

Employee Performance Evaluation Using the Standard Method of Deviation Multi-Objective Optimization by Ratio Analysis

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Abstract: Employee performance refers to the extent to which an employee can achieve the goals and expectations that have been set by the organization, both in terms of quantity and quality of work. Employee performance appraisals cover various aspects, such as productivity, skills, discipline, creativity, and the ability to adapt to change. The main problem in employee performance evaluation is often related to the accuracy of assessments of various aspects of performance. Employee performance appraisal is a systematic process to evaluate the extent to which an employee meets the standards set by the organization in carrying out his or her duties and responsibilities. The purpose of this study is to apply the SD-MOORA method in evaluating employee performance objectively and comprehensively in the evaluation process, improve the accuracy of assessment, and provide a clearer picture of employee performance based on relevant criteria. The results of employee performance evaluation using the SD-MOORA method show that Siti Aisyah and Dina Putri occupy the top position with the same preference value, which is 0.47715, which indicates that their performance is superior in meeting the evaluation criteria. Both of these employees demonstrated consistent performance across the various aspects measured. In second place, there is Ahmad Firdaus with a preference score of 0.42932, which also reflects a fairly good contribution, although slightly lower than the two employees in the first rank. These results provide guidance for management to identify the best performing employees as well as design appropriate development strategies for other employees to increase their contributions in the future.

Keywords: Decision-making; Employee; Evaluation; Performance; SD-MOORA;

1. INTRODUCING

Employee performance refers to the extent to which an employee can achieve the goals and expectations that have been set by the organization, both in terms of quantity and quality of work[1], [2]. Employee performance appraisals cover various aspects, such as productivity, skills, discipline, creativity, and the ability to adapt to change. Effective

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performance evaluation takes into account not only the work results, but also the processes taken to achieve the goals, including the ability to collaborate in a team and good communication. With an objective performance appraisal system in place, organizations can provide constructive feedback, design appropriate development programs, and motivate employees to continuously improve their competencies. Performance evaluations also play an important role in decision-making regarding employee promotions, awards, and career development. Employee performance appraisal is a systematic process to evaluate the extent to which an employee meets the standards set by the organization in carrying out his or her duties and responsibilities[3], [4]. This process includes measuring various aspects, such as productivity, quality of work, technical skills, communication skills, as well as their contribution to the goals of the team and the company. The main problem in employee performance evaluation is often related to the accuracy of assessments of various aspects of performance. Often, the data used in the assessment is not entirely objective or can be influenced by personal biases. Assessments may also not accurately represent an employee's contribution to the company, especially when using methods that are too simplistic or do not take into account important criteria such as team collaboration, innovation, and quality of work. The main goal of performance appraisals is to provide constructive feedback to employees, identify areas for improvement, as well as design a more effective career development plan. In addition, this assessment also serves as the basis for decisions related to promotions, compensation, and awards, as well as ensuring alignment between individual performance and the organization's strategic goals.

A Decision Support System (DSS) is a computer-based system designed to assist decision-making in complex situations and involves many variables or criteria[5]. DSS is used to facilitate managers or decision-makers in choosing the best alternative from the various options available, taking into account various relevant factors or criteria. DSS uses a variety of analysis methods such as multi-criteria analysis, simulation, optimization, and statistical techniques to process data and produce objective and measurable recommendations. The main benefit of DSS is to improve the efficiency and effectiveness of decision-making[6]–[8]. With DSS, decisions are made based on objective data and information, reducing reliance on intuition or immeasurable estimates. DSS also helps speed up the decision-making process, as the system can quickly analyze large amounts of data and generate alternative solutions that can be considered. In addition, DSS also minimizes human error that may occur due to bias or limited knowledge. DSS can be used to evaluate various scenarios or alternatives, so that decision-makers can choose the most optimal solution according to the goals they want to achieve. DSS plays an important role in improving the quality of decisions and the success of the organization in achieving its goals[9].

