Examining the Analytical Hierarchy Process to Help the BMKG Regional Office of Sumatra Make the Best Employee Assessment Decision

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Abstract

The evaluation of the best employees is an important process in supporting the improvement of organisational performance, work motivation, and the objectivity of decision-making in the government agency environment. However, the manual evaluation process often leads to obstacles, such as subjectivity, inconsistency, and difficulty in determining priorities among criteria. This study aims to analyse the application of the Analytic Hierarchy Process (AHP) method in the decision support system for evaluating the best employees at the BMKG Regional Office in Sumatra. The AHP method is used because it can break down complex problems into a hierarchical structure, compare each criterion in pairs, and produce more measurable priority weights. This research uses a quantitative approach with data collection techniques through observation, interviews, and documentation. The analysis process is carried out by structuring the decision hierarchy, determining criteria and alternatives, conducting pairwise comparisons, calculating priority weights, and testing the consistency level of the assessments. The research results show that the AHP method can assist in the process of evaluating the best employees in a more systematic, objective, and transparent manner. The application of this method also facilitates management in determining the best employees based on the established criteria weights, making the resulting decisions more accurate and accountable. Thus, the AHP method is suitable to be used as a basis for developing a decision support system for evaluating the best employees at the BMKG Regional Office in Sumatra.

Keywords: *Analytic Hierarchy Process, Decision Support System, Best Employees, Performance Evaluation, BMKG Regional Sumatra*

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Introduction

Improving the quality of human resources is one of the main factors in the success of an organization, including government agencies that provide public services. In the context of Indonesian bureaucracy, employee performance management has become an important focus, as evidenced by the issuance of the Minister of PANRB Regulation Number 6 of 2022 concerning ASN Employee Performance Management and the Minister of PANRB Circular Letter Number 3 of 2023 concerning Procedures for Determining ASN Employee Performance Ratings. At the same time, BMKG is a government agency that carries out tasks in the fields of meteorology, climatology, air quality, and geophysics, with information services that directly impact safety, economic activities, and the needs of the wider community. In the BMKG Strategic Plan 2025–2029, BMKG's strategic issues also emphasise the importance of realising human resources that are integrity-driven, competent, professional, and globally competitive, as well as a clean and accountable digital-based bureaucratic transformation. The first aspect of work quality is neatness, which is regarded as rather acceptable based on well-organised work results; the accuracy of ASN in task performance is regarded as less good. Work Quantity comprises targets and execution time, both of which are subpar, as well as the quantity of work. One aspect of responsibility is job responsibility, which is seen as excellent. Fourth, accountability encompasses employment responsibility, which is regarded as excellent [1].

The direction of this policy indicates that employee performance evaluations can no longer be viewed merely as administrative activities, but rather as strategic instruments for maintaining organisational quality. The BMKG Strategic Plan 2025–2029 even sets targets for improving BMKG HR services, including targets for the value of HR meritocracy management and the value of personnel management in accordance with ASN management NSPK. This emphasises that the quality of decisions in the field of personnel management, including awarding the best employees, must be based on measurable, consistent, and accountable mechanisms. For BMKG work units in the Sumatra region, this need becomes even more important because the nature of BMKG services demands high precision, discipline, responsibility, and work coordination. The sub-district government has carried out a number of initiatives, including community outreach, training public workers to increase their capacity, and bolstering digital infrastructure to speed up services [2].

On the other hand, the process of evaluating the best employees often faces practical issues. Evaluations usually involve many criteria, while the weighting between criteria has not always been clearly formulated. A 2024 study on employee performance appraisal systems shows that the absence of a digital system and the lack of clear criterion weighting can result in less accurate evaluations. Another study also shows that manual methods in selecting the best employees tend to be less efficient, less consistent, and can reduce the perception of transparency within the organization. In the context of government agencies, similar issues are also found when the process of determining the best employees is not supported by an adequate decision support system. These findings indicate that the issue of evaluating the best employees is not just about who scores the highest, but also about how the decision is made objectively and fairly. Employee performance evaluation, monitoring, and development. The findings of the study point to a number of problems with performance evaluation implementation. A review of the literature is the research methodology employed. [3], [4].

