# Analytical Hierarchy Process to Determine the Prioritized Factors in Improving Employee Performance

*Rini Sovia[1]*, Randy Permana[2], Heri Yanto[3], Jasmir[4]*
[1,2,3],Department Informatics Engineering, Faculty of Computer Science,Universitas Putra Indonesia"YPTK" Padang- Indonesia
[4]*Department Informatics Enginerering, Faculty of Computer Science,STIKOM Dinamika Bangsa Jambi- Indonesia*

**Abstract** - Increased Productivity and efficiency of a company is very dependent on the performance of individuals in the company. There are three factors that greatly affect the performance improvement, namely Talent management, Intellectual Intelligence, and citizenship behavior organization. Most companies tend to choose to provide training on these three factors to employees without knowing which factors are most needed to be developed based on the state of the company's resources. Analytical Hierarchy process (AHP) is one of the methods in a decision support system that describes multi-criteria problems in the form of a hierarchy. Through this research, Ahp will be used to give priority scale to criteria that have been previously defined so that decision makers will focus on the lowest priority scale as a result in decision making.

**Keyword:**Determine, AHP, Employee, Performance, Improving Employee

## Introduction

Acceptance of new employees at a company involves several criteria which are the assessment for a leader. This assessment is based on three criteria like talent management, intellectual intelligence, and organizational behavior. The three criteria become a measurement value for a leader in making decisions on company progress. For effectiveness on work, a Decission Support System (DSS) is needed in the company. The purpose of this paper is to build a system that provides input to the company to prioritize the development of human resources based on one of the predetermined factors. Decission Support System (DSS) is a computer-based information system that can help in solving problems individually or in complex ways. In the DSS that will be used must meet several criteria, namely, the existence of a knowledge-based system, which can process a useful information ranging from raw data, personal data, or documents, to solve problems in making a decision. AHP is a model in decision making that outlines multi-factor problems or more than one criterion (Darsono). Described can be defined as a representation of a complex problem in a multilevel structure where the first level is the goal, followed by the level factors, criteria, sub criteria, and so on down to the last level of alternatives. With hierarchy, a complex problem can be broken down into groups which are then arranged into a hierarchical form so that the problem will appear more structured and systematic. AHP is often used as a method of solving problems compared to other methods, for the following reasons:

1. The hierarchical structure, as a consequence of the criteria chosen in the deepest sub criteria.
2. Take into account validity up to the tolerance limit of the inconsistencies of various criteria and alternatives chosen by decision making.
3. Take into account the power and output of the decision making sensitivity analysis.

## Methodology



**Corresponding Author: Rini Sovia, Email:* rini_sovia@upiyptk.ac.id
Article History: Received: July 02, 2019, Accepted: Sep 28, 2019

**2.1 Data Analysis**

Analysis is one of the most important parts of scientific research methodology, because by analyzing the data it can be given meaning and meaning that is useful in solving a problem. To achieve the research objectives, the analysis used in this study is qualitative and quantitative data analysis.

Method of *Analytic Hierarchy Process* (AHP) is a comprehensive decision-making method. This method can take into account qualitative and quantitative matters at once. There are some basics that must be understood in solving problems using the AHP method, including:

**1. Decomposition**

Defining the problem by breaking the whole problem into elements and described in the form of a hierarchy is shown in the figure below:

