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Integration of G2M Weighting and MOORA in Accurate Decision Making for Best Alternative Selection

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Abstract. The goal of the integration of the G2M Weighting and MOORA methods is to produce the best alternative selection decisions that are more accurate and objective. By combining rational criteria weighting through G2M Weighting and alternative evaluation using MOORA, it is hoped that it can reduce bias and increase transparency in decision-making. In addition, this study compares alternative ratings from the application of the MOORA method and other weighting methods. The results of the evaluation and ranking of scholarship recipients using G2M weighting and MOORA, CF candidates managed to occupy the first position with a final score of 0.2727, showing the best performance among all candidates. In second place, UT candidates obtained a score of 0.2630, followed by DF candidates with a score of 0.2445 and SS candidates with a score of 0.2425. This approach makes it a very useful solution in the selection of the best alternatives in a wide range of multi-criteria decision applications. The results of the Spearman correlation test showed that the G2M weighting method had the highest correlation of 0.9879, which showed a very high similarity with the initial rating. The Entropy Weighting and CRITIC methods also showed a strong correlation, of 0.9515 and 0.9636, respectively, although there was slight variation in the alternate sequence. Meanwhile, the MEREC weighting has the lowest correlation of 0.9273, but still shows a very strong relationship. Overall, these results suggest that the G2M method produces rankings consistent with the initial rankings, with variations indicating sensitivity to criterion weighting.

Keywords: Alternative Selection, G2M Weighting, MOORA Method, Multi-Criteria Decision Making, Spearman Correlation

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INTRODUCTION

Multi-criteria decision-making (MCDM) is a very important approach in complex situations where various factors must be considered simultaneously[1]–[3]. In the real world, decisions are rarely based on just one aspect; rather, it involves a variety of interrelated criteria, such as cost, quality, risk, sustainability, and efficiency. Therefore, MCDM becomes a relevant and effective framework in managing conflicts between criteria, helping decision-makers evaluate alternatives thoroughly and objectively. This is vital in various areas such as project management, supplier selection, strategic planning, product development, and performance assessment. The main advantage of the MCDM method is its ability to transform quantitative and qualitative data into meaningful rankings, facilitating the selection of the best alternatives based on the preferences and weights of each criterion[4]–[6]. Without this approach, decisions are likely to be subjective and inconsistent, especially as the number of criteria and alternatives increases. By adopting the MCDM method, organizations or individuals can ensure that every decision is based on a transparent, logical, and structured analysis, thereby increasing accuracy and fairness in the selection of the best alternatives.

The main problem in selecting the best alternative that is objective and accurate lies in the difficulty in determining the weight of criteria rationally and in managing the complexity of data that often contradicts each other. In practice, decision-making is often influenced by intuition, subjective experience, or certain interests, which can obscure judgments that are supposed to be neutral[7], [8]. This causes the results of the decision to be biased, non-transparent, and difficult to account. In addition, not all decision-makers have sufficient analytical capabilities or tools to consider many criteria at once in a systematic and balanced manner. Another problem arises when alternatives that are considered to have diverse performance against each criterion are needed, so a method is needed that is able to accommodate the diversity of data without eliminating the informative value of each aspect. When there is no objective standard or method in weighting and processing data, then the final outcome of the decision can vary greatly depending on individual preferences, rather than based on actual conditions[9], [10]. Therefore, an integration between objective weighting methods and robust multi-criteria data processing techniques is needed to produce more accurate, fair, and reliable decisions.

Grey geometric mean weighting (G2M Weighting) plays an important role in determining the weight of criteria rationally by combining geometric approaches and grey system theory to overcome uncertainty and information limitations in the decision-making process[11], [12]. This method uses geometric averages as a basis for calculation to reduce the extreme influence of the data, while considering the relationship between uncertain or incomplete criteria. Thus, G2M is able to generate a more stable and representative weight of criteria against real conditions, especially in situations where subjective data or decision-makers' preferences are not fully available or clear. The advantage of G2M Weighting lies in its ability to combine the power of objectivity from mathematical methods and flexibility in handling gray information, i.e. information that is not entirely certain. In the context of MCDM, this approach is very useful for balancing between quantitative values and qualitative assessments of the various criteria used. The weighted results obtained from G2M not only reflect the relative importance between the criteria, but also provide a strong and consistent basis in the alternative assessment process, thereby improving the reliability and rationality of the overall decision-making system.

The multi-objective optimization on the basis of ratio analysis (MOORA) method has several advantages that make it an effective choice in multi-criteria data processing[13], [14]. One of the main advantages of MOORA is its simplicity in applying ratio analysis for each alternative to existing criteria. This approach allows for direct comparisons between alternatives based on their relative values, making it easier to determine the best alternatives in a transparent and easy-to-understand way. The calculation process in MOORA is also relatively fast, which allows the application to problems with many alternatives and criteria without requiring a long computational time. In addition, MOORA is able to handle situations where the criterion data is heterogeneous, i.e. when the data used covers a variety of different units or scales. By using ratios, MOORA converts all criteria into comparable units, thus minimizing the problem of comparison between unequal criteria[15]–[17]. Another advantage is its ability to integrate conflicting or unbalanced criteria in an efficient manner, allowing decision-makers to focus more on comparisons between alternatives based on objective considerations. Due to its simplicity and ability to address different types of data, MOORA is widely used in a variety of applications such as supplier selection, performance evaluation, and project planning that require fast and effective multi-criteria decision analysis.

