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Implementation of a Best Employee Assessment System Using Fuzzy Multiple Attribute Decision Making

Farah Munadia [1]*, Purnomo Hadi Susilo [2], Nur Qomariyah Nawafilah [3]

[1]*Informatics Engineering Study Program, Faculty of Science and Technology, Lamongan Islamic University*
farahmnd73@gmail.com[1]*, purnomo@unisla.ac.id[2], nq.nawafil@unisla.ac.id[3]

Abstract

Employee performance evaluation is a crucial process in human resource management to objectively identify individuals with superior performance. At PT Labari Sehat Perkasa, the evaluation process has traditionally been conducted manually, making it prone to subjectivity, inconsistency, and evaluator bias. These issues often lead to less optimal results in supporting managerial decisions such as promotions and rewards. Therefore, this study implements a technology-based employee evaluation system using the Fuzzy Multiple Attribute Decision Making (FMADM) method. This method was chosen for its ability to transform quantitative data into flexible linguistic values, thus enabling a more objective classification of employee performance. The system applies five main criteria: discipline, responsibility, initiative, job performance, and teamwork, each weighted according to its importance. The implementation results show that 82% of employees are categorized as "Good," 4% as "Very Good," and 12% as "Fair." In conclusion, the application of the FMADM method improves the objectivity of evaluations, simplifies decision-making processes, and enhances employee motivation and productivity at PT Labari Sehat Perkasa.

Keywords: *Employee Evaluation System, FMADM, Decision Support, Performance Assessment.*

1. Introduction

In the era of globalization, companies are required to manage human resources effectively in order to remain competitive. Human resources are the most valuable asset for a company because the quality of employee performance directly affects productivity and the achievement of organizational goals [1]. PT Labari Sehat Perkasa, as an outsourcing company engaged in labor provision services, faces challenges in selecting and objectively evaluating employee performance. To date, employee assessments are still conducted manually, which often leads to subjectivity and bias from evaluators [2]. This condition not only reduces the accuracy of assessment results but also has the potential to create a sense of unfairness among employees. Such circumstances can lead to decreased motivation, loyalty, and employee work enthusiasm [3]. Therefore, a structured, objective, and transparent evaluation system is needed so that management can make more accurate decisions related to job promotions, reward distribution, and periodic performance evaluations [4]. With the implementation of a technology-based system, the assessment process is expected to become more effective, consistent, and capable of providing an objective overview of employee performance [5].

The main problem faced by PT Labari Sehat Perkasa is the employee evaluation system that still relies on manual methods. This manual process tends to be subjective because it heavily depends on the perceptions of individual evaluators, which may vary. This often results in inconsistent decisions that cannot be scientifically justified [6]. In addition, the increasing number of employees complicates the evaluation process, as it requires more time and is prone to data processing errors. Limitations in manual assessments also cause difficulties for the company in accurately ranking the best employees. In fact, determining the best employees is crucial to support managerial policies such as job promotions, job rotation, and reward allocation. Inaccurate assessments may lead to internal conflicts and decreased employee job satisfaction [7]. Therefore, a systematic approach supported by scientific methods is required to produce assessments that are more objective, efficient, and well-targeted. Several studies related to employee evaluation decision support systems have been conducted. Satria and Tambunan (2020) developed a decision-making system for selecting recipients of livable housing assistance using the FMADM and SAW methods to improve result accuracy [8].

Pradana (2020) compared the SAW and FMADM methods in selecting Islamic elementary schools, showing that FMADM is more flexible in handling multiple criteria [9]. Gustian (2023) applied the SAW method in employee performance evaluation within government institutions with fairly effective results, although it lacked flexibility [10]. Meanwhile, Puspa (2023) used the Weighted Product (WP) method to assess employee performance in hospitals, which proved to be faster in the calculation process [11]. However, the WP method

is not capable of handling data uncertainty effectively. From these studies, it can be observed that FMADM has advantages in processing quantitative data into linguistic categories, making it easier to understand and more objective.

This makes FMADM a relevant method to be implemented in the employee evaluation system at PT Labari Sehat Perkasa. The Fuzzy Multiple Attribute Decision Making (FMADM) method was selected in this study because it is capable of handling complex evaluation criteria by considering the importance weight of each criterion. The fuzzy logic used in FMADM allows ambiguous or uncertain data to be processed into easily understood linguistic information such as "Good," "Fair," or "Poor." In this study, five main criteria were determined, namely discipline, responsibility, initiative, work performance, and teamwork. Each criterion was assigned a specific weight according to its level of importance. The calculation process involved matrix normalization, weighting, and preference value determination, resulting in an objective ranking of employees. Compared to other methods such as SAW or WP, FMADM is superior in providing consistent results while also being able to handle data uncertainty. Thus, this method is expected to provide an accurate and transparent solution for the company in determining the best employees [8].

