Employee Performance Appraisal to Determine Best Engineer Candidates with Analytical Hierarchy Process Approach

M R Zakaria¹ and Y H Putra²

¹Magister Sistem Informasi, Universitas Komputer Indonesia, Dipati Ukur Jl, 112-116, Bandung, Jawa Barat, Indonesia
²Kepala Program Pascasarjana Magister Sistem Informasi, Universitas Komputer Indonesia, Dipati Ukur Jl, 112-116, Bandung, Jawa Barat, Indonesia

Abstract. The research is aim to emergence of the best Engineer candidates in accordance with the criteria in accordance with the type of project at PT. Multipanel Intermitra Mandiri. By using data of engineer and interview of PT. Multipanel Intermitra Mandiri stakeholder, it was found that Analytical Hierarchy Process (AHP) method could be used in weighting criteria as well as alternative and technique. This research had result that AHP can give the best alternatives for the type of project. The main result is emergence of the best Engineer candidates in accordance with the criteria and sorted awareness of the top rankings and the proposed team of Engineers in accordance with the type of project at PT. Multipanel Intermitra Mandiri. The results of the analysis by using AHP method can rank the best Engineer with the criteria that has been determined with the highest weight value is 0.1622 and the lowest value is 0.0522. From the result that can be formed a combination of teams in accordance with the character of the project type. With this result, we can know about employee engineer performance. Employee performance appraisal can improve the quality of PT. Multipanel Intermitra Mandiri so it can continue to compete in the industrial world.

1. Introduction

The appraisal, or rating, of employee performance has evolved over more than half a century of personnel management practice [1]. Regardless of specific job demands, it was assumed that the judgmental factors used in a "rating scale" applied to all employees in a group. Typically, it offered five or more gradations of each rating factor [1-3].

Base on previous studies on the appraisal [3-5], here, the purpose of this study was to show an Analytical Hierarchy Process (AHP) method for understanding how make decision with parameters base on criteria. To confirm that the model is effective, the results obtained from this AHP method are the emergence of an employee ranking based on its performance. As an example, employee performance appraisal is used to generate alternative of recommendations best employees and abundance criteria in electoral considerations employee performance [4].

AHP is a process of systemic rationality. With AHP it is possible to consider an issue as a whole and examine the simultaneous interaction of the various components that are arranged on a regular
basis tiered (hierarchy) so easily understood and analyzed [6,7]. The main result on this research is emergence of the best Engineer candidates in accordance with the criteria and sorted awareness of the top rankings and the proposed team of Engineers in accordance with the type of project.

2. Methods
The Analytic Hierarchy Process (AHP) is a theory of relative measurement of intangible criteria. With this approach to relative measurement, a scale of priorities is derived from pairwise comparison measurements only after the elements to be measured are known [6-10].

In the AHP, paired comparisons are made with judgments using numerical values taken from the AHP absolute fundamental scale of 1 to 9. A scale of relative values is derived from all these paired comparisons and it belongs to an absolute scale that is invariant under the identity transformation like the system of real numbers. The AHP is useful for making multicriteria decisions involving benefits, opportunities, costs, and risks [8].

3. Results and Discussion

3.1. Establishing selection criteria, alternatives and data collection.
The main purpose of this study is the best Engineer candidate with 5 categories of criteria and 10 alternatives described in Figure 2. The final best engineer candidates were selected based on suitability as determined by matching of these selection criteria [7-10].

Figure 1. Best Engineer Candidates Selection Process.

3.2. Evaluating weight of criteria by AHP approach
The selection criteria at each level of the hierarchy structure have differing degrees of importance to the decision-making process, so that each alternative has a different level depending on the weight value apportioned to each criterion. In this study, the AHP method used paired comparison to weight the importance criteria based on a hierarchical structure. Notably, the AHP method has the advantages of yielding results that are more precise and verifying consistency of judgment. The computation of the weights using the AHP approach involves two main steps 1) Development of the pair-wise comparison matrix and 2) synthesis of judgements [7-9].

3.2.1. Development of a pair-wise comparison matrix
The matrix of pair-wise comparisons was constructed from $i \times j$ elements, where $i$ and $j$ were the number of criteria (n) so that in matrix A (Equation 1), represents comparative values of criterion $i$ with respect to criterion $j$, such that and when $i = j$. The comparisons between each criterion were made using the measurement scale of Saaty [8] which gave numerical values between 1 and 9 depending on the relative importance of the criterion (Table 1).

| Definition                  | Intensity of importance |
|-----------------------------|-------------------------|
| Equally important          | 1                       |
| Moderately more important   | 3                       |
| Strongly more important     | 5                       |
| Very strongly more important| 6                       |
| Extremely more important    | 9                       |
| Intermediate values        | 2,4,6,8                 |
Table 2. Matrix pair of criteria.