The Standard Deviation Method for Multi-Objective Optimization with Ratio Analysis (SD-MOORA) is a decision-making method used to optimize multiple conflicting objectives by combining standard deviation and ratio analysis[10]. The essence of this method is to handle comparisons between different objectives while considering variability (or uncertainty) in the data. This method is often applied in situations where decision-makers need to evaluate various alternatives based on a set of criteria that have varying levels of importance and performance in each scenario. This method can improve decision-making by providing a more comprehensive analysis that takes into account both performance and uncertainty, resulting in more informative and balanced decisions in multi-objective optimization problems. The advantage of the SD-MOORA method lies in its ability to overcome optimization problems involving many conflicting objectives by considering the variability and uncertainty of the data[11]. By using standard deviations, this method can identify the stability and reliability of alternative performance across various criteria, so that decisions taken are more objective and not affected by possible data fluctuations. In addition, the use of ratio analysis allows for fairer comparisons between alternatives even

though the criteria used have different units or scales. This method also integrates weighting criteria, which allows adjustments according to different priorities or interests, resulting in solutions that are more in line with the specific goals of the decision-maker. The SD-MOORA method provides a transparent, flexible, and efficient framework for solving complex decision-making problems, especially in multi-objective contexts. The purpose of this study is to apply the SD-MOORA method in evaluating employee performance objectively and comprehensively in the evaluation process, improve the accuracy of assessment, and provide a clearer picture of employee performance based on relevant criteria. This study offers a contribution using an objective approach to determine the weighting of performance criteria by using standard deviations, which helps to reduce subjective bias in the assessment process. This allows companies to have a more accurate and fair evaluation of employee performance.

2. METHOD

Research Stage

The research stage is a systematic and structured series of steps or processes carried out by the researcher to answer a research question or solve a research problem [12], [13]. In the context of scientific research, this stage includes all activities that must be carried out from the planning stage to the stage of reporting research results. The purpose of the research stage is to ensure that the process of data collection, analysis, and conclusion drawing is carried out objectively, validly, and accountably [14], [15].

a. Identify Assessment Criteria and Variables

At this stage, the researcher will identify and establish the criteria and variables used in employee performance evaluation. These criteria can include aspects such as productivity, quality of work, punctuality, interpersonal skills, and managerial abilities. The determination of criteria is carried out by considering the purpose of the evaluation and the needs of the organization.

b. Data Collection

Employee performance data is collected through appropriate methods, such as direct observation, surveys, interviews, or performance reports. This data will include information related to employee performance across various predetermined criteria. In addition, the data collected also includes numerical values for each criterion to enable quantitative analysis.

c. Application of Standard Methods of Deviation and Multi-Objective Optimization

At this stage, the researcher will apply the standard deviation method to calculate the variation and uncertainty in the performance data collected. Furthermore, multi-objective optimization techniques will be used to optimize performance evaluation by considering several criteria at once, where each criterion has a certain weight. Ratio analysis is used to objectively compare employee performance based on predetermined criteria.

d. Result Analysis

After the application of the method, the next stage is to analyze the results of the performance evaluation. The researcher will analyze the data obtained to see how employees perform on each of the evaluated criteria. This analysis aims to identify the strengths and weaknesses of employees, as well as identify areas that need improvement.

e. Preparation of Recommendations and Conclusions

Based on the results of the analysis, recommendations for employee performance development will be prepared, both individually and collectively. These recommendations can include training, upskilling, or changes in managerial policies. The research will conclude with a conclusion that summarizes the main findings and

the contribution of the research to the improvement of the performance evaluation system in the organization.

SD-MOORA Method

SD-MOORA is a method used in decision support systems to solve multi-criteria optimization problems, by utilizing standard deviation as a tool to assess the consistency and stability of data in the calculation of preference ratios. This method combines the basic concepts of MOORA with the measurement of variation or distribution of data through standard deviations, to improve accuracy and objectivity in choosing the best alternative.

A decision matrix is a matrix that contains value data for each alternative based on predefined criteria.