The implementation of an FMADM-based employee evaluation system at PT Labari Sehat Perkasa was carried out through the development of a web-based application using PHP and JavaScript programming languages and a MySQL database [12]. This system allows management to input employee data, assign scores for each criterion, and automatically obtain employee ranking results. System testing results show that 82% of employees fall into the "Good" category, 4% into the "Very Good" category, and 12% into the "Fair" category. These data can serve as a basis for strategic decision-making such as job promotions or reward allocation. In addition, this system also improves transparency and accountability, as every calculation result can be traced back to the input data. With the implementation of FMADM, the evaluation process becomes more objective, efficient, and capable of increasing employee motivation because the results are perceived as fair and transparent. Ultimately, this system contributes to improving overall company productivity.

2. Research Methods

This research applies the Fuzzy Multiple Attribute Decision Making (FMADM) method to develop a best employee evaluation system at PT Labari Sehat Perkasa. FMADM was chosen because of its ability to transform both quantitative and qualitative data into objective linguistic values, which simplifies the decision-making process [9]. In employee performance assessment, the collected data are generally complex as they involve multiple aspects such as discipline, responsibility, initiative, work achievement, and teamwork. Each of these aspects has a different level of importance; therefore, a method capable of assigning proportional weights and scores is required to ensure that the results accurately represent actual conditions.

FMADM operates by constructing a decision matrix that contains employee evaluation data for each criterion, followed by a normalization process to equalize the assessment scales. Subsequently, each normalized value is multiplied by the criterion weight determined by management. The results of these calculations are then summed to obtain a preference value, which serves as the basis for ranking employees. As a result, the system does not only produce numerical outputs but can also be interpreted in linguistic categories such as "Very Good," "Good," or "Fair." This approach makes the evaluation results easier for management to understand, especially for those who may not focus on detailed mathematical computations [13]. The research stages consist of problem identification, data collection, system design, FMADM method implementation, and system testing. Research data were obtained from employee performance evaluations conducted by the company using five main criteria: discipline, responsibility, initiative, work performance, and teamwork [11]. Each criterion was assigned a weight based on its level of importance as determined by management. Furthermore, each alternative (employee) was given a score according to these criteria [14].

The formula produces a weight value (W) derived from crisp values obtained from the initial assessment results for each criterion. These crisp values represent the quantitative interpretation of linguistic assessments and serve as the foundation for determining the relative importance of each criterion in the decision-making process. After the weight values for all criteria have been established, a weight normalization process is carried out to ensure that the total weight distribution is proportional and comparable across all criteria. This normalization step is essential to prevent any single criterion from dominating the evaluation results and to maintain balance in the overall assessment [15].

$$\boldsymbol{w_j = \frac{w0}{\Sigma w0}} \tag{1}$$

Subsequently, the formula is utilized to normalize the decision matrix by calculating the normalized performance rating value (Vji) of each alternative Ai for every attribute Cj. This process adjusts the performance scores based on the type of attribute, whether it is categorized as a benefit or a cost criterion. Through matrix normalization, differences in measurement scales among criteria are eliminated, allowing all performance values to be compared on a uniform scale. As a result, the normalized matrix accurately represents the relative performance of each alternative with respect to each criterion [16].

$$r_{ij} = \begin{cases} \frac{x_{ij}}{Max_i x_{ij}} \; jika \; j \; adalah \; atribut \; keuntungan \; (benefit) \\ \frac{Min_i x_{ij}}{x_{ij}} \; jika \; j \; adalah \; atribut \; biaya \; (cost) \end{cases} \tag{2}$$

Furthermore, the same formula is applied to calculate the preference value for each alternative (Vi) by summing the products of the normalized matrix (R) and the corresponding weight values (W). This preference value reflects the overall performance score of each alternative after considering both the normalized performance ratings and the importance of each criterion. A higher preference value indicates that the alternative demonstrates better overall performance and is therefore more desirable compared to other alternatives in the evaluation process [17].

$$V_i = \sum_{j=1}^{n} W_j \cdot r_{ij} \quad (3)$$

The Fuzzy Multiple Attribute Decision Making (FMADM) method offers several advantages that make it widely used in multi-criteria decision-making, including best employee evaluation [18]. One of its primary advantages is its ability to convert quantitative data into qualitative, linguistically based information. This facilitates easier interpretation of results because the output is not limited to numerical values but also includes categories such as “Very Good,” “Good,” “Fair,” or “Poor” [19].