| Criteria | Preference | Quality | Quantity | Timelines | Effectiveness | Independent | Result |
|----------|------------|---------|----------|-----------|---------------|-------------|--------|
| Quality  | 1          | 3       | 5        | 3         | 5             | 0.44        |        |
| Quantity | 0.33       | 1       | 3        | 0.33      | 3             | 0.16        |        |
| Timelines| 0.20       | 0.33    | 1        | 0.33      | 3             | 0.09        |        |
| Effectiveness| 0.33 | 3 | 0.33 | 0.20 | 1 | 0.26 |
| Independent| 0.20 | 0.33 | 0.33 | 0.20 | 1 | 0.05 |
| Total    | 2.07       | 7.67    | 12.33    | 4.87      | 17            | 1           |        |

Then calculated the criterion weight (Priority Vector) by normalizing each value in the matrix column pairwise comparison by dividing each value in the matrix column with the sum of the corresponding column. The steps can be seen in Table 3, the value of $1/5$ here follows the number of criteria which amounted to 5 pieces.

3.2.2. Synthesis judgments

After getting the result, the next step is to calculate the value of eigen vector ($\lambda$) to be used in calculating consistency index or CI by summing the result of multiplication between cells in the Total row in Table 2 with Results in Table 3 with the following calculation:

$$\lambda_{max} = (\sum a_{1i} x \bar{x}_i) + \ldots + (\sum a_{ni} x \bar{x}_n)$$

As the result $\lambda = 5.3177$.

Then calculate the consistency index or CI using equation:

$$CI = \frac{\lambda_{max} - n}{n-1}$$

And result is $CI = 0.0794$.

Due to the CI value $\neq 0$, it must be calculated the tolerance limit of inconsistency by using equation:

$$CR = \frac{CI}{RI}$$

Where the RI value is taken from the Random Consistency Index in Table 3 with $n = 5$ which is worth 1.12. As the result is $CR = 0.0716$.

The results of CR calculations are still considered consistent because they are smaller than 10% or 0.1.

Table 3. Random consistency Index (RI), Saaty [8].

| Ordo matrix | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Random Index| 0.00| 0.00| 0.58| 0.90| 1.12| 1.24| 1.32| 1.41| 1.45| 1.49|

After obtaining the weight of each criterion and the alternative, the final step is to calculate the final weight for each alternative.

The calculation is obtained from the multiplication of priority vector criteria with the priority vector of each alternative. The final weight calculation of each alternative uses the equation:
\[ z = \sum(x_n \times y_n) \]  

(5)

From the analysis result, the level of importance of criteria that can be seen in Figure 2.

In Figure 2, it can be seen that the criterion level of Quality criteria is 45%, followed by effectiveness with interest rate 26%, then Quantity with 15% level, Time accuracy with 9% and Independence with the lowest importance level of 5%.

In Figure 3, we can see the ranking graph of the Engineer candidate based on the ranking of the alternatives. Based on the test results, then can be prepared a scale of priority of each alternative. In model testing, it is necessary to consider the following CR values of CI. It is important to keep the CI value to no more than 0. The value 0 in CI shows the bottom of the model being made consistent. However, if the value of CI is more than 0, it is necessary to do further testing by calculating CR. The value of CI is acceptable if after calculated CR and the CR value is not more than 0.10.

Based on the type of project that is in the company, it can be suggested alternatives candidate Engineer in accordance with the type of project from the results of employee performance assessment each candidate has a different rating level on each criteria required as in Figure 2, can be seen in Table 4.

| Type of Project             | Description                                                                 | Alternative Advice Candidates |
|-----------------------------|-----------------------------------------------------------------------------|--------------------------------|
| Project safe                | • Project completion of more than 6 months commencing from the start of the project.  
                                • Preferably quality, quantity, and independence. | Anwar, Tri, Dharma, Teguh.    |
| Project needs attention      | • Project completion up to 5 months from the start of the project.             
                                • Preferably quality, effectiveness, and timeliness.                       | Ari, Anwar, Afiq, Hendri.     |
| Projects that require close supervision | • Completion of the project up to 3 months from the start of the project.    
                                • Preferably effectiveness, quantity, and timeliness.                     | Tri, Zefni, Hendi, Zainuddin. |

Table 4. Project Type and Alternative Suggestion Candidate.
In Table 4, it can be seen that the type of secure project can be handled by Anwar, Tri, Dharma and Teguh. Project Types that need attention can be handled by Ari, Anwar, Afiq and Hendri. While the types of projects that need close supervision are handled by Tri, Zefni, Hendi and Zainuddin.

4. Conclusions
From the analysis that has been done, can be drawn some points of conclusion as follows:

- The results of the analysis by using AHP method can rank the best Engineer with the criteria that has been determined with the highest weight value of 0.1622.
- The results of the analysis by using AHP method can be used in determining the alternatives of the Engineering team in accordance with the type of project in PT. Multipanel Intermitra Mandiri.

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