The Implementation of Analytical Hierarchy Process for Determining Best Employee

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Abstract. In organisation, the judgement of best employee is still carried out conventionally. This is made the judgement takes time and long process. That is why to resolve the problem will be built a decision system using Analytical Hierarchy Process method. The criteria used in these study are attitude, productivity, discipline, cooperation ability, educational level, neatness, loyalty, realization of work plan. After using the application, the result is we have test the program three times with different criteria value. The first result is gotten within 3,2 minutes, second is within 4,5 minutes and the last time is within 3,3 minutes so the average AHP method report can be printed is in 3,7 minutes with 5 samples.

1. Introduction
Now days, information technology has developed following the globalization. The development of information technology has made the using of technology in all aspect of people’s life. Such as, the implementation information technology in an organisation. Human resource is one of important element for reaching a goal in a organisation [1,2]. If employee performance can be managed well, an organisation will run well. However, determining best employee is not an easy works in reality. Then, that is needed one model of determining system to resolve that problem. Problem that often happens in a process selection and judgment performance is subjectivity of decision making [3-5].
This problem can be solved by building a Decision Support System (DSS) application with Analytical Hierarchy Process method. In previous research, built a decision support system that can help to judge employee, change criteria, and change value weight for making decision of new employee [6,7]. A decision support system for determining best lecturer with the criteria that is subjective or not sure using Fuzzy AHP method [8-11]. Case study in small scale, manufacturing organization supplier selection through analytical hierarchy process [12-17]. The differences of this research with the previous research namely on criteria and value weight.

Based on the description above, authors are interested for doing a research with the title “The Implementation of Analytical Hierarchy Process Method for Determining Best Employee”.

2. Methods
The research methodology that is done in this research are problem identification, identify problem which is faced by organisation, data collecting methodology, that is consist of observation which directly done at PT. Karsa Prima Permatra Nusa as the data source, literature review, collecting materials which needed in this research. The material can be collected from the book, journal, or article in internet. Last is sampling. Sampling is employee data collecting technique which done by collecting data archive from human resource department that is related to the objek research, system analysis, do analysis against the problem and analysis against AHP method ways of working in
determining best employee in one organisation, system designing, designs interface of the determining best employee application using AHP method, system development, develop software using VB Net 2008 programming language and database using Microsoft Access 2007, testing, do testing against the application for searching bug. Testing is done with running every features which are compatible with the system designing.

AHP is decision method which is developed by Prof. Thomas. L. Saaty from University of Pittsburgh in 1970s. AHP is a process that is based on development hierarchy theory, set priorities, and reasonable consistency [4]. AHP method is a method that is used to solve unstructured complex situation into some component hierarchical order by giving subjective value about the importance of every variable in relative terms, and to set which variable that has the highest priority to influence the result of that situation. In AHP, decision is taken by comparing in pairs alternatives which will be selected by using paired comparison questionnaire where in weight judgment importance involving decision maker respondents who are understanding and comprehending with the goal of the organization.

Basically, the steps in AHP method involve hierarchical order from the problem faced. First, the problem will be solved, described into elements that is criteria and alternative which then structured hierarchy. Second, is doing criteria judgment and alternative judgement through paired comparison. For all circumstance scale 1 to 9 is the best scale in showing opinion. Paired comparison scale listed in Table 1 [2].

| Importance Intensity | Description                                      |
|----------------------|--------------------------------------------------|
| 1                    | Both elements are equally important              |
| 3                    | One of element is a little more important than the element |
| 5                    | One of element is more important than the element |
| 7                    | One element is absolutely more important than the other element |
| 9                    | One element is very absolutely more important than the other element |
| 2,4,6,8              | Values are between adjacent value of consideration |

The third step is determination of priority weights, considerations of paired comparison synthesized to get all of priority through these stages, add up the values of each paired comparison matrix column, divide $a_{ij}$ value on each column with the sum of the related column so that normalized matrix is obtained, add up value of each normalized matrix row and divide with the sum elements of each row. The result of division shows the priority value of each elements.

