904	Dwi Amanda Lestari	0.21804	4
IDS-1901	Deni Fahri Akbar	0.166246	5
IDS-1908	Nadia Silvia	0.127546	6
IDS-1907	Nadia Ramadani	0.1168	7
IDS-1909	Ria Safira	0.1168	7
IDS-1903	Desita Setyowati	0.0811	8
IDS-1905	M Yogi Syaputra	0.056814	9

Based on the results of the best staff assessment ranking using the Gray Relational Analysis method and the Simplified Pivot Pairwise Relative Criteria Importance Assessment weighting method, the results were obtained for Rank 1 obtained by Denis Irawan with a final Gray Relational Analysis value of 0.243014. Rank 2 was obtained by Rini Dwi Lestari with a final Gray Relational Analysis score of 0.226854. Rank 3 was obtained by M. Firdaus Efendi with a final Gray Relational Analysis score of 0.219174.

3.4 Best Staff Selection Web Application Using GRA and PIPRECIA-S Methods

The best staff selection web application is a software platform used by companies to assist in the decision-making process related to the selection of the best staff in performance appraisal. The application provides the necessary tools to manage staff data, determine criteria, conduct assessments, and make recommendations for staff selection based on the criteria used. The best staff ranking web application can be seen in Figure 2 below.

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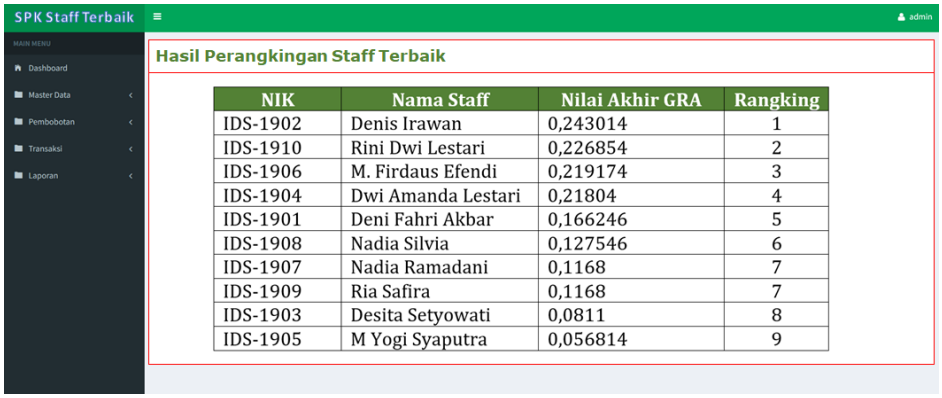

NIK	Nama Staff	Nilai Akhir GRA	Rangking
IDS-1902	Denis Irawan	0,243014	1
IDS-1910	Rini Dwi Lestari	0,226854	2
IDS-1906	M. Firdaus Efendi	0,219174	3
IDS-1904	Dwi Amanda Lestari	0,21804	4
IDS-1901	Deni Fahri Akbar	0,166246	5
IDS-1908	Nadia Silvia	0,127546	6
IDS-1907	Nadia Ramadani	0,1168	7
IDS-1909	Ria Safira	0,1168	7
IDS-1903	Desita Setyowati	0,0811	8
IDS-1905	M Yogi Syaputra	0,056814	9

Figure 2. Application Display of Staff Ranking Results

The results of the web-based application assessment and manual calculations using the Gray Relational Analysis method and the Simplified Pivot Pairwise Relative Criteria Importance Assessment weighting method did not differ in the final value and ranking in the selection of the best staff.

Technology acceptance testing is an important stage in ensuring that a new technology model or system is well accepted and used by end users[25]. The model development used in this study is the basic model of research using the TRITAM concept which is a modification of the TAM model, by adding Trust and Risk factors in the Technology Acceptance Model. This model is to test the acceptance of technology in the best staff selection web application, the results of application testing can be seen in the following table 6.

Table 6. TRITAM Model Test Results on Web Applications

No	Aspects / Criteria	Actual Score	Ideal Score	% Total Score	Criteria
1	Trust	187	240	77.92	Good
2	Risk	182	240	75.83	Good
3	Perceived Usefullnes	431	480	89.79	Excellent
4	Perceived Easy of Use	389	480	81,04	Excellent
	Total	1189	1440	82.56	Excellent

Based on the results of data processing respondents' responses as many as 3 respondents, namely company leaders who determine the best staff assessment and based on 4 TRITAM Model criteria, Trust results are obtained by 77.92%, Risk by 75.83%, Perceived Usefullness by 89.79%, PPerceived Easy of Use by 81.04%. Of the overall criteria of the TRITAM Model for technology acceptance, the result was Good at 82.56%.

4. CONCLUSION

The selection of the best staff using a combination of the Grey relational Analysis (GRA) decision model and Simplified Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA-S) helps in the selection of the best staff because the weight of the criteria produced is not based on the assumptions of a decision maker. The results of the best staff assessment ranking using the Gray Relational Analysis method and the Simplified Pivot Pairwise Relative Criteria Importance Assessment weighting method obtained the results, namely for Rank 1 obtained by Denis Irawan with a final Gray Relational Analysis value of 0.243014. The results of data processing in the TRITAM Model test for the best staff selection application were adjusted to the conclusion of the overall results of the TRITAM Model criteria for technology acceptance of 82.56% with good criteria results.

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