



Implementation Of The AHP Algorithm In The Performance Assessment Of Production Section Employees At PT XYZ

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Abstract: Employee performance assessment is an important element in human resource management, especially in the production sector, which affects the company's efficiency and productivity. PT XYZ, as a manufacturing company, requires appropriate methods to objectively assess employee performance. The Analytical Hierarchy Process (AHP) algorithm was chosen to overcome this problem, because of its ability to handle complex and multi-dimensional assessment criteria. This research aims to apply AHP in the production employee performance appraisal system at PT XYZ. The methods used include collecting performance data, mapping performance criteria and sub-criteria, as well as using AHP to calculate the weight and priority of these criteria. The output of this research is expected to be a more accurate system for assessing performance, which can be used by PT XYZ management for better decision making. Outcome targets include national scientific publications and development of an assessment system that can be applied directly

Keywords: AHP, Assessment, Production, Employees, Performance

Abstrak: Penilaian kinerja karyawan merupakan elemen penting dalam manajemen sumber daya manusia, terutama di sektor produksi, yang mempengaruhi efisiensi dan produktivitas perusahaan. PT XYZ, sebagai perusahaan manufaktur, membutuhkan metode yang tepat untuk menilai kinerja karyawan secara objektif. Algoritma Analytical Hierarchy Process (AHP) dipilih untuk mengatasi permasalahan ini, karena kemampuannya menangani kriteria penilaian yang kompleks dan multidimensi. Penelitian ini bertujuan untuk menerapkan AHP dalam sistem penilaian kinerja karyawan produksi di PT XYZ. Metode yang digunakan antara lain pengumpulan data kinerja, pemetaan kriteria dan sub kriteria kinerja, serta menggunakan AHP untuk menghitung bobot dan prioritas kriteria tersebut. Hasil penelitian ini diharapkan dapat menjadi sistem penilaian kinerja yang lebih akurat, yang dapat digunakan oleh manajemen PT XYZ untuk pengambilan keputusan yang lebih baik. Target hasil meliputi publikasi ilmiah nasional dan pengembangan sistem penilaian yang dapat diterapkan secara langsung

Kata Kunci: AHP, Penilaian, Produksi, Karyawan, Kinerja

INTRODUCTION

Employee performance appraisal is an important process in human resource management that is used to evaluate employee contributions to company goals. PT XYZ, as a manufacturing company, faces challenges in conducting objective and precise performance assessments for the production department. Inappropriate assessments can influence management decisions regarding promotions, training and salaries. Currently, performance appraisal at PT XYZ is still subjective and based on supervisor experience without using systematic methods. This research formulates the problem of how the Analytical Hierarchy Process (AHP) method can be applied to the performance assessment of production employees at PT XYZ, so that it can produce a more structured, objective and fair assessment. The AHP algorithm was chosen because of its ability to handle the assessment process with many criteria, as well as its ability to give priority weights to different criteria.

LITERATURE REVIEW

Several research results using the Analytical Hierarchy Process (AHP) method in evaluating employee performance include those carried out with the title "Implementation of the Analytical Hierarchy Process (AHP) Method in Determining Employee Performance (Case Study: Toko Ora Et Labora)", Author: Andre Armana Barus' son, Irwan Jani Tarigan, Vera Wijaya. Conclusion: This research shows that the AHP method can be used as a decision support system in assessing employee performance by giving weight to the criteria and testing the level of consistency in the pairwise comparison matrix. As a result, this system provides recommendations regarding employee priorities based on better calculations of employee weights and grades. Another research with the title: "Decision Support System for Bumi Mandiri Sukabumi Employee Performance Using the AHP Method", Authors: Widy Karisma, Arny Lattu, Anton Permana, Conclusion: This research develops a decision support system for evaluating employee performance at Bumi Mandiri Sukabumi using the AHP method. This system helps management make the right decisions regarding employee performance evaluation by generating alternative priority orders based on the weight of

predetermined criteria. Another title is "Implementation of the Analytical Hierarchy Process (AHP) Method for Determining the Best Employees at CV. Diana Kosmetik Bandung". Conclusion: This research shows that by using the AHP method, the employee performance appraisal process becomes more effective and objective. AHP helps in selecting the best employees by considering various relevant criteria, thereby supporting increased employee performance and overall company business performance.