The fourth step is determining logical consistency. In decision making, it’s important to know how well the consistency is, because we do not want decision is based on low consideration consistency. Things that can be done in this steps are multiply each value on first column with the first relative priority element, value of second column with the second relative priority element, and so on, add up each row, the result of row addition is divided with related relative priority element, add up the division result above with the sum of element, the result called max,

Count the consistency index (CI) with this formula:

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

Count consistency ratio (CR) with this formula:

$$CR = CI / RI$$ (2)

where: CR = Consistency Ratio, RI = Random Index

Measuring consistency in decision making is important to know how well consistency is because we do not want the decision based on low consideration consistency. The value of ratio consistency must be low than 5% for 3x3 matrix, 9% for 4x4 matrix, 10% for larger matrix. If out of that ratio
limit above so the value of matrix comparison must be done again. RI values with each matrix size listed in the Table 2 [6].

Table 2. Random Index.

| Matrix size | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| RI          | 0.6 | 1   | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.5 |     |

Analysis process is done by AHP method to choose the best employee. The criteria used are in Table 3. Attitude (C1) is the important criteria because related to employee behaviour. Good attitude can give the good effect to the organisation too. Productivity (C2) is employee ability in producing than the task that is given. A employee can be called productive if they can produce goods or services effectively and efficiently. Work discipline (C3) can be showed by punctuality when came to office. With discipline, an organisation can be operated as it should be. Team work (C4) is person urge to work in a team with other cooperatively and become a group. A good team work can build a great team and effective to reach target that is given by organisation. Educational level (C5) determine an employee knowledge level. With higher educational level, employee is expected can work well and efficiently in a organisation. Neatness aspect (C6) in solving one task in organisation can be self judgement in determining best employee. Next is loyalty aspect (C7). Every organisation must wish a loyalty and faithfulness from their employee. With loyalty, employee does not always moving around. Realization of work plan (C8) is one of important aspect in human resource that is considered by organisation. Every organisation wish employee can make realization of work plan that has been made to reach the goal. With realization of work plan, so employee can be given fully trust and responsibility by organisation.

Table 3. Criteria.

|     | C1   | C2   | C3     | C4   | C5     | C6   | C7     | C8     | Value |
|-----|------|------|--------|------|--------|------|--------|--------|-------|
| 0-20| 0%   | -25% | Often late | 0-20 | >SHC   | 0-20 | New    | 0%     | 0     |
| 21-40| 26%  | -50% | 6-8 times | 21-40| SHC    | 21-40| 1-2 years | 21%     | 1     |
| 41-60| 51%  | -80% | 4-5 times | 41-60| Bachelor | 41-60| 2-3 years | 41%     | 2     |
| 61-80| 81%  | -90% | 2-3 times | 61-80| Magister | 61-80| 3-5 years | 61%     | 3     |
| 81-100| 91% | -100%| Never    | 81-100| Doctor | 81-100| <5 years | 81%     | 4     |

Next, the criteria judgement is done through the paired comparison scale between 1 to 9. Paired comparison scale listed in Table 4.

Table 4. Paired Comparison Scale.

| Importance Intensity | Definition                  | Description                                           |
|----------------------|-----------------------------|-------------------------------------------------------|
| 1                    | Equally important           | Both elements are equally important                   |
| 3                    | A little more important     | One of element is a little more important than the element |
| 5                    | Quite important             | One of element is more important than the element      |
| 7                    | More important              | One element is absolutely more important than the other element |
| 9                    | Absolutely important        | One element is very absolutely more important than the other element |
| 2,4,6,8              | Value between               | If elements i has comparison value between 1 to 9      |
Reciprocal The opposite If elements i has comparison value between 1 to 9 when compared with elements j, then j has the opposite value of i.

3. Results
Paired comparison matrix has eight criteria that can be seen in Table 5. Every matrix column is added up. After added up every column, then divide the comparison value with the sum of the column which is made the normalization matrix. As example, evaluation row = C1 and column = C1, then the fill of row C1 and column C1 equal 1, the sum of column C1 equal 8.45, then divide = 1 / 8.45 = 0.1183

Therefore, row C1 and column C1 is filled with value 0.1183 at normalization matrix. The next steps is finding value weight of every criteria, which is the average of row in Table 5, the example at criteria KL1 is average of row C1 = (Sum of C1)/(Count of C1) = 0.1456. Then do the counting until criteria C8.