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

Normalization is carried out to change the scale of the data so that it can be compared fairly.

$$x_{ij}^* = \frac{x_{ij}}{\sqrt{\sum_{i=1}^j x_{ij}^2}} \quad (2)$$

Standard deviations are used to assess data variation on each criterion.

$$\sigma_j = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_{ij}^* - \bar{x}_{ij})^2} \quad (3)$$

Criterion weights provide relative weight for each criterion in the decision-making process.

$$w_j = \frac{\sigma_j}{\sum_{j=1}^n \sigma_j} \quad (4)$$

The final stage is to calculate the preference value for each alternative. The final value of preference is calculated by the ratio of comparison between the alternative and the ideal solution.

$$y_i = \sum_{j=1}^n w_j * x_{ij}^* - \sum_{j=g+1}^n w_j * x_{ij}^* \quad (5)$$

The SD-MOORA method not only selects alternatives based on ratio comparisons but also assesses the stability and reliability of the data used in decisions, making it a very useful tool in complex and multi-criteria decisions.

3. RESULT AND DISCUSSIONS

Employee performance evaluation is a critical process in ensuring organizational growth and sustainability. It provides a structured framework to assess employees' contributions based on various performance criteria, such as productivity, teamwork, innovation, leadership, and problem-solving skills. However, challenges often arise in balancing subjective and objective factors in the evaluation process. To address these challenges, the integration of the Standard Method of Deviation (SD) with the Multi-Objective Optimization by Ratio Analysis (MOORA) method offers a systematic and quantitative approach to employee performance evaluation.

The SD-MOORA approach enhances decision-making by assigning weights to performance criteria using standard deviation, ensuring an objective reflection of the variability and importance of each criterion. Subsequently, the MOORA method evaluates and ranks employees based on their performance relative to the criteria. This combined approach ensures a fair and transparent evaluation process by emphasizing both consistency and differentiation among employees' performances. Implementing the SD-

MOORA method not only optimizes employee ranking but also aids organizations in identifying high-performing individuals who can drive strategic goals and foster a culture of excellence.

Data Collection

Data collection in Employee Performance Evaluation is an important stage in the employee performance evaluation process, where the necessary information is collected to measure the extent to which employees can meet the expectations and standards that have been set by the organization. The data collected can be both quantitative and qualitative data, and typically includes various aspects of performance, such as productivity, quality of work, communication skills, punctuality, and the ability to work in a team. This data collection is carried out through various methods, such as performance assessments conducted by direct supervisors, as well as interviews or direct observations of employee behavior in the workplace. In addition, historical data such as attendance records, target achievements, and feedback from customers are also often included in the assessment. Accurate and objective data collection is essential to produce a fair and thorough evaluation, which can ultimately be used to design employee development programs, promotions, or other related decisions in human resource management.

Table 1. Data Collection

Name	Productivity	Quality of Work	Communication Skills	Attendance	Ability to Work in a Team
Ahmad Firdaus	4	5	4	5	4
Siti Aisyah	5	4	5	5	5
Budi Santoso	3	3	4	4	3
Dina Putri	5	5	5	4	5
Rudi Prabowo	4	4	3	4	4
Laila Septiana	3	4	3	3	3

Employee performance evaluation data is obtained directly from the company through an internal assessment system designed to evaluate staff based on certain criteria. The data collection process involves supervisors and managers of related divisions who provide assessments of employee performance using quantitative methods. This data is then processed using a multi-criteria analysis method to objectively determine the performance rating of each employee, which will later be used as a basis for management decisions.

SD-MOORA Method in Employee Performance Evaluation

The SD-MOORA method is a combination of weight calculation using standard deviation and the MOORA method to evaluate employee performance objectively and accurately. The SD-MOORA approach provides more precise results because it combines weights based on data variability with multi-objective analysis, making it suitable for employee evaluation in various divisions. This method also helps companies identify employees with superior performance while providing insights for the development of overall performance improvement strategies.

A decision matrix is a matrix that contains value data for each alternative based on pre-defined criteria using equation (1).

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

Normalization is carried out to change the scale of the data so that it can be compared fairly using equation (2).

$$x_{11}^* = \frac{x_{11}}{\sqrt{\sum_{i=1}^j x_{i1,16}^2}} = \frac{4}{\sqrt{100}} = 0.4$$

The following calculation results using the SD-MOORA method for normalization values in employee performance evaluation, are shown in table 2.