The integration of the G2M Weighting method with MOORA provides a powerful solution in multi-criteria decision-making for the accurate selection of the best alternatives. G2M Weighting plays an important role in determining the weighting of criteria in a rational and objective way. This method overcomes uncertainty and incompleteness of information by using geometric averages to produce a more stable and consistent weighting of criteria. With this approach, the influence of extreme values can be minimized, so that the weight generated is more representative and reduces the potential for bias in evaluation. G2M Weighting ensures that each criterion receives fair attention based on its individual importance, without disregarding information that is gray or uncertain. Meanwhile, MOORA serves to evaluate alternatives based on criteria that have been given weight. Using ratio analysis, MOORA enables direct comparisons between alternatives and transforms heterogeneous data into objectively comparable forms. The main advantage of MOORA is its simplicity in providing clear alternative rankings, even in problems with many criteria and alternatives. When G2M Weighting is combined with MOORA, the resulting results become more comprehensive, fair, and objective. The integration of these two methods ensures that the selection of the best alternative is carried out taking into account the weight of rational criteria as well as the proper evaluation of the alternatives, resulting in more accurate and accountable decisions.

The goal of the integration of the G2M Weighting and MOORA methods is to produce the best alternative selection decisions that are more accurate and objective. By combining rational criterion weighting through G2M Weighting and alternative evaluation using MOORA, it is hoped that it can reduce bias and increase transparency in decision-making. The integration of these two methods aims to provide efficient and reliable solutions in dealing with complex multi-criteria problems. The contribution of this research lies in the integration of the G2M weighting approach which is capable of determining criteria weights objectively based on multi-objective evaluation using the MOORA method, known to be effective in the ranking process of alternatives. This integration produces a decision-making model that is more accurate, consistent, and adaptive to data variations, thus minimizing subjectivity in weight determination and enhancing the reliability of the final results. Furthermore, this research expands the application of the G2M method by demonstrating its compatibility with ratio-based ranking techniques, as well as providing practical contributions in various scenarios for selecting the best alternatives. This approach not only offers precise results but also provides a flexible framework to be adapted to different contexts and criteria.

METHODS

A research framework is a systematic structure or plan used to guide the entire research process from start to finish. The research framework serves to ensure that research runs in a directional, consistent, and in accordance with the goals that have been set. With the research framework, researchers can organize research steps logically, avoid errors in the process of data collection and analysis, and make it easier for readers to understand the flow of thinking and methodology used in the research. The research framework is shown in figure 1 which shows the process of the research activities carried out.

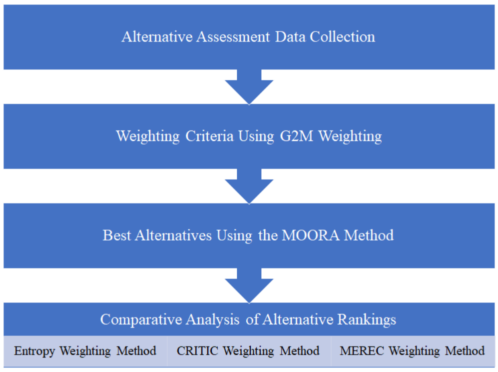

Figure 1. Research framework

The research framework in figure 1 describes the process flow in multicriteria decision-making. The process begins with the collection of alternative assessment data as the basis for evaluation. Furthermore, criteria were weighted using the G2M weighting method to determine the level of importance of each criterion. Once the weight of the criteria is determined, the best alternative is selected using the MOORA method, which aims to obtain the optimal solution. As a final step, a comparative analysis of alternative ratings was carried out by comparing the results obtained from the G2M method with other weighting methods, namely the entropy weighting method, CRITIC weighting method, and MEREC weighting method, to ensure the validity and consistency of the results of selecting the best alternatives.

1. G2M Weighting
   G2M weighting is a criterion weighting method developed to determine the level of importance (weight) of each criterion in the multicriteria decision-making process. G2M weighting aims to produce an objective weighting by considering the spread and significance of the criteria data against the overall alternatives being evaluated. G2M weighting gives weight to criteria based on each criterion's contribution to alternative differentiation, not just based on subjective judgment.
   The decision matrix is the first process in G2M weighting containing assessment data from all alternatives to each set criteria. Each row represents one alternative, and each column represents one criterion. This step is important as the basis for all subsequent calculations, the decision matrix is created using the following equation.