One of the methods considered relevant to address this issue is the Analytic Hierarchy Process or AHP. This method is known as a multi-criteria decision-making technique that can break down complex problems into a hierarchical structure, then assess the importance level of each criterion through pairwise comparisons. The Analytic Hierarchy Process (AHP) is a methodical approach to evaluation-related decision-making. Each criterion is given a weight using the AHP approach, and alternatives are assessed using the weights that are derived. [5], [6]. The Analytical Hierarchy Process (AHP) is a way for making logical, scientific decisions to address complicated, multi-criteria problems with several options [7].

AHP also allows for the integration of subjective and objective considerations within a single analytical framework. In addition, AHP has a consistency ratio mechanism to test whether the decision-maker's judgements are sufficiently consistent. In AHP practice, a CR value below 0.10 is generally considered acceptable, making the weighting results more reliable. Recent studies also emphasise that the stage of forming the pairwise comparison matrix is the most critical part of AHP, as this stage greatly determines the quality of the resulting priority weights. Creating a hierarchy for choosing logistics center locations using the Analytical Hierarchy Process (AHP) approach [8].

The use of AHP in this research is relevant because the evaluation of the best employees is essentially a multi-criteria decision-making problem. One technique for making decisions that can assist farmers in selecting the best livestock feed is the AHP (Analytic Hierarchy Process) method [9]. An employee cannot be evaluated based solely on one aspect, but rather on a number of interrelated aspects, such as discipline, work quality, responsibility, communication, attendance, loyalty, ethics, or other indicators adjusted to the needs of the institution. In previous studies, AHP has been used to assist in weighting criteria and produce a more objective assessment process in the case of evaluating the best employees or staff. However, as far as my initial search has gone, the publications found are still dominated by the context of companies or government agencies in general, not specifically in the context of BMKG Regional Sumatera. Therefore, the application of AHP to this object holds significant value, both from a practical and academic perspective.

Practically, this research can assist the institution in obtaining a more systematic evaluation mechanism. Academically, this research expands the application of AHP in the environment of government institutions that have strong technical work and public service characteristics. Based on the description, it can be understood that there is a need for a decision support system in employee evaluation.

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Literature Review

2.1 Decision Support System (DSS)

Decision Support System (DSS) is a computer system that can be used as an assistant in making decisions by using data and models to solve problems sequentially. The decision support system provides problem-solving and communication capabilities for semi-structured problems [10]. DSS was first introduced by Michael S. Scott in the early 1970s. DSS is also known as a decision support system, which is a computer system that can represent potential problems or the ability to combine problems with semi-structured and unstructured problems. The system used will assist in decision-making in semi-structured and unstructured conditions where no one knows exactly how decisions should be made [11].

The following features are expected to be present in the DSS [12], namely:

a. Assisting decision-makers by integrating human judgement with computer-based data, especially in semi-structured and organised situations. Other computer systems, or conventional quantitative techniques, cannot address this issue.
b. Supports all levels of management, from top executives to managers.
c. Support for independent decisions, where decisions can be made once, multiple times, or repeatedly.
d. Supports the design, selection, and execution phases of the intelligence decision-making process.

Decision Support Systems are designed to provide information, offer guidance, make predictions, and support users in making more effective decisions. This system is based on the application of decision-making theories developed in disciplines such as operations research and management science. The main difference is that previously problem-solving was done through manual iterative calculations, usually to find minimum, maximum, or optimal values. Meanwhile, nowadays, personal computers can solve similar problems in a much shorter time [13].

2.2 Analytical Hierarchy Process

Analytical Hierarchy Process (AHP) is a decision-making method developed by Thomas L. Saaty around the 1970s, which is used to solve problems involving multiple criteria and alternatives. AHP is a functional hierarchy method that uses human perception as its main input [14]. AHP solves problems involving various complex factors or criteria by organising these criteria into a hierarchical structure that facilitates evaluation and comparison. In AHP, the hierarchy is defined as a tiered representation of a complex problem, where the first level includes the main objective, followed by factors, criteria, sub-criteria, and finally alternatives at the last level, which simplifies analysis and decision-making. [15].

By using a hierarchical structure, complex problems can be broken down into groups that are systematically organised, making the issues more structured. Criteria and alternatives are evaluated through pairwise comparisons for various problems [15].