In addition, FMADM enables the weighting of criteria, allowing factors considered more important by management to exert greater influence in the calculation process. Another advantage lies in the transparency of the calculation procedure, as each stage from normalization and weighting to preference value calculation can be traced and verified. This makes FMADM more accurate, objective, and accountable compared to manual evaluation methods, which tend to be subjective. Despite its many strengths, the FMADM method also has several limitations that need to be considered. One limitation is its dependence on the determination of criterion weights by decision-makers or management. If the assigned weights are not accurate, the final results may become biased or fail to reflect actual performance conditions. Furthermore, FMADM only generates rankings without providing a detailed explanation of performance gaps among employees [20].

As a result, managers still need to conduct additional analyses to obtain more comprehensive information regarding specific employee weaknesses. Another limitation is that the method is less flexible in dealing with highly dynamic or rapidly changing data, as any modification requires the recalculation process to be repeated from the beginning. From a technical standpoint, the implementation of FMADM requires an understanding of mathematical concepts and fuzzy logic [21]. Therefore, for organizations that are not yet familiar with technology-based systems, the initial implementation may require additional time and costs. Nevertheless, these limitations can be minimized through proper system design and adequate training for management personnel.

The application of FMADM in this study was carried out through systematic stages starting from data collection to final computation. First, five primary criteria for employee evaluation were identified: discipline, responsibility, initiative, work performance, and teamwork. Each criterion was then assigned a weight based on its level of importance. Second, employee data were organized into a decision matrix containing the scores of each employee for every criterion. Third, matrix normalization was conducted to standardize the assessment scale for both benefit and cost criteria using FMADM formulas [22].

In this study, the FMADM method was implemented in a web-based system developed using PHP, MySQL, HTML, and JavaScript. The system was designed to be user-friendly for company management when conducting employee evaluations. Through a simple interface, users can input employee data, assign scores according to the criteria, and automatically obtain employee ranking results. The implementation results indicate that 82% of employees fall into the “Good” category, 4% into the “Very Good” category, and 12% into the “Fair” category. With the implementation of this system, the evaluation process becomes faster, more transparent, and more accurate compared to manual assessments. Moreover, the system is capable of generating evaluation reports that can be used as a basis for strategic decision-making, such as job promotions, reward distribution, and periodic performance evaluations.

3. Results and Discussion

The results of this study consist of the implementation of a best employee evaluation system at PT Labari Sehat Perkasa using the Fuzzy Multiple Attribute Decision Making (FMADM) method. This system was developed to address problems associated with manual evaluation processes, which tend to be subjective, time-consuming, and inefficient. Through the implementation of a web-based system, company management is able to conduct employee evaluations in a more objective, transparent, and measurable manner. The research data used in this study are derived from the performance assessments of permanent employees at PT Labari Sehat Perkasa based on five main criteria, namely discipline, responsibility, initiative, work performance, and teamwork. Each criterion was assigned a weight according to its level of importance, where the highest weights were given to discipline and responsibility, while initiative, work performance, and teamwork were assigned relatively lower but still significant weights.

The collected employee data were then input into the system and processed using the FMADM method. The calculation process was carried out through several stages, including normalization of the decision matrix, normalization of weights, calculation of weighted values, and determination of the final preference values. Based on the calculation results, each employee obtained a different score reflecting their individual performance. These scores were subsequently ranked to determine the order of the best employees. The login page serves as the main gateway for users to access the employee evaluation system. This interface was designed to be simple while still prioritizing security aspects, ensuring that only authorized users are able to enter the system. On this page, users are required to input a registered username and password stored in the database. The interface is designed to be user-friendly, allowing even new users to log in easily without confusion. The functionality of the login page plays a crucial role in maintaining the confidentiality of company data while ensuring proper access control.

Fig. 1: User Login Page

The testing results indicate that the login page functions properly as expected. The system only grants access to users who enter valid login credentials, while incorrect inputs trigger notification messages. This demonstrates that the system's security mechanisms operate effectively. The simple interface also makes the login process quick and straightforward for users. Therefore, the login page successfully fulfills its role as the initial gateway in maintaining system security and ensuring smooth usage of the employee evaluation system. The calculation page represents the core component of the employee evaluation system, as this section processes all previously input data using the FMADM method. The page display illustrates how the system processes criteria data, weights, and employee scores into structured calculation results.