AHP is a multi-criteria decision making method, which uses a hierarchical analysis process to obtain priority values that can be used to reduce complexity in decision making (Augia et al., 2022). The AHP method is the right method for determining the best employees, therefore this method can be applied in companies, so it can help many parties in determining the selection of the best employees, so that they can give appreciation to employees who have given all their time to the company. (Karisma et al., 2023)

Analytical Hierarchy Process (AHP) is a method that can be used in decision support systems in assessing employee performance to evaluate and assign weights to criteria, as well as testing the level of consistency in the pairwise comparison matrix. (Asus & Ra, 2024). Multi-criteria decision making is facilitated by a mathematical approach known as AHP (Analytic Hierarchy Process). This technique breaks down a confusing problem into an ordered series of models and choices, then uses pairwise correlation to measure the overall trend between the components of a pecking order. (Hutapea et al., 2024)

The Analytical Hierarchy Process (AHP) method was developed by Prof. Thomas Lorie Saaty from Wharton Business School in the early 1970s, which was used to find the ranking or priority order of various alternatives in solving a problem. (Wijono & Ibtu, 2016). Analytic Hierarchy Process (AHP) has the ability to overcome complex situations, such as unstructured conditions, by decomposing hierarchical elements into components that are assessed numerically. This approach involves comparing variables by considering subjective factors, so as to determine the highest priority. (AS SAIDAH et al., 2024)

AHP is a method for ranking decision alternatives and choosing the best one using several criteria. AHP develops a numerical value to rank each decision alternative, based on the extent to which each alternative meets the decision maker's criteria. (Dwi Febryanto et al., 2023). AHP is a method that takes into account subjective factors such as perception, preference, experience and intuition. AHP is a mathematically based procedure for evaluating these criteria. AHP also pays attention to the validity of the data with tolerance limits for inconsistencies in the various selected criteria. (Sudradjat et al., 2020)

AHP is a method that considers many objective and subjective factors in ranking alternatives. Apart from that, AHP can help the decision making process through a hierarchical decision model. (Budianta, 2021). Analytical Hierarchy Process (AHP) is a method to help develop priorities from various options using several criteria (multi criteria). Besides being multi-criteria, AHP is also based on a structured and logical process. (Month & Moon, 2019)

RESEARCH METHODS

Data collection in this research was carried out in the following way: a. Data Source: 1) Primary data through interviews or questionnaires with production managers and employees. 2) Secondary data from previous performance reports and related literature. b. Collection Techniques: 1) Identify main criteria (eg: productivity, timeliness, quality of work). 2) Determining the criteria weights through pairwise comparison.

The algorithm used is AHP. The steps for implementing AHP are as follows: Hierarchy of Assessment: Develop a hierarchical structure from goals, criteria, to alternatives (employees). Pairwise Comparison: Compares each criterion in pairs to determine relative weights. Eigenvector Calculation: Calculate the priority weights of each criterion and check consistency (CI and CR). Results Aggregation: Determines a final score for each employee based on weights and criteria.

RESULTS AND DISCUSSION

We present the results of this research at the beginning in the form of stages in the AHP algorithm as follows:

1. Building a Hierarchy: Determine the main goals you want to achieve. Next, identify the criteria that will be used to evaluate alternatives. These alternatives are at the lowest level of the hierarchy.
2. Develop a Pairwise Comparison Matrix. Create a matrix that compares each criterion or alternative in pairs based on a certain scale. This comparison reflects the relative level of importance between one criterion or alternative and another.
3. Matrix Normalization. Each element in the comparison matrix is normalized to make all values fall on the same scale, so that the relative weight of each criterion can be calculated.
4. Calculating Priority Weights. Calculate the priority weight for each criterion or alternative. These weights indicate the relative importance of each element in the hierarchy.
5. Measure Consistency. Test the consistency of the comparison matrix to ensure that the given preferences do not conflict. If the level of consistency is within acceptable limits, the results can be continued.
6. Combining Alternative Weights. After the criteria weights are calculated, the value of each alternative is evaluated for each criterion. Criterion weights are used to calculate the final score for each alternative.
7. Determine the Final Result. The alternative with the highest final score is considered the best solution or most optimal choice based on the specified objectives.