Table 2. Normalization Values

Name	Productivity	Quality of Work	Communication Skills	Attendance	Ability to Work in a Team
Ahmad Firdaus	0.4	0.4834	0.4	0.4834	0.4
Siti Aisyah	0.5	0.3867	0.5	0.4834	0.5
Budi Santoso	0.3	0.29	0.4	0.3867	0.3
Dina Putri	0.5	0.4834	0.5	0.3867	0.5
Rudi Prabowo	0.4	0.3867	0.3	0.3867	0.4
Laila Septiana	0.3	0.3867	0.3	0.29	0.3

Standard deviations are used to assess data variation on each criterion using equation (3), the calculation results are shown in table 3.

Table 3. Standart Deviation Criteria

Productivity	Quality of Work	Communication Skills	Attendance	Ability to Work in a Team
0.08165	0.06643	0.08165	0.06643	0.08165

Criterion weights provide relative weight for each criterion in the decision-making process using equation (4), the calculation results are shown in table 4.

Table 4. Weight Criteria

Productivity	Quality of Work	Communication Skills	Attendance	Ability to Work in a Team
0.21611	0.17583	0.21611	0.17583	0.21611

The final stage is to calculate the preference value for each alternative. The final value of preference is calculated by the ratio of comparison between the alternative and the ideal solution using equation (5), the calculation results are shown in table 5.

Table 5. Preference Values Alternatives

Name	Preference Values
Ahmad Firdaus	0.42932
Siti Aisyah	0.47715
Budi Santoso	0.33510

Dina Putri	0.47715
Rudi Prabowo	0.37371
Laila Septiana	0.31349

The SD-MOORA method not only selects alternatives based on ratio comparisons but also assesses the stability and reliability of the data used in decisions, making it a very useful tool in complex and multi-criteria decisions. The results of employee performance evaluation rankings using SD-MOORA are shown in table 6.

Table 6. The Results of Employee Performance Evaluation Rankings Using SD-MOORA

Name	Preference Values	Ranking
Siti Aisyah	0.47715	1
Dina Putri	0.47715	2
Ahmad Firdaus	0.42932	3
Rudi Prabowo	0.37371	4
Budi Santoso	0.3351	5
Laila Septiana	0.31349	6

The results of employee performance evaluation using the SD-MOORA method show that Siti Aisyah and Dina Putri occupy the top position with the same preference value, which is 0.47715, which indicates that their performance is superior in meeting the evaluation criteria. Both of these employees demonstrated consistent performance across the various aspects measured. In second place, there is Ahmad Firdaus with a preference score of 0.42932, which also reflects a fairly good contribution, although slightly lower than the two employees in the first rank. Furthermore, Rudi Prabowo ranked fourth with a score of 0.37371, followed by Budi Santoso in fifth place with a score of 0.3351. In last position, Laila Septiana recorded a preference score of 0.31349, which indicates that there is room for improvement in her performance. These results provide guidance for management to identify the best performing employees as well as design appropriate development strategies for other employees to increase their contributions in the future.

4. CONCLUSION

Employee performance evaluation is a critical process in ensuring organizational growth and sustainability. It provides a structured framework to assess employees' contributions based on various performance criteria, such as productivity, teamwork, innovation, leadership, and problem-solving skills. However, challenges often arise in balancing subjective and objective factors in the evaluation process. To address these challenges, the integration of the Standard Method of Deviation (SD) with the Multi-Objective Optimization by Ratio Analysis (MOORA) method offers a systematic and quantitative approach to employee performance evaluation. The results of employee performance evaluation using the SD-MOORA method show that Siti Aisyah and Dina Putri occupy the top position with the same preference value, which is 0.47715, which indicates that their performance is superior in meeting the evaluation criteria. Both of these employees demonstrated consistent performance across the various aspects measured. In second place, there is Ahmad Firdaus with a preference score of 0.42932, which also reflects a fairly good contribution, although slightly lower than the two employees in the first rank. Furthermore, Rudi Prabowo ranked fourth with a score of 0.37371, followed by Budi Santoso in fifth place with a score of 0.3351. In last position, Laila Septiana recorded a preference score of 0.31349, which indicates that there is room for improvement in her performance. These results provide guidance for management to identify the best performing employees as well as design appropriate development strategies for other

employees to increase their contributions in the future. This study offers a contribution using an objective approach to determine the weighting of performance criteria by using standard deviations, which helps to reduce subjective bias in the assessment process. This allows companies to have a more accurate and fair evaluation of employee performance.

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