In the AHP method, hierarchy is an effective way to solve complex systems. This hierarchy takes the form of a linear structure, where influence is distributed from the top level to the bottom level. This method is considered efficient because it can make problems more structured and organised, and supports the control and processing of information more functionally [16]. The process of prioritisation is carried out by determining the relative weights between elements, so that the level of importance (preference) of each element can be measured within the context of a broader problem.

$$\mathbf{K} = \begin{matrix} K_1 \\ K_2 \\ K_2 \\ \vdots \\ K_n \end{matrix} \begin{matrix} K_1 & K_2 & \dots & K_n \\ K_{11} & K_{12} & \dots & K_{1n} \\ K_{21} & K_{22} & \dots & K_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ K_{m1} & K_{m1} & \dots & K_{mn} \end{matrix}$$

Matrix K is a pairwise comparison matrix among the criteria.
Divide the total sum of each row by the relevant priority element to obtain the lambda value.

$$\lambda = \frac{\sum(\text{baris})}{prioritas}$$

To obtain λ max, sum the lambda (λ) values and divide the result by the available elements.

$$\Lambda_{\max} = \frac{\sum \lambda}{n}$$

Calculate CI (Consistency Index) using the following formula

$$\text{CI} = \frac{(\lambda \max - n)}{n - 1}$$

Calculate CR (Consistency Ratio) using the following formula:

$$\text{CR} = \frac{\text{CI}}{RC}$$

Table 1. RC Values (Random Consistency)

Matrix Size	RC value
1, 2	0,00
3	0,58
4	0,90
5	1,12
6	1,24
7	1,32
8	1,41
9	1,45
10	1,49
11	1,51
12	1,48
13	1,56
14	1,57
15	1,59

Evaluating Hierarchy Consistency If the value is more than 10%, then the judgement data assessment must be corrected. However, if the Consistency Ratio is less than or equal to 0.1, then the calculation result can be considered correct (Kusrini, 2007).

Research Methodology

The methodology of this research uses a descriptive quantitative approach with a case study design at the BMKG Regional Office in Sumatra. This approach was chosen because the research focuses on analysing the application of the Analytic Hierarchy Process (AHP) method in a decision support system to determine the best employees based on a number of relevant criteria. The research object includes employee evaluation criteria, the weight of importance for each criterion, and the ranking results of the evaluated employee alternatives. The data used consists of primary and secondary data. Primary data were obtained through observation, interviews, and the distribution of questionnaires to parties directly involved in the evaluation process, such as leaders, the human resources department, and officials or staff who understand employee performance evaluation. The determination of respondents was carried out using purposive sampling techniques, which involved selecting respondents deemed to have the knowledge, experience, and authority to assess the criteria for the best employees. Meanwhile, secondary data were obtained from agency documents, performance appraisal guidelines, personnel archives, and scientific literature relevant to decision support systems and the AHP method.

The data analysis stage is carried out by constructing a hierarchical decision structure consisting of objectives, criteria, sub-criteria if necessary, and employee alternatives. To ensure that the assessments given by respondents are logical and acceptable, a Consistency Index (CI) and Consistency Ratio (CR) test are conducted, with the condition that a CR value ≤ 0.10 indicates consistent assessments. After the priority weights are obtained, all employee alternatives are ranked based on the highest final scores as the basis for determining the best

employee. The analysis results are then interpreted to assess the extent to which the AHP method can produce objective, systematic, and transparent decisions in supporting the evaluation process of the best employees at the BMKG Regional Office in Sumatra.

Results

In the Best Employee Assessment Variable (H), the highest criterion value is 100, and the lowest is 0. Thus, this variable can be divided into two categories: Lowest Value and Highest Value. The Lowest Value Variable will have a domain of [0 - 40], with the highest degree of membership (1) at the value of 40. As the value increases beyond 40, the level approaches the Highest Value. The Lowest Value Variable is represented by a triangular membership function, with the degree of membership increasing as the value approaches 40.

The Highest Value Variable will have a domain of [90 - 100], with the highest degree of membership (1) at the value of 100. As the value decreases from 100, the condition approaches the Lowest Value. However, if the value exceeds 90, the lighting condition approaches the Highest Value and falls outside the scope of the research data universe. The Highest Value variable is represented by a triangular membership function, with the degree of membership increasing as the value approaches 100.