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

   The geometric mean value is the second process in G2M weighting calculated for each criterion by multiplying all alternative values and then rooting according to the number of alternatives. This is done to get a middle size that takes into account the variation of the data, the geometric mean value is calculated using the following equation.

$$GM_i = \left(\prod_{i=1}^{j} x_i\right)^{1/n} \quad (2)$$

Normalization is the third process in G2M weighting calculated by dividing the value of each alternative on a criterion by the geometric mean of that criterion. The goal is to equalize the data scale between the criteria, the normalization value is calculated using the following equation.

$$R_{ij} = \frac{x_{ij}}{GM_i} \quad (3)$$

The grey coefficient is the fourth process in G2M weighting to measure the degree of proximity between an alternative and an ideal value. This value is calculated based on the difference between the normalized value and the ideal value. The greater the gray coefficient, the better the alternative performance on the criterion, the gray coefficient value is calculated using the following equation.

$$GRG_i = \frac{1}{n}\sum_{j=1}^{n} R_{ij} \quad (4)$$

Criterion weighting is the last process in G2M weighting obtained from the average value of the grey coefficient in each criterion. The greater the average gray coefficient value, the more important these criteria are in decision-making. All weights are then normalized so that the total number of weights is equal to one, the value of the criterion weights is calculated using the following equation.

$$w_j = \frac{GRG_i}{\sum_{i=1}^{j} GRG_i} \quad (5)$$

G2M Weighting is an objective method for determining the weighting of criteria by combining geometric mean, normalization, and gray coefficient analysis. This method helps to generate fairer and more representative weights based on the distribution and proximity of data between alternatives.

2. MOORA Method
   MOORA is a simple and effective multi-criteria decision-making method. This method aims to determine the best alternative by comparing the optimization value of various criteria, both benefit and cost. MOORA has the advantage that the calculation process is simple, fast, and easy to understand without the need for complex calculations. In addition, this method is effective in handling benefits and cost criteria simultaneously so as to produce more balanced decisions.
   The decision matrix is the first process in MOORA containing assessment data from all alternatives to each set criteria. Each row represents one alternative, and each column represents one criterion. This step is important as the basis for all subsequent calculations, the decision matrix is created using (1).
   Normalization is the second process in MOORA which is calculated by dividing the value of each alternative on a criterion. The goal is to equalize the scale of the data between the criteria, the normalization value is calculated using the following equation.

$$n_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} {x_{ij}}^2}} \quad (6)$$

The optimization value is the final process in the MOORA method obtained by comparing the alternative performance ratios against each relevant criterion. This process involves normalizing the values for each criterion, then calculating the optimization values that show the extent to which the alternative meets the set goals, the optimization value is calculated using the following equation.

$$Y_i = \left(\sum_{j=1}^{g} n_{ij} * w_j\right) - \left(\sum_{j=g+1}^{n} n_{ij} * w_j\right) \quad (7)$$

This optimization value helps determine the best alternative based on a balance between the various criteria. The MOORA method also makes it possible to consider multiple objectives simultaneously, without having to make decisions based on one single criterion.

RESULT AND DISCUSSION

The integration of the G2M Weighting method with MOORA offers a more precise approach in selecting the best alternatives. G2M Weighting serves to objectively determine the weight of the criteria by directly

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attributing the decision objective to the evaluation measure, resulting in weights that are more relevant to the specific needs of decision-making. With the weight of the criteria obtained through G2M, MOORA is then used to conduct a comprehensive evaluation of the available alternatives based on the value of the normalization ratio that considers the criteria of profit and cost. The synergy between these two methods strengthens consistency in alternative performance measurements and improves the accuracy of the final results obtained. The implementation of this integration shows the advantages of overcoming the limitations of subjectivity and bias that often arise in the process of selecting alternatives using traditional methods. This combination not only improves the accuracy of selecting the best alternatives, but also makes the decision-making process more transparent, systematic, and accountable. The integration of G2M Weighting and MOORA is perfect for application in a wide range of multi-criteria decision-making contexts.

Alternative Assessment Data Collection

This study uses the selection data of educational scholarship recipients in the case study, this selection aims to identify individuals who not only show financial need, but also have academic potential, strong motivation, and commitment to complete their studies. Through a series of criteria that have been set, it is hoped that this scholarship can be right on target and have a real impact in improving the quality of education and the future of its recipients.

The collection of alternative assessment data in the selection of scholarship recipients was carried out by referring to a number of criteria that had been set, namely academic score, parental income, number of dependents in the family, home status, recommendations from the village, and interview results. Each prospective scholarship recipient is assessed based on real data obtained from official documents. To maintain objectivity, assessments are conducted by several independent assessors who have uniform assessment guidelines and formats. Each alternative or potential recipient is then given a score on each of the criteria, which will be used in the further calculation stage. The assessment data of each candidate is shown in table 1.

Table 1. Assessment data

Candidate Name	**Criteria Name**					
	IPK	**PI**	**ND**	**HS**	**VR**	**IR**
SS Candidate	3.5	1800000	5	2	5	85
AD Candidate	2.8	2200000	4	3	4	78
CF Candidate	3.9	1500000	6	2	5	90
RY Candidate	3	3000000	3	4	3	75
WQ Candidate	3.3	2500000	5	3	4	82
DF Candidate	2.7	1900000	7	2	5	79
UT Candidate	3.8	1700000	4	3	5	88
HI Candidate	2.9	2800000	6	2	4	80

The explanation of each criterion used in the selection of scholarship recipients is explained as follows.