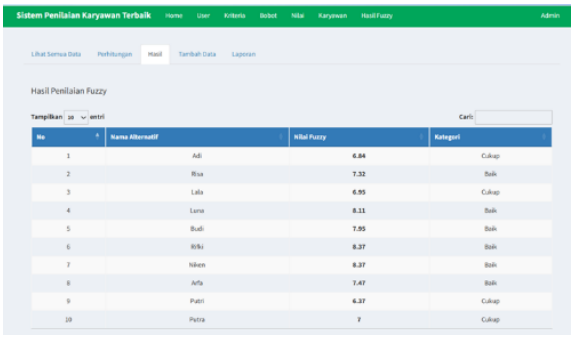

Fig. 2: Fuzzy Evaluation Results Page

Testing of the calculation page shows that the system is capable of processing data according to the FMADM formulas and automatically generating preference values. The displayed results are consistent with manual calculations, thereby confirming the accuracy of the system. Furthermore, the well-organized presentation of the calculations facilitates user understanding and interpretation of the analysis results. With the presence of this page, the employee evaluation process, which previously required a considerable amount of time, becomes significantly more efficient. The calculation page serves as concrete evidence of the successful implementation of the FMADM method in supporting decision-making within the company.

The decision matrix X functions as the foundation of the calculation process using the FMADM method. In this section, the employee evaluation data collected based on the predetermined criteria are arranged in matrix form, ensuring that each employee has a corresponding value for each criterion. The presentation of this matrix is intended to facilitate the normalization and weighting processes, as all alternatives and criteria are displayed in a structured manner. With the decision matrix in place, the system can perform further analysis consistently and reduce the potential for errors in data processing that may arise from manual input.

Table. 1: Decision Matrix X

Employee	C1	C2	C3	C4	C5
Adi Setiawan	8	6	9	6	5
Risa Salsabilah	10	9	8	5	3
Lala Fitriani	7	9	7	7	4
Luna Novita Sari	9	8	10	8	5
Budiono	10	10	9	7	2
Ainur Rifki	9	8	10	10	8
Niken Ayunda	7	10	9	9	7
Arfa Zahra	8	7	8	8	6
Putri Dwi Lestari	6	9	5	7	4
Ahmad Baakil	8	7	8	8	3

The construction of the decision matrix provides an initial and comprehensive overview of the distribution of employee performance scores across each evaluation criterion. Through this matrix, all employee assessment data are systematically organized so that each alternative (employee) has a corresponding value for every criterion being evaluated. From the arranged values, clear variations in performance among employees can be observed, reflecting differences in discipline, responsibility, initiative, work performance, and teamwork. These variations serve as the basis for further analysis, which will be processed through the normalization and weighting stages in accordance with the FMADM method. This arrangement ensures that each criterion is considered proportionally based on its predetermined weight,

preventing any single criterion from dominating the evaluation results inappropriately. By presenting all criteria and alternatives in a structured matrix format, the system minimizes data inconsistency and reduces the risk of calculation errors.

Therefore, the decision matrix serves as an essential foundation for ensuring that the evaluation process is conducted systematically and that the resulting assessments are more objective, accurate, and reliable. The calculation of preference values represents the final stage of the analysis process using the FMADM method. Preference values are obtained after the decision matrix has undergone normalization and after each criterion has been weighted according to its level of importance. This process ensures that the resulting preference values accurately reflect the relative feasibility and performance level of each alternative. At this stage, each employee receives a final numerical score that summarizes their overall performance across all criteria. These scores can then be directly compared to determine ranking positions objectively and consistently.

Table. 2: Preference Value Calculation Results

No	Name	Scores	Round Scores
1	Adi Setiawan	0.684210526	0.684
2	Risa Salsabilah	0.731578947	0.732
3	Lala Fitriani	0.694736842	0.695
4	Luna Novita Sari	0.810526316	0.811
5	Budiono	0.794736842	0.795
6	Ainur Rifki	0.87894737	0.878
7	Niken Ayunda	0.836842105	0.836
8	Arfa Zahra	0.747368421	0.747
9	Putri Dwi Lestari	0.636842105	0.637
10	Ahmad Baakil	0.7	0.700
….	…….	……	……
50	Yudha Prakoso	0.878947368	0.879

The results of the preference value calculations present a complete ranking of employees from the highest to the lowest score. These values are generated through an objective mathematical computation process, which significantly reduces subjectivity and personal bias in employee evaluation. By relying on quantitative calculations supported by predetermined criteria weights, the system ensures that each employee is assessed fairly and transparently. With the availability of preference values, company management can more easily identify high-performing employees who are deserving of rewards, recognition, or promotion opportunities. In addition, these results not only reflect individual employee performance but also function as a benchmark for evaluating the overall quality and effectiveness of human resource management at PT Labari Sehat Perkasa.