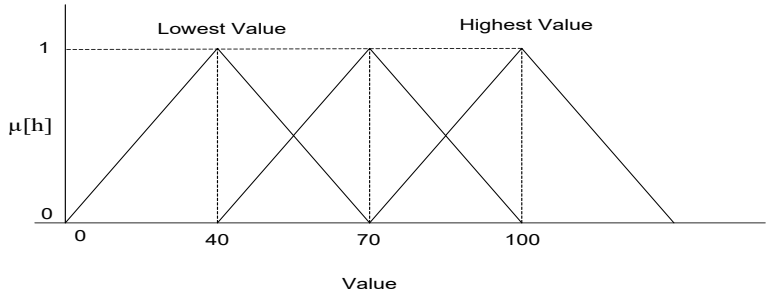

Figure 1. Determination Diagram on Value Variables

3.1 Evaluation Variables

Table 2. List of Lowest and Highest Scores

Type of Assessment	Lowest Value	Highest Value
Implementation of 5S	0	9
Attitude	0	9
Responsibility	0	9
Habilidad	0	10
SOP	0	9
Leadership	0	9
Cleanliness	0	9
Discipline	0	9
Craftsmanship	0	9
Initiative	0	9
Cooperation	0	9

Table 3. Pairwise Comparison Criteria Values

Rank	Factor	Management	Ability	Character	Organization
1	Management	1	7	4	3
3	Ability	0.143	1	3.5	3
2	Character	0.25	0.285	1	2
4	Organization	0.333	0.333	0.5	1
Total		1.726	8.619	9	9

Table 4. Pairwise Comparison Values Management

Rank	Factor	Implementation 5 R	Attitude
1	Implementation 5 R	1	8
3	Attitude	0.125	1
Total		1.125	9

Table 5. Pairwise Comparison Values of Ability

Rank	Fcktor	Habilidad	SOP	Character
1	Habilidad	1	7	6
3	SOP	0.142	1	2
2	Character	0.166	0.5	1
Total		1.309	8.5	9

Table 6. Pairwise comparison values of attributes

Rank	Factor	Responsibility	Cleanliness	Discipline	Craftsmanship
1	Responsibility	1	7	4	3
3	Cleanliness	0.142	1	3.5	3
2	Discipline	0.25	0.285	1	2
4	Craftsmanship	0.333	0.333	0.5	1
Total		1.726	8.619	9	9

Table 7. Comparative Performance Values of the Organization

Rank	Factor	Cooperation	Inisiatif
1	Cooperation	1	8
3	Initiative	0.125	1
Total		1.125	9

Table 8. Grading Scale

Skala Nilai	**Yudisium**	**Explanation**	**Ranking**
0 - 25	D	Not Eligible	4
26 - 45	C	Bad	3
46 - 75	B	Enough	2
76 - 100	A	Good	1

Conclusion

The conclusion of this research shows that the Analytic Hierarchy Process (AHP) method can be effectively used as an approach in the decision support system for evaluating the best employees at the BMKG Regional Office in Sumatra. This method is capable of breaking down

the originally complex decision-making process into a more structured one through the arrangement of hierarchies of goals, criteria, and alternatives. Thus, employee evaluations are no longer solely based on subjective considerations, but are grounded in the priority weights of each criterion that have been systematically analysed. The application of AHP also makes an important contribution to enhancing the objectivity, consistency, and transparency of the evaluation process. Through pairwise comparisons and consistency testing, each criterion can be assessed according to its level of importance, resulting in a more rational and accountable final outcome. This process helps management or decision-makers determine the best employees more accurately, while also minimising the potential biases that often arise in manual evaluations. In other words, AHP not only serves as a calculation tool but also as a framework for a more fair and measurable decision-making process.

Overall, this research confirms that the use of AHP is suitable for supporting the process of evaluating the best employees within the BMKG, particularly at the BMKG Regional Office in Sumatra. This method is relevant to support the organization's need for a more modern, accountable, and data-based employee evaluation system. Therefore, the results of this research are expected to serve as a foundation for the development of a more optimal decision support system in the future, as well as a reference for subsequent research that discusses employee performance evaluation using a multi-criteria approach.

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