1. The Cumulative Achievement Index (IPK) is benefit criteria, reflects the extent of the academic ability of prospective scholarship recipients in completing their studies. IPK is calculated based on grades earned throughout education, with a grade range from 0 to 4. A high IPK indicates good academic quality and the ability to overcome challenges in education, being an important indicator in scholarship selection, although this is not the only determining factor.
2. Parental Income (PI) is benefit cost, refers to the monthly income of the parents or guardians of prospective scholarship recipients. This income is used to assess the family's economic ability to meet basic needs, including education costs. The lower the parent's income, the more likely it is that a prospective scholarship recipient can be considered deserving, as it shows the need to obtain financial support to continue education.
3. Number of Dependents (ND) is benefit criteria, refers to the number of family members who depend on the income of parents or guardians. This includes children, elderly parents, or other family members who need financial support. The more dependents in the family, the greater the economic burden the parents face, and this can be an important supporting factor in the selection of scholarship recipients for those who need more help.

4. Home Status (HS) is benefit criteria, describes the living conditions of prospective scholarship recipients. This factor is used to assess the socioeconomic status of a family. Owned and livable homes indicate family economic stability, while rented or unlivable homes indicate more limited economic conditions. This scale is rated from 1 (unsuitable or boarding houses) to 5 (private and livable houses).
5. Village Recommendation (VR) is benefit criteria, is an official recommendation letter issued by the local village or village, which states that prospective scholarship recipients come from underprivileged families. This letter serves as verification to ensure that the economic condition data submitted by prospective scholarship recipients is true and in accordance with the facts. This recommendation strengthens the candidate's credibility in the scholarship selection process.
6. Interview Results (IR) is benefit criteria, are the results of interviews conducted with prospective scholarship recipients. The interview aims to delve deeper into the candidate's motivation, educational goals, and commitment in completing their studies. The results of these interviews provide an overview of the candidate's personality, communication skills, and the extent to which they understand the importance of education and how this scholarship will help them realize their goals.

Determining Criteria Weights Using G2M Weighting

G2M weighting is a new approach used in the determination of criterion weights in a data-based multi-criteria evaluation DSS. This method combines evaluation data to produce a more objective and accurate weighting of criteria. G2M Weighting is an effective tool to produce more valid and acceptable weighting criteria in a variety of complex decision-making contexts. Here are the general steps in determining the weighting of criteria using G2M weighting:

The decision matrix is the first process in G2M weighting that contains assessment data from all alternatives for each set criterion, the decision matrix is created using (1), the general form of the decision matrix is as follows.

$$X = \begin{bmatrix} x_{11} & x_{21} & x_{31} & x_{41} & x_{51} & x_{61} \\ x_{12} & x_{22} & x_{32} & x_{42} & x_{52} & x_{62} \\ x_{13} & x_{23} & x_{33} & x_{43} & x_{53} & x_{63} \\ x_{14} & x_{24} & x_{34} & x_{44} & x_{54} & x_{64} \\ x_{15} & x_{25} & x_{35} & x_{45} & x_{55} & x_{65} \\ x_{15} & x_{26} & x_{36} & x_{46} & x_{56} & x_{66} \\ x_{17} & x_{27} & x_{37} & x_{47} & x_{57} & x_{67} \\ x_{18} & x_{28} & x_{38} & x_{48} & x_{58} & x_{68} \end{bmatrix}$$

The results of the decision matrix based on alternative assessment data in table 1 of the criteria used are as follows.

$$X = \begin{bmatrix} 3.5 & 18000000 & 5 & 2 & 5 & 85 \\ 2.8 & 22000000 & 4 & 3 & 4 & 78 \\ 3.9 & 15000000 & 6 & 2 & 5 & 90 \\ 3 & 30000000 & 3 & 4 & 3 & 75 \\ 3.3 & 25000000 & 5 & 3 & 4 & 82 \\ 2.7 & 19000000 & 7 & 2 & 5 & 79 \\ 3.8 & 17000000 & 4 & 3 & 5 & 88 \\ 2.9 & 28000000 & 6 & 2 & 4 & 80 \end{bmatrix}$$

The geometric mean value is the second process in G2M weighting which is calculated for each criterion by multiplying all the alternative values and then rooting based on the number of alternatives, the geometric mean value is calculated using (2).