The recapitulation of evaluation results represents the stage of presenting the final data after all calculation processes have been completed. This section provides a comprehensive and aggregated overview of employee performance by grouping final scores into specific qualitative categories, such as “Very Good,” “Good,” and “Fair.” This form of presentation is particularly important because it transforms numerical results into linguistic categories that are easier for management to interpret and utilize in decision-making processes. By consolidating all evaluation outcomes into a single summary, the recapitulation facilitates a clearer understanding of overall employee performance conditions.

Table. 3: Recapitulation Results

Kategori	Jumlah Peserta	Persentase
Sangat Baik	2	4%
Baik	42	84%
Cukup	6	12%
Buruk	0	0%
Sangat Buruk	0	0%

The summary of the recapitulation results illustrates the general condition of employee performance within the company. The final data indicate that the majority of employees fall into the “Good” category, with a dominant percentage reflecting stable and satisfactory work quality across most evaluation criteria. This suggests that, overall, employee performance at PT Labari Sehat Perkasa meets organizational expectations. Nevertheless, a small proportion of employees are still categorized as “Fair,” indicating the presence of performance gaps that can become a focus for targeted training, coaching, and performance improvement programs.

The findings of this study demonstrate that the application of the Fuzzy Multiple Attribute Decision Making (FMADM) method in the best employee evaluation system at PT Labari Sehat Perkasa is capable of providing a solution that is more objective, transparent, and accurate compared to traditional manual evaluation methods. The data processing procedures, which were previously prone to bias and inconsistency, can now be carried out mathematically by systematically considering the weight of each criterion. As a result, the evaluation outcomes are more proportional and reflective of actual employee performance.

Based on the trial results, the system produces a performance score distribution showing that 82% of employees are classified in the “Good” category, 4% in the “Very Good” category, and 12% in the “Fair” category. These findings indicate that the majority of employees have demonstrated stable and consistent performance, although there remains a portion of employees who require further guidance, supervision, or performance development initiatives.

From a practical perspective, the implementation of this system provides significant benefits for company management, particularly in accelerating the employee evaluation process, reducing subjectivity, and facilitating the preparation of structured and comprehensive employee performance reports. Compared to previous studies that employed methods such as Simple Additive Weighting (SAW) or

Weighted Product (WP), the FMADM method has proven to be more effective in handling uncertainty in assessment data and more flexible in generating meaningful linguistic categories.

These advantages provide strong justification that the FMADM method can be considered an effective and reliable alternative for supporting strategic decision-making in human resource management. With the implementation of this system, the company is not only able to improve the accuracy and consistency of performance evaluations but also enhance employee motivation, strengthen transparency and fairness, and ultimately increase overall organizational productivity.

4. Conclusion

Based on the results of the research that has been conducted, it can be concluded that the implementation of a best employee evaluation system at PT Labari Sehat Perkasa using the Fuzzy Multiple Attribute Decision Making (FMADM) method is capable of producing evaluation results that are objective, transparent, and accurate. The application of this method enables the company to assess employee performance in a structured and systematic manner, thereby reducing subjectivity and bias that often arise in manual evaluation processes. The system was developed using five main criteria, namely discipline, responsibility, initiative, work performance, and teamwork, each of which was assigned a specific weight according to its level of importance in supporting organizational goals.The system testing results indicate that 82% of employees are classified in the "Good" category, 4% fall into the "Very Good" category, and 12% are categorized as "Fair." These findings demonstrate that the developed system is able to effectively differentiate employee performance levels based on predefined criteria and weighting mechanisms. Moreover, the results confirm that the FMADM-based evaluation system can assist management in identifying the best-performing employees more efficiently and objectively. The evaluation outcomes can also serve as a reliable basis for strategic managerial decision-making, such as determining job promotions, awarding incentives or recognition, and conducting periodic performance evaluations. Ultimately, the implementation of this system contributes to improving fairness, accountability, and effectiveness in employee performance management at PT Labari Sehat Perkasa.

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