Computer-Assisted Performance Measurement using Analytic Hierarchy Process

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Abstract. The purpose of this research is to choose the best employees who are entitled to a reward using Analytic hierarchy process method. Analytical hierarchy process method useful for choosing the best employee by giving subjective relative values about the importance of each variable, includes key Performance Indicator (KPI), attendance, and competence. With the rating scale, we can assess all employee and get the value. The results show that the analytic hierarchy process method and rating scale will produce employees with the highest scores. This research helps the company to determine the best employee who gets highest score from analytical hierarchy process technique.

1. Introduction
Selecting the best employee is the one of important process in a company because motivating the employee by giving them a reward such as bonus, vacation, and promotion that can optimize the productivity of each employee [1]. Some companies just looking a value of attendance to determine the best employee who entitled to a reward, or not paying attention the weight in every assessment criteria, but this method cannot be applied in judgment, because in the assessment process we must pay attention to each value in every each criteria.

Based on research, the selection process is important and must be accountable, and in every selection process, we will be faced with various choices. We can choose based on predetermined criteria, according to the process [2] [3] [4] [5] for example in supply chain process the supplier selection process, the right method is needed to be able to choose the best supplier based on the assessment of each criterion, because this is a key process [2] [5]. In education, the implementation of reward management in any academic institutions at rewarding students rightfully and consistently to appreciate their significance to the organization [3]. In choosing mobile services, we are faced with the process of determining the best service to be selected based on several criteria [4]. The selection process also can use to evaluate pressure implement supply chain management [6]. And In the study above the analytic hierarchy process used to choose one from several choices. This also happens in the process of selecting the best employees, companies are faced with many choices. All the problems can be resolved by summing all the values in each sub-criteria for each criterion. However, this will be difficult to assess all the employee in a company, if we create a matrix size of a number employee in a company it will be taking a long time.

Therefore, in determining the best employees, we need a method that can solve a complex situation that is not structured into a hierarchy, by giving subjective values to each criterion and get the score for the assessment, so the value can be used for assessing all the employee. Analytical Hierarchy Process
(AHP) method is the most widely used method in determining choices in various sectors [7]. The AHP method is a powerful instrument to decompose complex decision-making problems and to simplify (facilitate) decision-makers’ cognitive burden [8].

2. Method
This section discusses how to analysis data for selecting employee using the analytic hierarchy process (AHP). The first step was making hierarchy to criteria and sub-criteria, then head of division would give a value in every each criteria also sub-criteria according to its importance level. The method calculated every criteria into matrix using Analytical hierarchy process (AHP). Then each employee would be given a score according to each criteria and will be ranked. The candidate who had the best value means the best employee and entitled to a reward. Figure 1 shows the step for this research:

![Diagram of the AHP Process](image)

**Figure 1.** State of the research.
3. Results and Discussion

3.1. Making Hierarchy Structure
This is needed to determine the criteria and subcriteria. From the data, we can analyze and make a hierarchy structure for these cases in Figure 2:

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Structure Hierarchy Selecting The best Employee

Competency

KPI

Attendance
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Figure 2. Structure Hierarchy

3.2. Determine Criteria and Sub-Criteria
The next step is to determine the criteria and sub-criteria based on the hierarchy structure [9] in figure 2 used in this research. Here are the criteria and sub-criteria in Table 1:

| Table 1. Criteria and Sub-criteria. |
|-------------------------------------|
| **Indicato**r | **NO** | **Criteria** | **NO** | **Sub-criteria** |
|----------------|-------|--------------|-------|----------------|
| A              |       | Attendance   | B1    | On Time Project |
|                |       | B2           |       | Overdue Project |
|                |       | B3           |       | Kick off internal and external |
|                |       | B4           |       | Progress report internal/external PMO |
|                |       | B5           |       | Closing internal and external |
| B              |       | KPI          | C1    | Behaviour      |
|                |       | C2           |       | Initiative     |
|                |       | C3           |       | Discipline     |
|                |       | C4           |       | Cooperation    |
|                |       | C5           |       | Responsible    |
|                |       | C6           |       | Job mastery    |
|                |       | C7           |       | PDAC process   |
|                |       | C8           |       | Communication  |
|                |       | C9           |       | Guidance and award |
|                |       | C10          |       | Awards         |
|                |       | C11          |       | Problem-solving & decision making |


3.3. Determine relative value
The third step is to determine the relative value by the importance of different criteria as a set of normalized weights [7]. The normal AHP process is involved by choosing a ratio of relative importance between pairs of each criteria on a scale of 1 it is mean equal importance to 9 means extremely high prevalence [10].