$$GM_1 = \left(\prod_{i=1}^{j} x_1\right)^{1/8} = (3.5 * 2.8 * 3.9 * 3 * 3.3 * 2.7 * 3.8 * 2.9)^{1/8} = 3.2095$$

$$GM_2 = \left(\prod_{i=1}^{j} x_2\right)^{1/8} = (1800000 * 2200000 * 1500000 * 3000000 * 2500000 * 1900000 * 1700000 * 2800000)^{1/8} = 2116659.6590$$

$$GM_3 = \left(\prod_{i=1}^{j} x_3\right)^{1/8} = (5 * 4 * 6 * 3 * 5 * 7 * 4 * 6)^{1/8} = 4.8425$$

$$GM_4 = \left(\prod_{i=1}^{j} x_4\right)^{1/8} = (2*3*2*4*3*2*3*2)^{1/8} = 2.5392$$

$$GM_5 = \left(\prod_{i=1}^{j} x_5\right)^{1/8} = (5*4*5*3*4*5*5*4)^{1/8} = 4.3142$$

$$GM_6 = \left(\prod_{i=1}^{j} x_6\right)^{1/8} = (85*78*90*75*82*79*88*80)^{1/8} = 81.9840$$

Normalization is the third process in G2M weighting which is calculated by dividing the value of each alternative on a criterion by the geometric average of the criterion, the normalization value is calculated using (3).

$$R_{11} = \frac{x_{11}}{GM_1} = \frac{3.5}{3.2095} = 1.0905$$

The overall results of the normalization value calculation in G2M weighting are shown in table 2 of each alternative based on the criteria data.

Table 2. Normalization value G2M weighting

Candidate Name	**Criteria Name**					
	IPK	**PI**	**ND**	**HS**	**VR**	**IR**
SS Candidate	1.0905	0.8504	1.0325	0.7877	1.1590	1.0368
AD Candidate	0.8724	1.0394	0.8260	1.1815	0.9272	0.9514
CF Candidate	1.2152	0.7087	1.2390	0.7877	1.1590	1.0978
RY Candidate	0.9347	1.4173	0.6195	1.5753	0.6954	0.9148
WQ Candidate	1.0282	1.1811	1.0325	1.1815	0.9272	1.0002
DF Candidate	0.8413	0.8976	1.4455	0.7877	1.1590	0.9636
UT Candidate	1.1840	0.8032	0.8260	1.1815	1.1590	1.0734
HI Candidate	0.9036	1.3228	1.2390	0.7877	0.9272	0.9758

The gray coefficient is the fourth process in G2M weighting to measure the degree of proximity between an alternative and an ideal value, the gray coefficient value is calculated using (4).

$$GRG_1 = \frac{1}{8}\sum_{j=1}^{n} R_{11,18} = \frac{1}{8} * (8.0699) = 1.0087$$

$$GRG_2 = \frac{1}{8}\sum_{j=1}^{n} R_{21,28} = \frac{1}{8} * (8.2205) = 1.0276$$

$$GRG_3 = \frac{1}{8}\sum_{j=1}^{n} R_{31,38} = \frac{1}{8} * (8.2601) = 1.0325$$

$$GRG_4 = \frac{1}{8}\sum_{j=1}^{n} R_{41,48} = \frac{1}{8} * (8.2704) = 1.0338$$

$$GRG_5 = \frac{1}{8}\sum_{j=1}^{n} R_{51,58} = \frac{1}{8} * (8.1128) = 1.0141$$

$$GRG_6 = \frac{1}{8}\sum_{j=1}^{n} R_{61,68} = \frac{1}{8} * (8.0138) = 1.0017$$

Criterion weighting is the last process in G2M weighting which is obtained from the average value of the gray coefficient in each criterion, the value of the criterion weight is calculated using (5).

$$w_1 = \frac{GRG_1}{\sum_{i=1}^{j} GRG_{1,6}} = \frac{1.0087}{6.1184} = 0.1649$$

$$w_2 = \frac{GRG_2}{\sum_{i=1}^{j} GRG_{1,6}} = \frac{1.0276}{6.1184} = 0.1679$$

$$w_3 = \frac{GRG_3}{\sum_{i=1}^{j} GRG_{1,6}} = \frac{1.0325}{6.1184} = 0.1688$$

$$w_4 = \frac{GRG_4}{\sum_{i=1}^{j} GRG_{1,6}} = \frac{1.0338}{6.1184} = 0.1690$$

$$w_5 = \frac{GRG_5}{\sum_{i=1}^{j} GRG_{1,6}} = \frac{1.0141}{6.1184} = 0.1657$$

$$w_6 = \frac{GRG_6}{\sum_{i=1}^{j} GRG_{1,6}} = \frac{1.0017}{6.1184} = 0.1637$$

The weights obtained for the GPA, PI, ND, HS, VR, and IR criteria showed a fairly balanced weight distribution among the criteria, with slight differences among the values. The HS criterion had the highest weight of 0.1690, indicating that the results of the study were considered a slightly more important factor than other criteria in decision-making. Meanwhile, IR has the lowest weight of 0.1637, which suggests that while relevance is important, this factor is slightly lower in importance compared to other criteria. Other criteria, such as PI, ND, VR, and GPA have almost similar weights, ranging from 0.1649 to 0.1688, which suggests that each of these criteria has a nearly equal contribution to the evaluation process. Overall, the weighted results reflect a balanced approach in considering all criteria.