Next is counting the matrix consistency, which is a multiply between table 4 and table 5. As example, row C1 and column C1, then fill of row C1 and column C1 (table 4) = 1, weight C1 = 0.1456, so he consistency = 1 x 0.1456 = 0.1456. Then do the counting until criteria C8. The result of multiply can shape consistency matrix.

The next step is determining Consistency Vector, which done by dividing the sum of consistency matrix each row with value weight that is gotten. After the value of Consistency Vector is determined, so it’s needed to count two other value, that is lamda (λ) and Consistency Index (CI), before the end of ratio consistency counted. The value of lamda (λ) is the average Consistency Vector value. We can get λ max value with syntax: λ max = the sum of Consistency Vector / the sum of criteria and the result is 8.36305. After that, search CI value use the formula (1) above, then the result is CI = 0.0519.

| Criteria Comparison Matrix | Normalization Matrix | Weight Matrix | Consistency Matrix | Consistency Vector |
|-----------------------------|----------------------|---------------|-------------------|-------------------|
| C1 10.000                   | 60.000               | 0.1183        | 0.1456            | 0.1404            |
| C2 0.1667                   | 10.000               | 0.0197        | 0.0234            | 0.0193            |
| C3 0.2000                   | 20.000               | 0.0237        | 0.0323            | 0.0213            |
| C4 0.2500                   | 30.000               | 0.0296        | 0.0472            | 0.0314            |
| C5 0.3333                   | 40.000               | 0.0394        | 0.0694            | 0.0567            |
| C6 0.5000                   | 50.000               | 0.0592        | 0.1011            | 0.08438           |
| C7 20.000                   | 60.000               | 0.2367        | 0.2032            | 0.1715            |

The final step of AHP, is determining Consistency Ratio (CR). CR value is gotten from dividing CI with Random Index (RI). RI value is a direct function from the sum of criteria that is being considered as seen in Table 6.

| Criteria Sum | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|----|
| RI           | 0 | 0.58 | 0.9 | 1.12 | 1.24 | 1.32 | 1.41 | 1.45 | 1.49 |

Therefore, the criteria that is used amounted 8, so RI value used is 1.41. So, the calculation of CR value use formula (2) above and we can get the result is CR = 0.0368.
Because of CR value used is under 0.1, then the comparison criteria that is done is consistent. So, the AHP weight criteria value used for determining the rank of employee. As example, that is 5 employee with criteria as listed in Table 7.

**Table 7. Employee Criteria Value.**

| Employee | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 |
|----------|----|----|----|----|----|----|----|----|
| M1       | 1  | 2  | 1  | 1  | 1  | 3  | 1  | 1  |
| M2       | 1  | 3  | 2  | 2  | 3  | 2  | 1  | 1  |
| M3       | 0  | 2  | 1  | 1  | 4  | 1  | 1  | 1  |
| M4       | 1  | 1  | 2  | 1  | 2  | 3  | 0  | 1  |
| M5       | 1  | 2  | 1  | 2  | 1  | 1  | 1  | 0  |

Next, multiply process done between criteria value from each employee with the criteria weight value. So, the best employee as ordered by the sum of value form the highest to the lowest are: M2, M1, M3, M4 and M5, or can be seen in Table 8.

**Table 8. Judgement Result.**

| Employee | Total Value | Rank |
|----------|-------------|------|
| M2       | 1.3637      | 1    |
| M1       | 1.2245      | 2    |
| M3       | 1.1802      | 3    |
| M4       | 1.0991      | 4    |
| M5       | 0.6891      | 5    |

4. Conclusions

After finishing this research about Implementation Analytical Hierarchy Process method for determining best employee, can be concluded that this application can be used to help determining best employee with AHP method by compared importance scale between criteria with criteria values form each employee. This application can show AHP method calculation steps, we have test the program three times with different criteria value. The first result is gotten within 3.2 minutes, second is within 4.5 minutes and the last time is within 3.3 minutes so the average AHP method report can be printed is in 3.7 minutes with 5 samples.

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