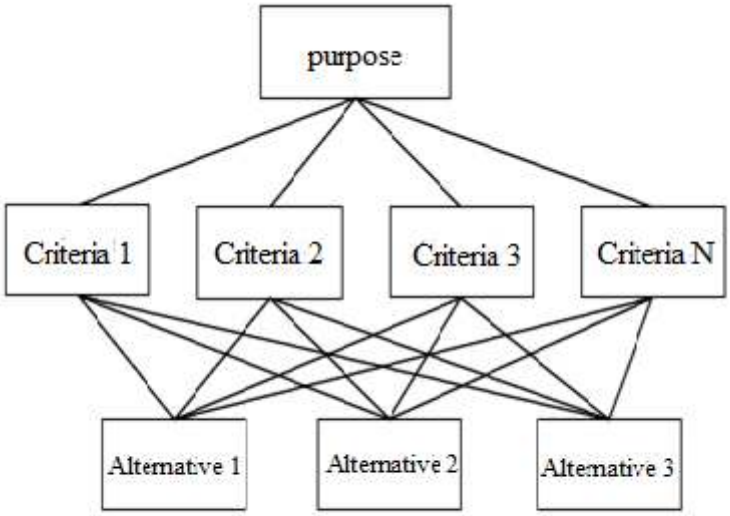


**Figure 2.** AHP Structure

**2. Comparative Judgment**

The first step is to determine the elements by making a pairwise comparison, i.e. comparing the elements in pairs according to the given criteria. The paired comparison matrix is filled using numbers to make judgments about the relative importance of two elements and is written in the form of a pairwise comparison matrix. As a basis for using the AHP method, it must refer to the AHP fundamental scale shown in Table 1 below.

**Table 1:** Relative importance value

| **Intensity of Interest** | **Information** |
|---|---|
| 1 | Both elements are equally important |
| 3 | One element is slightly more important than the other |
| 5 | One element is more important than the other |
| 7 | One element is clearly more important than the other |
| 9 | One element is more absolutely important than the other |
| 2,4,6,8 | Values between two adjacent considerations |
| The opposite | If activity i gets one number compared to activity j, then j has the inverse value compared to i. |

Source: Kusrini, 2007

**3. Synthesis of Priority**

From the next comparison matrix *eigen vector is* made to get *local priority*. Consideration of pairwise comparisons is synthesized to obtain overall or *global priority*. The things done in this step are:

a. Add up the values of each column in the matrix.
b. Divide each value from the column by the total number of columns to get the normalized matrix.
c. Add up the values of each row and divide by the number of elements to get the average value.

4. *Consistency*

In decision making, knowing how good consistency is important is because research does not want decisions based on low consistency. For this reason, several things to do in this step are:

a. Make a multiplication of each value in the first column with the relative priority of the first element, the value in the second column with the relative priority of the second element, and so on.
b. multiply each row.
c. The results of multiply row are divided by the relative priority element.
d. Add up the quotient with the number of elements, then the result is called λ max.
e. Calculate the *Consistency Index* (CI) with the formula:

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

Where :

n = number of elements.

f. Calculate the *Consistency Ratio* (CR) with the formula:

$$CR = CI / RI$$

Where:

CR = *Consistency Ratio;*
CI = *Consistency Index*
RI = *Random Consistency Index*

List of *Random* Consistency Index (RI) can be seen in Table 2.

Table 2. List of *Random* Consistency Indexes

| Matrix Size | IR 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 |

Source: Kusrini, 2007



*Corresponding Author: *Rini Sovia, Email:* rini_sovia@upiyptk.ac.id
Article History: Received: July 02, 2019, Accepted: Sep 28, 2019

If the value is more than 10% then the judgment rating must be improved, but if the consistency ratio (CI / RI) is less or equal to 0.1 then the calculation results can be declared correct.

## Results and Discussion

There are several criteria that are assessed for AHP in this study, where the criteria are obtained based on the questionnaire tested on 84 respondents in a company. The criteria consist of talent management, intellectual intelligence, and organizational skills.

Talent management is the ability for individuals to manage talents owned by individuals or follow-up from the company to the development of talent from employees. Intellectual Intelligence is related to the intellectual abilities of employees such as the ability to express opinions and reasoning. Meanwhile, the ability to operate includes the ability of employees to understand and follow every company regulation.

**Table 3 :** Tabulation of scores from each respondent

| Respondent Number | x1 | x2 | x3 |
|---|---|---|---|
| **1** | 48 | 45 | 42 |
| **2** | 46 | 45 | 43 |
| **3** | 46 | 38 | 42 |
| **4** | 44 | 39 | 39 |
| **...** | ... | ... | ... |
| **84** | 37 | 28 | 35 |

Based on table 1, the assessment scores from 84 respondents to talent management with variable X1, Intellectual Intelligence with variable X2 and organizational ability for X3.