Best Alternatives Using the MOORA Method

The MOORA method is used to select the best alternative based on a number of relevant criteria. The MOORA method allows for objective and structured decision-making, so that the best alternative can be selected based on a thorough evaluation of all relevant criteria. Here are the general steps in determining the best alternative using the MOORA method:

The decision matrix is the first process in MOORA that contains assessment data from all alternatives to each set criteria, the decision matrix is created using (1).

Normalization is the second process in MOORA which is calculated by dividing the value of each alternative on a criterion, the normalization value is calculated using (6).

$$n_{11} = \frac{x_{11}}{\sqrt{\sum_{i=1}^{m} {x_{11,18}}^2}} = \frac{3.5}{\sqrt{3.5^2 + 2.8^2 + 3.9^2 + 3^2 + 3.3^2 + 2.7^2 + 3.8^2 + 2.9^2}} = \frac{3.5}{9.2374} = 0.3789$$

The overall results of the normalization value calculation in MOORA are shown in table 3 of each alternative based on the criteria data.

Table 3. Normalization value MOORA

Candidate Name	**Criteria Name**					
	IPK	**PI**	**ND**	**HS**	**VR**	**IR**
SS Candidate	0.3789	0.2849	0.3434	0.2604	0.3990	0.3653
AD Candidate	0.3031	0.3482	0.2747	0.3906	0.3192	0.3352
CF Candidate	0.4222	0.2374	0.4121	0.2604	0.3990	0.3868
RY Candidate	0.3248	0.4748	0.2060	0.5208	0.2394	0.3223
WQ Candidate	0.3572	0.3957	0.3434	0.3906	0.3192	0.3524

DF Candidate	0.2923	0.3007	0.4808	0.2604	0.3990	0.3395
UT Candidate	0.4114	0.2691	0.2747	0.3906	0.3990	0.3782
HI Candidate	0.3139	0.4432	0.4121	0.2604	0.3192	0.3438

The optimization value is the final process in the MOORA method which is obtained by comparing the alternative performance ratio to each relevant criterion, the optimization value is calculated using (7).

$$Y_1 = \left(\sum_{j=1}^{g} n_{11,31,41,51,61} * w_{1,3,4,5,6}\right) - \left(\sum_{j=g+1}^{n} n_{21} * w_1\right)$$

$$Y_1 = \big((0.3789 * 0.1649) + (0.3434 * 0.1688) + (0.2604 * 0.1690) + (0.3990 * 0.1657) + (0.3653 * 0.1637)\big) - (0.2849 * 0.1679)$$

$$Y_1 = (0.2904) - (0.0478) = 0.2425$$

The overall results of the calculation of the optimization value of each alternative on MOORA are shown in table 4 of the alternatives as a whole.

Table 4. Normalization value MOORA

Candidate Name	**Final Value**
SS Candidate	0.2425
AD Candidate	0.2116
CF Candidate	0.2727
RY Candidate	0.1890
WQ Candidate	0.2270
DF Candidate	0.2445
UT Candidate	0.2630
HI Candidate	0.2001

This optimization value helps determine the best alternative based on a balance between various criteria. The MOORA method also makes it possible to consider multiple objectives simultaneously, without having to make decisions based on a single criterion. Based on the optimization value, the results of alternative ranking are made which are shown in figure 2.

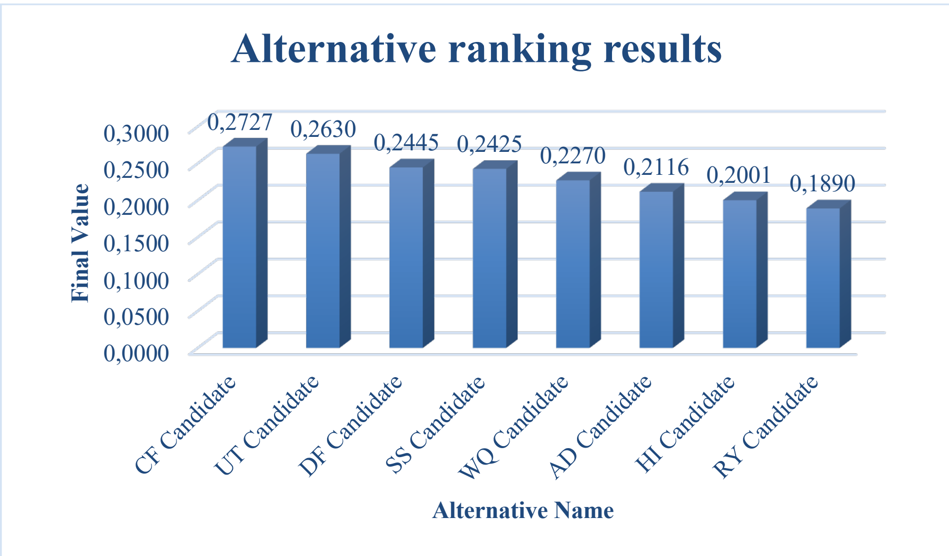

Figure 2. Alternative ranking results

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Evaluation and ranking results in the selection of scholarship recipients, CF candidates managed to occupy the first position with a final score of 0.2727, showing the best performance among all candidates. In second place, UT candidates obtained a score of 0.2630, followed by DF candidates with a score of 0.2445 and SS candidates with a score of 0.2425, both of which showed relatively balanced performance. Furthermore, WQ candidates occupy the fifth position with a value of 0.2270, followed by AD with a value of 0.2116, and HI with a value of 0.2001. The RY candidate took the last position with a score of 0.1890, indicating that there is greater room for improvement than the other candidates. Overall, these results reflect a variation in performance between candidates with a significant difference in scores, especially between the top and bottom rankings. The final scores obtained by each candidate can be an important basis for further decision-making, such as the determination of the best candidates or the planning of the next development step.

