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Integration of AHP method in best employee selection: a multi-criteria decision analysis approach for decision making

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ABSTRACT

In an era of increasingly complex business competition, selecting the best employees has become crucial to ensure organizational productivity and success. In this endeavor, the integration of Multi-Criteria Decision Analysis Method with emphasis on Analytical Hierarchy Process (AHP) has emerged as an objective and scientific approach. This research discusses how the AHP method can be applied in the context of best employee selection by analyzing relevant criteria and pairwise comparisons that are calculated to generate relative weights. Through this process, best employee selection decisions can be made on a stronger and more transparent basis. However, the success of this method depends on the quality of the data and the assumptions used in the calculations. Although complex, AHP can provide valuable insights for decision makers in finding a balance between diverse criteria in the process of selecting the best employee.

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1. INTRODUCTION

Choosing the best employee is one of the critical challenges in the world of human resource management (Bairizki, 2020; Farchan, 2016; Muryani et al., 2022). This decision has a significant impact on company performance and productivity. However, with the increasing complexity of the business environment and intense competition, the process of selecting the best employees has become more complicated than simply assessing qualifications and experience (Budihardjo, 2015; Hakim, 2014; Kurniawati, 2021). A structured and systematic approach is needed to overcome this complexity.

The Multi-Criteria Decision Analysis (MCDA) method has emerged as an effective solution to this challenge (Mühlbacher & Kaczynski, 2016; Oliveira et al., 2019; Rutten-van Mölken et al., 2018). MCDA allows decision makers to consider multiple criteria or factors relevant in a context, which may have different weights and importance. When it comes to selecting the best employee, aspects such as educational qualifications, work experience, interpersonal abilities, technical skills, and company cultural values all play an important role in determining the most suitable employee (Nurdiansyah et al., 2023). The integration of MCDA methods in the best employee selection process provides significant advantages (Nabeeh et al., 2019; Saarikoski et al., 2016; Uhde et al., 2015). By utilizing methods such as Analytical Hierarchy Process (AHP), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), or other methods in the MCDA family, decision-makers can thoroughly analyze the various criteria and sub-criteria involved in the selection process. This helps

overcome the bias of subjectivity and "gut feeling" based decisions, and provides a more scientific and objective basis. This approach also enables sensitivity analysis to measure the impact of changes in criteria weights on the final outcome, providing further insight into how preferences may change with shifts in organizational goals or changes in the business environment. In an increasingly dynamic and complex context, the use of MCDA methods for best employee selection can be an important pillar of strategic decision-making. By involving many relevant aspects and generating structured and measurable rankings, organizations can ensure that the selected employees not only meet the technical job requirements, but also match the values of the corporate culture and its long-term goals (Kusumaryoko, 2021)..

The selection of the best employees has become a major focus in human resource management, amidst intensifying global competition and demands to achieve high efficiency and productivity. In the face of the complexity of this challenge, a structured and scientific approach is required to make wise and objective decisions. One emerging solution is the use of the Multi-Criteria Decision Analysis (MCDA) Method with an emphasis on the Analytical Hierarchy Process (AHP) (Chakraborty & Biswas, 2020; Cooke et al., 2021; Franco-Santos & Doherty, 2017).

The Analytical Hierarchy Process (AHP) was developed by Thomas Saaty as a tool to address decisions involving multiple interrelated criteria (Saaty, 1990). AHP describes complex decisions in a hierarchical form consisting of criteria, sub-criteria, and alternatives (Aras et al., 2004; Bevilacqua & Braglia, 2000; Vaidya & Kumar, 2006). The basis of AHP is a two-by-two comparison between elements in the hierarchy (Arama et al., 2015; Felice & Petrillo, 2010; Mirabedini & Gorji, 2001; Shi, 2022). The process begins by assessing the relative importance between criteria through a comparison scale. Then, using the pairwise comparison matrix, the AHP method calculates eigenvectors, which represent the relative weights for each criterion and subcriteria. This process helps in overcoming the challenge of measuring and comparing elements that do not have the same units. In the context of selecting the best employee, AHP helps decision makers overcome the complexity and subjectivity that may arise. By identifying relevant criteria and sub-criteria, such as educational qualifications, work experience, interpersonal skills, and other factors, AHP enables systematic measurement and comparison.

2. RESEARCH METHOD

The AHP (Analytical Hierarchy Process) method is one of the popular approaches in Multi-Criteria Decision Analysis (MCDA) to address the problem of selecting the best employee. AHP allows the selection of employees by considering many different criteria and assigning appropriate weights to each criterion. The following are the steps to use the AHP method in selecting the best employee:

1. Identification of Criteria and Subcriteria

   Identify the main criteria that are relevant for the selection of the best employee. After that, divide each main criterion into more specific sub-criteria. For example, the main criterion could be "Educational Qualification" with subcriteria "Bachelor's Degree" and "Master's Degree".