Each of these variables is searched for the average value of the entire value of the variable so that it can be used as input for AHP with the following values:

**Table 4 :** Variable averages

| X1 (Talent management) | X2 (Intellectual Intelligence) | X3 (Organizational Ability) |
|---|---|---|
| 40.6 | 39.67 | 40.46 |

Based on table 2, the average of all respondents is around 40.6, while the average artificial intelligence is around 39.67 and the organizational ability is 40.46.

Ahp requires weighting for each variable that will be used as input for the decision support system. Since the values of the variables X1, X2 and X3 are numeric, a weighting is done based on the ranking of the three values as shown in Table 3.

**Table 5 :** Ranking the results of the average of each variable for weighting

| Weight Value | Average value |
|---|---|
| 1 | 39.67 |
| 2 | 40.46 |
| 3 | 40.6 |

each value of the variables is weighted based on the order of values from low to high so we get a weight value of 1, 2 and 3 based on the average value of each of these variables.

Then each weight value is arranged by using paired matrix and the value of the matrix is based on the level of importance of each variable to the other variables.

**Table 6 :** Arrangement of paired matrices

| Criteria / Alternative | X1 | X2 | X3 |
|---|---|---|---|
| X1 | 1 | ½ | 2/3 |
| X2 | 3/1 | 1 | 2/1 |
| X3 | 3/2 | 1/3 | 1 |

As seen on table 4, the values generated from the matrix are arranged based on the level of importance between one variable and another variable. For example the criteria X1 and X2 means that the weight of the X1 variable is three times more important than the X2 variable.

The next step is to simplify the matrix value and find the value of the total column values of each variable X1, X2 and X3.

**Table buzzer 7:** value pairs before normalized matrix

| Criteria / Alternative | X1 | X2 | X3 |
|---|---|---|---|
| X1 | 1 | 0.5 | 0.66 |
| X2 | 3 | 1 | 2 |
| X3 | 1.5 | 0.33 | 1 |
| ∑ Column | 5.5 | 1.83 | 3.66 |

The column values of each variable function to normalize the values of the previously formed pair matrix. Each value is divided by the total column values to get a normalized matrix like the results in table 6.

**Table 8 :** Division of relative weights obtained from the division of each column by the total column values

| | X1 | X2 | X3 |
|---|---|---|---|
| X1 | .18 | 0.27 | .16 |
| X2 | 0.54 | 0.54 | 0.54 |
| X3 | 0.27 | .18 | 0.27 |

Search for eigen vector values

Vector Eigenvalue is obtained from the sum of each variable that has been normalized with the number of columns with eigenvectors. Next is the search process for Eigen Vector.

Eigen Vector Talent Management => ∑ Row / Column

= 0.61 / 3

= 0.20

Intellectual Intelligence Vector Eigen => ∑ Line / Column



*Corresponding Author: Rini Sovia, Email: rini_sovia@upiyptk.ac.id
Article History: Received: July 02, 2019, Accepted: Sep 28, 2019

= 1.62 / 3

= 0.54

Eigen Vector Organizational Behavior => ∑ Row / Column

= 0.72 / 3

= 0.24

**Table 9 :** Vector Eigenvalues

| | **X1** | **X2** | **X3** | **∑ Line** | **∑ Vector Eigen** |
|---|---|---|---|---|---|
| X1 | .18 | 0.27 | .16 | 0.61 | .20 |
| X2 | 0.54 | 0.54 | 0.54 | 1.62 | 0.54 |
| X3 | 0.27 | .18 | 0.27 | 0.27 | .24 |

Furthermore, the maximum eigenvalue (maximum X) is obtained by adding up the multiplication results of the number of columns with the eigenvector value.