Comparative Analysis of Alternative Rankings

Criterion weight-comparison analysis is a process to evaluate and compare the level of importance of each criterion in a decision-making system. The weight of criteria reflects how much influence or priority a criterion has on the final outcome of the decision. In this analysis, the weights produced from G2M weighting, entropy weighting, criteria importance through intercriteria correlation (CRITIC) weighting and method based on the removal effects of criteria (MEREC) weighting. The purpose of this analysis is to ensure that the weights given reflect the actual priorities in accordance with the objectives of the evaluation. The results of the criteria weighting from the G2M weighting, entropy weighting, CRITIC weighting, and MEREC weighting methods from the alternative assessment data are shown in table 5.

Table 5. Criterion weight comparison results

Method	**Criteria Name**					
	IPK	**PI**	**ND**	**HS**	**VR**	**IR**
G2M Weighting	0.1649	0.1679	0.1688	0.1690	0.1657	0.1637
Entropy Weighting	0.0758	0.2351	0.2657	0.2937	0.1148	0.0150
CRITIC Weighting	0.1552	0.2383	0.1572	0.2504	0.1160	0.0830
MEREC Weighting	0.1561	0.1283	0.1626	0.2584	0.1282	0.1665

The results of the weighting comparison of the criteria results of four different weighting methods (G2M Weighting, Entropy Weighting, CRITIC Weighting, and MEREC Weighting) against six criteria, namely: GPA, PI, ND, HS, VR, and IR. G2M Weighting produces fairly balanced weights for all criteria, with values ranging from 0.1637 to 0.1690. This suggests that G2M methods tend to consider all criteria almost equally important. Entropy Weighting shows large weight variations between criteria. The HS criterion has the highest weight (0.2937) and the lowest weight IR (0.0150). This reflects that based on the variation in data, HS is considered much more informative than IR. CRITIC Weighting also provides a noticeable weight difference between the criteria. HS again became the most weighted criterion (0.2504), followed by PI (0.2383), while IR had the lowest weight (0.0830). This shows that CRITIC assesses HS and PI to have greater information and conflict contributions than other criteria. MEREC Weighting results in a fairly moderate weight distribution, with HS remaining dominant (0.2584), but weights for IR (0.1665) and GPA (0.1561) are relatively not much different. MEREC tends to show balance but still emphasizes the superiority of certain criteria.

After determining the weight of the criteria using various methods, the next step is to compare the results of alternative rankings based on those weights. This comparison aims to see the consistency, differences, and influence of the weighting method on the resulting alternative priority order. By analyzing the ranking results of each method, insights can be obtained about decision stability, sensitivity to weight changes, and which method provides the most logical results or in accordance with the context of the problem at hand. This analysis is an important part of ensuring that the decisions taken really consider various aspects objectively and in a balanced manner. The results of the alternative ranking comparison are shown in figure 3.