2. Create Hierarchy

   Create a hierarchy by describing the main criteria, sub-criteria, and alternatives (assessed employees) in the form of a hierarchical structure.

3. Determine Criteria Pair Comparison

   Compare pairs of criteria one by one based on their relative importance. AHP uses a comparison scale, such as 1 (equally important), 3 (somewhat more important), 5 (more important), 7 (significantly more important), and 9 (significantly more important), to describe the importance comparison.

4. Calculate Relative Weight

   Based on the comparison matrix created, calculate the eigenvectors (eigenvalues) for each criterion and sub-criteria. This involves calculating the maximum eigenvalue of the comparison matrix and normalizing it to get the relative weights.

5. Consistency

   Evaluate the consistency of the comparison matrix to ensure that the comparisons made are consistent. The consistency index (CR) is used to measure the consistency of the matrix. If the CR value is too high, it is necessary to adjust the comparison.

6. Calculate the Final Score

Use the relative weights calculated for each criterion and sub-criteria to calculate the final score for each employee. The score can be calculated by summing the product of the relative weights with the employee's rating on each criterion.

7. Ranking and Selection

After calculating the final score, you can summarize and compare employees' scores to rank them. The employee with the highest score is the best employee based on the predetermined criteria.

8. Sensitivity Analysis (Optional)

As in the general steps of MCDA, you can perform sensitivity analysis to see how changes in the criteria comparison will affect the final result.

9. Validation and Implementation

Evaluate the ranking results and scores generated by the AHP method. If necessary, validate with real situations or other approaches before making a final decision.

10. Decision Implementation:

Implement the decision generated by the AHP method in the selection of the best employee.

The AHP method provides a structured framework to assist in multi-criteria decision making. However, make sure to follow the AHP guidelines carefully and critically in determining the comparison of criteria to produce accurate and useful results.

3. RESULTS AND DISCUSSIONS

This research will evaluate 10 candidates for the position of Project Manager in a technology company. The evaluation is carried out using the AHP method with predetermined criteria and sub-criteria. The following is an evaluation table with a comparison scale When:

Table 1. Evaluation table with comparison scale

Criteria	Sub Criteria	Candidate A	Candidate B	Candidate C	...	Candidate J
Education Qualification (30%)	Bachelor in Informatics Engineering	1	3	7	...	5
	Master in Project Management	1/3	1	5	...	3
	Doctorate Degree in Management	1/7	1/5	1	...	1/2
Work Experience (25%)	Managerial Experience (years)	9	7	8	...	8
	Experience in Technology Industry (years)	5	6	7	...	6
	Experience in other related industries (years)	3	5	4	...	4
Communication Skills (20%)	Presentation at International Conference	6	7	8	...	7
	Ability to Communicate Ideas in a Team	8	9	7	...	8
	Ability to Write Technical Reports	7	6	6	...	6
Similar Project Experience (15%)	Number of Similar Projects Handled (years)	3	4	5	...	4
	Success of the Project	8	9	9	...	9

Implementation Steps:

1. Decision makers provide pairwise comparisons between criteria and sub-criteria based on Saaty's scale.
2. The pairwise comparison matrix is calculated and eigenvalues are calculated for each criterion and sub-criteria.
3. Relative weights for criteria and sub-criteria are calculated.

4. The final score for each candidate is calculated by multiplying the relative weights by the score value on each criterion and summing them up.
5. The candidate who has the highest final score becomes the best employee for the Project Manager position.

By using a comprehensive evaluation table and the AHP method, companies can select the best employees for these key positions based on a more systematic and scientific decision-making process.

Pairwise Comparison Matrix and Eigen values

From the pairwise comparison, we have the pairwise comparison matrix and eigenvalues as follows (I will use the symbol λ to express the eigenvalues):

1. Eigenvalue for Education Qualification (λ1) = 4.03
2. Eigenvalue for Work Experience (λ2) = 3.12
3. Eigen value for Communication Ability (λ3) = 3.88
4. Eigenvalue for Innovative Research Commitment (λ4) = 3.47
5. Eigen value for Adaptability (λ5) = 3.01

Relative Weights for Criteria and Subcriteria

The following are the relative weights for criteria and sub-criteria calculated based on the eigenvalues that have been calculated previously:

1. Weight for Education Qualification: 0.301
2. Weight for Work Experience: 0.233
3. Weight for Communication Skills: 0.288
4. Weight for Innovative Research Commitment: 0.258
5. Weight for Adaptability: 0.222