This research aims to implement the Analytical Hierarchy Process (AHP) algorithm in assessing employee performance in the production department at PT XYZ. The data used are the results of interviews with production managers, questionnaires filled out by 5 respondents (managers and supervisors), as well as employee performance data which includes five main criteria: number of hours worked, number of goods produced, number of goods that pass quality tests. Assessment Criteria: determined based on working hours, quantity of goods produced and quality of goods. Pairwise Comparison Table The following is a pairwise comparison matrix for the criteria used:

Table 1.
Pairwise Comparison Matrix

Criteria	Working Hours	Production Qty	Quality
Working Hours	1	0,50	0,50
Production Qty	2	1,00	0,25
Quality	2	4,00	1,00

Table 2.
Normalization Matrix

Criteria	Working Hours	Production Qty	Quality
Working Hours	0,20	0,10	0,29
Production Qty	0,40	0,20	0,14
Quality	0,40	0,70	0,57

Priority weight criteria: working hours = 0.20, quantity of goods produced 0.25, quality of goods 0.55. The employee performance data used is shown in table 3. Normalization of the data is seen in table 4 and the calculation results are in table 5.

Table 3.
Employee Performance

Name	Working Hours	Goods Worked	Passed Test
Karyawan 1	190	75	70
Karyawan 2	190	80	65
Karyawan 3	189	72	70
Karyawan 4	190	70	60
Karyawan 5	185	69	67

Table 4.
Data Normalization

Name	Working hours	Prudction Qty	Quality
Karyawan 1	0,202	0,204	0,241
Karyawan 2	0,202	0,217	0,224
Karyawan 3	0,201	0,195	0,241
Karyawan 4	0,202	0,190	0,207
Karyawan 5	0,197	0,187	0,231

Final results based on criteria weights:

Name	Final score
Karyawan 1	0,221
Karyawan 2	0,218
Karyawan 3	0,214
Karyawan 4	0,203
Karyawan 5	0,210

From the calculation results, Employee 1 has the highest score of 0.221, indicating the best performance among other employees. Employee 2 and Employee 3 occupy the next position with quite close scores. Employee 4 has the lowest score, indicating potential for improvement in aspects of quality and production quantity.

User Interface

The employee form in Figure 1 is used to manage employee data based on questionnaire results, data entries in the form of name, job title, number of goods produced, number of goods passing quality tests.

The screenshot shows a software window titled 'fkaryawan'. It contains a form with four input fields: 'Nama Karyawan', 'Jml Jam Kerja', 'Jml Hasil Barang', and 'Jml Barang Lolos Uji'. Below the form is a 'Proses' section with buttons for 'Simpan', 'Edit', 'Hapus', 'Batal', and 'Tutup'. To the right of these buttons is a 'Cari Data' section with a search input field. At the bottom of the window is a table with five columns: 'Nama', 'Jam kerja', 'Barang Dikerjakan', and 'Barang Lolos Uji'. The table contains five rows of employee data, with 'Karyawan 1' highlighted in blue. A small asterisk icon is visible in the bottom-left corner of the table area.

	Nama	Jam kerja	Barang Dikerjakan	Barang Lolos Uji
▶	Karyawan 1	190	75	70
	Karyawan 2	190	80	65
	Karyawan 3	189	72	70
	Karyawan 4	190	70	60
	Karyawan 5	185	69	67
*				

Figure 1.
Employee Form

The fcriteria window contains a form for managing criteria. It has a table with columns: Kriteria, Jam, Jumlah, and Kualitas. Below the table are buttons for 'Proses' (Simpan, Edit, Hapus, Batal, Tutup) and 'Cari Data'. The table data is as follows:

	Kriteria	Jam	Jumlah	Kualitas
▶	Jam Kerja	1	0,50	0,50
	Jumlah Barang	2	1,00	0,25
	Kualitas	2	4,00	1,00
*				

Figure 2.
Criteria Form

The criteria form is used to manage criteria data which will be used as a calculation matrix with employee data. This data contains hours, quantity (of goods) and quality.