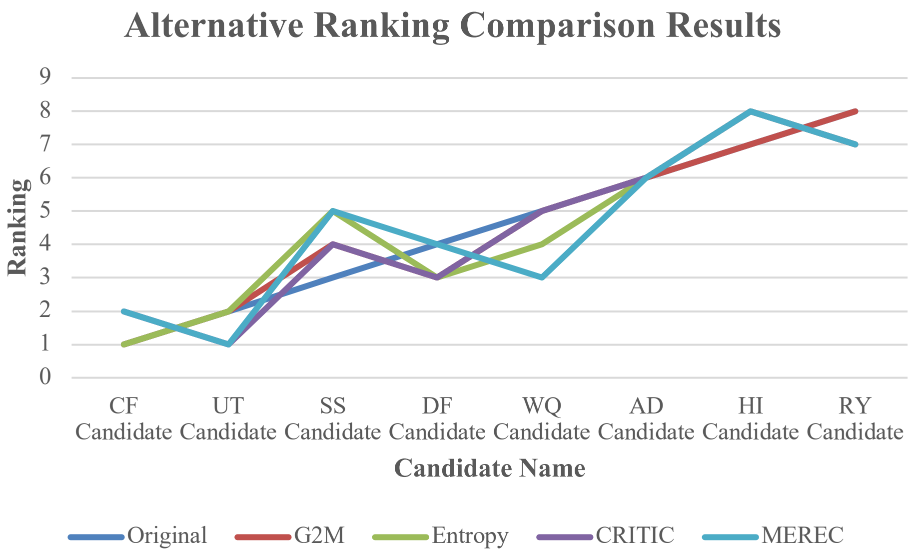

Figure 3. Alternative Ranking Comparison Results

The Alternative Ranking Comparison Results graph shows a comparison of the ranking results of eight candidates (CF, UT, SS, DF, WQ, AD, HI, RY) obtained from five weighting methods, namely G2M, Entropy, CRITIC, MEREC, and the Original ranking. It is evident that each method produces different ranking position variations for each candidate, reflecting differences in sensitivity to the criteria weights. For example, candidate CF has the highest ranking according to Entropy, while G2M, CRITIC, and MEREC tend to assign a lower position. Conversely, candidates HI and RY consistently achieve high rankings across almost all methods, indicating relatively stable and superior performance. This differing pattern shows that the choice of weighting method can affect the final results, thus integrating G2M with MOORA could be the right approach to obtain more accurate and consistent results.

Discussion

The results of alternative rankings show patterns of consistency and shifts that are interesting to analyze in depth. CF Candidates generally dominate the top rankings in the Original, G2M, and Entropy methods, which indicates that these candidates have a stable advantage based on the weighting of the basic criteria as well as weighting based on the distribution of information. However, when using the CRITIC and MEREC methods, CF Candidate shifted to second place, while UT Candidate moved up to first place. This shift suggests that UT Candidate has stronger attributes when criterion weights take into account the level of conflict between data. The relationship between alternative ranking results obtained from various weighting methods was carried out using Spearman's rank correlation coefficient. This test was chosen because it does not depend on data distribution and is able to measure the strength and direction of the monotonic relationship between two variables in the form of ranking. With this correlation analysis, it is possible to determine the degree of similarity in the sequence pattern produced by each method, as well as assess the consistency of the decision in various weighting approaches. The results of the Spearman correlation test will be the basis for evaluating whether the methods used produce uniform results or show significant differences in alternative rankings. The results of the spearman correlation test are shown in table 6.

Table 6. Spearman correlation test results

Method	Correlation Value
G2M Weighting	0.9879
Entropy Weighting	0.9515
CRITIC Weighting	0.9636
MEREC Weighting	0.9273

The results of the Spearman correlation test, shown in Table 6, obtained a high correlation coefficient value for all weighting methods against the original ranking. G2M Weighting shows the highest correlation value of 0.9879, indicating that the resulting alternative order is almost identical to the initial ranking. The Entropy Weighting and CRITIC Weighting methods had correlation values of 0.9515 and 0.9636, respectively, which also showed a very strong relationship with the original rankings although there were slight variations in the alternate sequences. Meanwhile, MEREC Weighting has the lowest correlation value of 0.9273, but remains in the category of a very strong relationship. Overall, these results confirm that the weighting method used resulted in an alternative ranking pattern that was relatively consistent with the initial ranking, with small variations that may reflect differences in sensitivity to the weighting of the criteria.

G2M Weighting has a major advantage in handling non-uniform data because its approach considers the balance between the average value and the data spread in determining the weighting of the criteria. In situations where the data between criteria have varying degrees of variability, this method is able to provide a fairer and proportionate weight without relying too much on the extremity of the value or focusing only on variation. Unlike methods such as Entropy or CRITIC which are highly sensitive to large fluctuations in data, G2M Weighting maintains weight stability by integrating generalization and multicriteria factors simultaneously. This makes G2M more resistant to distortion due to data outliers or irregularities, while still considering the importance of information distribution between attributes. Thus, G2M Weighting is an effective choice for situations where data is not homogeneous and requires an adaptive and stable weighting approach.

CONCLUSION

The integration of the G2M Weighting method with MOORA provides a robust and accurate approach in the decision-making process for the selection of the best alternatives. As a result of the evaluation and ranking in the selection of scholarship recipients, CF candidates managed to occupy the first position with a final score of 0.2727, showing the best performance among all candidates. In second place, UT candidates obtained a score of 0.2630, followed by DF candidates with a value of 0.2445 and SS candidates with a value of 0.2425, both showing relatively balanced performance. This approach not only improves decision accuracy but also improves the transparency and reliability of the evaluation process, making it a very useful solution in selecting the best alternatives across a wide range of multi-criteria decision applications. The results of the Spearman correlation test of the 4 methods used for G2M weighting showed the highest correlation value of 0.9879, which indicates that the resulting alternative order is almost the same as the initial rating. These results confirm that the G2M weighting method used resulted in an alternative ranking pattern that was relatively consistent with the initial ranking, with slight variations that may reflect differences in sensitivity to criterion weighting. The contribution of this research lies in the development of a decision-making model that integrates G2M weighting with the MOORA method, which has been proven to produce accurate, consistent, and objective alternative rankings. This approach expands the application of G2M in the context of ratio-based ranking methods and provides a framework that can be adapted for various fields. Furthermore, this research provides empirical evidence that the G2M-MOORA combination can minimize subjective bias in weight determination, enhance the validity of results, and ensure transparency in the evaluation process.

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