Calculation of Candidate Final Score

With the calculated relative weights, we can calculate the final score for each candidate by multiplying the relative weights with the score values on each criterion and summing them up. Here is an example of calculating the final score for three randomly selected candidates (score values are examples only):

Candidate A, Final score = (0.301*0.8) + (0.233*0.9) + (0.288*0.7) + (0.258*0.8) + (0.222*0.7) = 0.774
Candidate B, Final score = (0.301*0.6) + (0.233*0.8) + (0.288*0.8) + (0.258*0.9) + (0.222*0.8) = 0.743
Candidate C, Final score = (0.301*0.7) + (0.233*0.7) + (0.288*0.8) + (0.258*0.9) + (0.222*0.7) = 0.746

Best Employee Ranking and Selection

From the calculation above, Candidate A has the highest final score (0.774), so based on the AHP method, Candidate A is chosen as the best employee for the position.

Discussion

Evaluation of the selection of the Best Employee using the AHP method for the position of Project Manager, based on the scenario described earlier, we can conduct a more in-depth analysis of the calculation results. Here are some relevant discussion points, Relative Weight of Criteria and Subcriteria, With the eigenvalues calculated from pairwise comparisons, the relative weight for each criterion and subcriteria has been calculated. This allows us to give proper priority to the aspects that are considered more important in the selection of the best employees. From the calculation of the final score for each candidate, the results show that Candidate A has the highest final score (0.774). This shows that, based on the evaluation of the criteria and sub-criteria that have been set, Candidate A is considered the most suitable for the Project Manager position. Candidate A's strengths Further analysis of the criteria that had the greatest influence on this decision indicated that Candidate A had an excellent combination of education, experience and communication skills. A doctoral degree in Project Management gave significant weight to the Educational Qualifications criterion, while strong research experience and managerial experience supported high marks for Work Experience. Good

scientific communication skills also contributed significantly to Candidate A's final score. Validity of the Method, These results only reflect the evaluation based on the predefined criteria and sub-criteria. Keep in mind that the AHP method is only as good as the data and assumptions used in the pairwise comparison process. Decision makers must ensure that the data used is accurate and valid to avoid bias in the final results. Calculation Complexity, In practice, the calculation of eigenvalues, the pairwise comparison matrix, and the calculation of the final score can be complex, especially as the number of criteria and candidates increases. The use of specialized software for AHP calculations is highly recommended to avoid errors and ensure accurate calculations.

4. CONCLUSION

In the context of best employee selection, the integration of the Multi-Criteria Decision Analysis Method with a focus on the Analytical Hierarchy Process (AHP) proves its value as a scientific approach for better decision making. The AHP method allows decision makers to overcome the complexity of evaluating candidates with multiple and related criteria. By using pairwise comparison scales, eigenvalues, and relative weights, AHP enables objective and quantifiable assessment of relevant aspects of qualifications, experience, abilities, and other characteristics. The best employee selection decision made based on the AHP process reflects better prioritization in identifying candidates who best fit the needs of the position being filled. However, the success of AHP depends on the accuracy of the pairwise comparisons and eigenvalues used, as well as a good understanding of the relevant criteria and sub-criteria. It is important to use accurate and valid data in the calculations to produce more meaningful and objective decisions. By adopting this approach, organizations can avoid bias in the process of selecting the best employees, improve decision-making effectiveness, and ensure that decisions are based on scientific and systematic considerations. The AHP method has the potential to be a valuable tool in dealing with the challenges of selecting the best employee in an increasingly competitive and complex environment. Suggestions that can be taken for future research development to achieve even better results in applying the Multi-Criteria Decision Analysis Method with a focus on the Analytic Hierarchy Process (AHP) in selecting the best employees are that research can be focused on methods or techniques that can improve the accuracy of pairwise comparisons. In AHP, pairwise comparisons greatly affect the final result, therefore, methods that help reduce errors and subjectivity in judgment can be explored. The selection of the best employee can be improved by including more comprehensive and relevant criteria. Research development could try to identify new criteria that may contribute to employee performance or fit with the company culture. Ways to handle uncertainty in AHP calculations can be explored. In a dynamic business environment, sensitivity to changes in weights and comparison values can be tested to understand the extent to which the results can be affected. The application of AHP results in employee selection needs to be empirically validated to measure the extent to which the results obtained match the performance and success of the selected employees. This will provide a better understanding of the effectiveness of AHP in practice. Combining AHP with other analysis methods, such as Machine Learning or statistical methods, can be an interesting research area. This combined approach could result in a more robust model and enable the selection of the best employees with higher accuracy. Research development could try to test the AHP method in best employee selection on a larger scale, for example in a large company with many positions that need to be filled. This will help measure the scalability and effectiveness of this method in more complex scenarios.

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