3.3.1 Make a matrix for each criteria
The table below is a matrix table for KPI criteria, which has been filled with values according to their relative value of the importance compared to other criteria.

| Criteria     | Attendance | KPI  | Competency |
|--------------|------------|------|------------|
| Attendance   | 1.00       | 0.14 | 0.33       |
| KPI          | 7.00       | 1.00 | 2.33       |
| Competence   | 3.00       | 0.43 | 1.00       |
| TOTAL        | 11.00      | 1.57 | 3.67       |

3.3.2 Normalize the matrix
Then do normalization on the matrix above by dividing the value of each field by a total of each column so that the matrix is normal. Table 3 shows the result.

| Kriteria     | Attendance | KPI  | Competence | Priority vector |
|--------------|------------|------|------------|-----------------|
| Attendance   | 0.09       | 0.09 | 0.09       | 0.27            |
| KPI          | 0.64       | 0.64 | 0.64       | 1.91            |
| Competence   | 0.27       | 0.27 | 0.27       | 0.82            |
| TOTAL        | 1.00       | 1.00 | 1.00       | 3.00            |

3.3.3 Consistency Test
After that, test the consistency of the above values by multiplying the initial matrix with priority vector then dividing it by the priority vector value [11] with this formula

\[ CI = \left( \frac{\text{max} - n}{n - 1} \right) \]

\[ IR = 1.98 - \frac{(n-2)}{n} \]

\[ CR = \frac{CI}{IR} \]

Based on the results of the above calculations, the results show that the value of CR = 0, less than 0.1 so that the above matrix values have been consistent and from the results of the analysis also obtained the value of local weights for each dimension are as follows in Table 4.

| DIMENSION | LOCAL WEIGHTS |
|-----------|---------------|
Do the same to all the criteria and sub-criteria. Then we have the result in Table 5:

| NO | CRITERIA | Local weights | Indicator | Local weights | Global weights |
|----|----------|---------------|-----------|---------------|----------------|
| A  | Attendance | 0.09 |           |               | 0.09           |
| B  | KPI       | 0.64 | B1        | On Time Project | 0.60 | 0.384 |
|     |           |       | B2        | Overdue Project | 0.20 | 0.128 |
|     |           |       | B3        | Kick-off internal and external | 0.08 | 0.0512 |
|     |           |       | B4        | Progress report internal/external PMO | 0.05 | 0.0.32 |
|     |           |       | B5        | Closing internal and external | 0.08 | 0.0512 |
| C  | Competence | 0.27 | C1        | Behaviour | 0.10 | 0.027 |
|     |            |       | C2        | Initiative | 0.10 | 0.027 |
|     |            |       | C3        | Discipline | 0.10 | 0.027 |
|     |            |       | C4        | Cooperation | 0.10 | 0.027 |
|     |            |       | C5        | Responsible | 0.10 | 0.027 |
|     |            |       | C6        | Job mastery | 0.10 | 0.027 |
|     |            |       | C7        | PDAC process | 0.10 | 0.027 |
|     |            |       | C8        | communication | 0.10 | 0.027 |
|     |            |       | C9        | Guidance and award | 0.03 | 0.081 |
|     |            |       | C10       | awards | 0.03 | 0.081 |
|     |            |       | C11       | Problem solving & decision making | 0.10 | 0.027 |

3.4. *Calculate Values of all employees*

The fourth step is to assign values to each employee by multiplying the value of each employee with global weights in Table 5.

3.5. *Perform the ranking process*

After assessing all employees, then we can see the top five candidates see the ranking than we can choose the highest score, [12] as the best employee. We can see the result in Table 6:

| No | Name               | Score   |
|----|--------------------|---------|
| 1  | Aditya Eka Pramana | 126.715 |
| 2  | Arfi Finandhita    | 121.111 |
| 3  | Deded              | 128.29  |
| 4  | Decki permana      | 125.87  |
| 5  | Rangga Gumilar     | 126.26  |
4. Conclusion
Based on research to selecting the best employee Using Analytical Hierarchy Process (AHP) and rating scale its show the score from each employee, then we can decide who the best employee for the company by seeing the highest score. It is suitable to help company entitled the best employee.

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