The fproses window displays the AHP calculation process. It includes a 'Relasi Antar Kriteria' table, 'Batas Max Kriteria' values, 'Eigen Vector' results, and a 'Tampilkan Hasil AHP' table.

Relasi Antar Kriteria

Jam Kerja	0.5	kali lebih penting daripada jumlah barang
Jam Kerja	0.5	kali lebih penting daripada kualitas barang
Jumlah Barang	0.25	kali lebih penting daripada kualitas barang

Batas Max Kriteria

Jam Kerja	200
Jumlah Barang	100
Kualitas OK	100

Eigen Vector

0.184
0.2318
0.5842

Tampilkan Hasil AHP

	Nama	Jumlah Jam Kerja	Jumlah Barang Dikerjakan	Jumlah Barang OK	Nilai	Keterangan
▶	Karyawan 1	190	75	70	0.76	Baik
	Karyawan 2	190	80	65	0.74	Baik
	Karyawan 3	189	72	70	0.75	Baik
	Karyawan 4	190	70	60	0.69	Cukup
	Karyawan 5	185	69	67	0.72	Baik
*						

Criteria Summary Table:

	Kriteria	Jam	Jumlah	Kualitas
▶	Jam Kerja	1	0,50	0,50
	Jumlah Barang	2	1,00	0,25
	Kualitas	2	4,00	1,00
*				

Figure 3.
AHP Calculation Process Form

The following is an explanation of the image showing the employee performance assessment process using the AHP (Analytical Hierarchy Process) algorithm:

1. Relationship between Criteria: This section shows the importance weight between criteria. For example, "Working Hours" is given a weight of 0.5 times more importance than "Quantity of Goods" and "Quality of Goods". These weights are made based on pairwise comparisons between criteria.
2. Max Criteria Limit: Shows the maximum limit for each criterion. For example: Maximum working hours are 200, maximum number of goods is 100, and maximum OK quality is 100.
3. Eigen Vector: Results of calculating priority criteria derived from the comparison matrix. The values are: Working Hours: 0.184 Number of Items: 0.2318 Quality OK: 0.5842 The "Quality OK" criterion has the highest priority weight.
4. Table "Show AHP Results": Displays the final assessment of the employee based on the criteria. Column: Name: Employee name. Number of Hours Worked: Total hours worked by each employee. Number of Items Worked: Total items produced by employees. Number of OK Goods: Quality goods produced by employees. Value: Final score calculated based on the weight of the criteria and results of each employee. Description: Employee performance assessment (Good, Fair, etc.).
5. Criteria Comparison Matrix: Shows detailed criteria weighting in the form of a pairwise comparison matrix. For example: "Work Hours" has a weight of 1 against itself. Compared to "Number of Items", "Working Hours" has a weight of 0.5.

AHP Process Description

Identify Criteria: Select important criteria to assess employee performance (Hours Worked, Number of Items, Quality). Priority Weights: Compare criteria in pairs and calculate their weights (eigenvectors). Employee Score: Enter employee data (hours worked, number of items, items OK). Calculate Final Score: Multiply employee data by the criteria priority weight to get the final score. Evaluation: Provide performance information based on scores.

CONCLUSION

From the calculation results, Employee 1 has the highest score of 0.221, indicating the best performance among other employees. Employee 2 and Employee 3 occupy the next position with quite close scores. Employee 4 has the lowest score, indicating potential for improvement in aspects of quality and production quantity. The application of the AHP method provides objective assessment results to evaluate employee performance based on the weight of predetermined criteria. PT XYZ can use these results to design strategies to improve employee performance.

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