X Maximal = (5.5 x 0.20) + (1.83 x 0.54) + (3.66 x 0.24)

= 1.1 + 0.98 + 0.87

= 2.95

Based on the maximum X value obtained, the correspondence test is tested, if the CR value (consistent ratio) <0.100, then the correspondent's preferences are stated consistent.

$$\text{Consistency CI} = \frac{\text{X Max - n}}{\text{n - 1}}$$

$$= \frac{2.95 - 3}{3 - 1}$$

$$= \frac{2.95 - 3}{2}$$

= 0.05 / 2

= 0.025

RI value (Random Index) is obtained based on the value of the determination of the order of the matrix used n. B erdasarkan matrix is used, the RI value used is 0.580 with 3 matrix order.

CR = CI / RI

= 0.025 / 0.580

= 0.043

= 0.043 <0.100 => Consistent

The value of CR (consistency ratio ) is smaller than 0.100 which means the correspondent data is valid, so the ranking value of each variable can be found using AHP.

Talent Management => 0.20x100% = 20%
Intellectual Intelligence => 0.54x100% = 54%
Organizational Behavior => 0.24x100% = 24%

Based on AHP, it is found that the priority variables with the highest value are Intellectual Intelligence, Organizational Behavior and Talent Management.

## Conclusions

In this paper shows how the application of decision support systems for decision making for an organization in improving the performance of its employees. Dss presents an alternative in the form of the best variables in improving employee performance, so that the company is expected to be able to prioritize to develop employee capabilities related to Talent Management and Organizational Behavior so that there is a balance in improving employee performance .

## References


[1] Kusrini., 2007, *Konsep Dan Aplikasi Sistem Pendukung Keputusan*, Andi offset, Yogyakarta.

[2] Thomas L. Saaty, 481 pp., RWS Publ., 1999. ISBN 1-888603-02-X.

[3] Darmanto, Eko, 2014, *Penerapan Metode Ahp (Analythic Hierarchy Process)Untuk Menentukan Kualitas Gula Tumbu,* Jurnal SIMETRIS, Vol 5 No 1.

[4] *Decision Making for Leaders Vol. II of the AHP Series* Thomas L. Saaty, 315 pp., RWS Publ., 2001 (new ed.). ISBN 0-9620317-8-X.

[5] Shabna e., shri hari subhashri r., sridevi r., monisha p., kavimani s. (2018) role of certain drugs in cardiotoxicity induction for the experimental purpose. Journal of Critical Reviews, 5 (4), 1-5. doi:10.22159/jcr.2018v5i4.26326

[6] Nirmala, Kulandaisamy Agnes, and Marimuthu Kanchana. "Leucas aspera – A Review of its Biological activity." Systematic Reviews in Pharmacy 9.1 (2018), 41-44. Print. doi:10.5530/srp.2018.1.8

[7] M I Ahmed,"A Compact Triangular Ring Patch Antenna For Radio Location And Fixed Satellite Applications",National Journal Of Antennas And Propagation, Volume 1, Issue 1, 2019

[8] Satria Abadi, Setyawan Widyarto, Nur Syufizah Ahmad Shukor(2019),Customer and Stakeholder Perspective using Analytical Hierarchy Process Method for Evaluation Performance of Higher Education, vol 8, No.3, page 1057 - 1064 (2019), International Journal of Supply Chain Management,

[9] Satria Abadi, at al (2019), Identification of Sundep, Leafhopper and Fungus of Paddy by Using Fuzzy SAW Method, vol; 11, issue: 1, International Journal of Pharmaceutical Research DOI: https://doi.org/10.31838/ijpr/2019.11.01.093

[10] Satria Abadi, Setyawan Widyarto (2018)The Designing Criteria and Sub-Criteria of University Balance Scorecard using Analitical Hierachy Process Method vol 7 (2.29)(2018) 804-807International Journal of Engineering and Technology (UAE) DOI: 10.14419/ijet.v7i2.29.14260




*Corresponding Author: Rini Sovia, Email:* rini_sovia@upiyptk.ac.id

Article History: Received: July 02, 2019, Accepted: Sep 28, 2019