

# Design of mathematical models assessment of working achievements based on spencer competency in PT. Z

K Siregar<sup>1,\*</sup> and S F Siregar<sup>2</sup>

<sup>1</sup>Department of Industrial Engineering, Universitas Sumatera Utara, Medan 20155, Indonesia

<sup>2</sup>Department of Chemical Engineering, Universitas Sumatera Utara, Medan 20155, Indonesia

\*E-mail: khawaritasiregar@yahoo.com

**Abstract.** This research is design employee performance assessment by considering work result of employee based on competency. Relevant competencies are identified according to Spencer's competence of employees that subsequently processed by Analytical Hierarchy Process (AHP) method. The results of weighting AHP indicate the highest priority order of criteria, there are; concern of customer satisfaction (0.1325), group work (0.1324) and technical expertise (0.0826). The weight of the criteria is used to design the Work Performance Value (WPV) to be used as the basis for calculating the incentive index. The higher incentive index of an employee, the greater amount of incentives was earned. The calculation of incentives is made to four employees of chopsticks production. From employee incentives A, B, C and D, employee D has the highest incentive index and increment of IDR 2,700,675 compared to previous incentive system. The incentive division system based on the Work Performance Values (WPV) of this proposal reflects a real incentive so that the incapacity of incentive can be reduced.

## 1. Introduction

In both government organizations and private organizations are now increasingly required to maintain the existence of the company. Therefore, it is necessary Human Resources (HR) who have high competence because of the expertise or competence will be able to support the improvement of employee performance. Employee performance appraisal is the way companies do to improve and develop human resources. The results of the performance appraisal, the company is expected to be able to know the advantages and weaknesses of employees as a basis to maintain the advantages and reduce the existing weaknesses in an effort to improve productivity for the sake of corporate progress. PT. Z is one of the companies engaged in the paper industry (Joss Paper), skewers and chopsticks. In general, employees work because they are encouraged to meet the needs of his life so that employees work harder when the results achieved from his work to get reward or satisfactory remuneration. One form of reward that can be given is incentives. PT. Z provides bonuses or incentives to all employees based on work performance as measured by absenteeism. This has an impact on the lack of enthusiasm and motivation of employees in the work. Therefore, it is necessary to design a mathematical model of performance appraisal by taking into account the factors of employee work result to calculate incentive giving.

The purpose of this research is to identify the competence of production employees at PT. Z as a basis for providing incentives based on performance appraisal using the Analytical Hierarchy Process (AHP) method. The benefits of this research are to be considered in determining the decision making



strategy about planning, designing and developing the provision of incentive with optimal employee performance.

The first step taken in this research is:

- Identify the factors that become the assessment of employee performance.
- Determine factor weights by using the Analytical Hierarchy Process (AHP) Method.
- Establish criteria of assessment which is the competence to be calculated.
- Designing models mathematic assessment of employee performance as a basic model of incentives

### *1.1. Analytical Hierarchy Process (AHP)*

According to Wang *et al.* [1], the contractor selection process is a multi-criteria decision-making (MCDM) problem. Numerous MCDM models including utility theory [2], fuzzy theory [3], and performance-based modeling [4] have been developed for contractor qualification or final selection. The AHP [5, 6] is a decision-making method that was developed by Saaty. This technique calculates the qualified priorities of a given set of alternatives on a scale based on the judgment of the decision-maker. The process stresses the importance of the intuitive judgments of a decision-maker and consistency in the comparison of alternatives in the decision-making process. Skibniewski and Chao [7] suggested that the strength of this approach is that it organizes tangible and intangible factors in a systematic way and offers a structured, simple solution to decision-making problems. The AHP-based approach has become quite popular primarily due to its simple and systematic implementation steps [8, 9].

## **2. Methodology**

The research type is descriptive research. In this case, the researchers conducted a survey by distributing questionnaires to the respondents. Questionnaires were filled with or without the help of surveyors depending on their needs. Respondents in this research are employees of PT. Z and the variables contained in this study are competency criteria Lyle M. Spencer and Signe M. Spencer which is the factor of performance appraisal from the results of employee questionnaires and the results of the value of performance appraisal by using competency criteria Lyle M. Spencer and Signe M. Spencer. The procedure of research implementation consists of several stages: At the beginning of the study conducted a preliminary study to identify the problems contained in the company; After identification then the research problem was formulated; Preparation of theoretical basis, using appropriate theories to solve problems for the problem; Data collection consisting of observation and research directly in the field; Data processing by Analytical Hierarchy Process (AHP) method; Discussed the results of data processing; Drawn conclusions and given suggestions.

## **3. Results and Discussion**

Questionnaires understanding a preliminary questionnaire that collects performance assessment criteria are considered relevant in supporting the work of production employees of PT. Z. In addition, the understanding questionnaire aims to disseminate performance appraisal by using Spencer's competence as an effort to demonstrate and understand the advantages of the Spencer method. The criteria chosen based on the questionnaire were then grouped into six groups of Spencer criteria.

**Table 1.** Spencer Criteria Grouping

| No | Criteria Grouping             | Criteria                                        |
|----|-------------------------------|-------------------------------------------------|
| 1  | Actions and Success           | Passion for achievement                         |
|    |                               | Attention to tidiness, quality and thoroughness |
|    |                               | Initiative / Proactive                          |
| 2  | Helping and Serving Consumers | Spooler information, problem definition         |
|    |                               | Concern for customer satisfaction               |
| 3  | Impact and Influence          | Awareness of organization                       |
|    |                               | Building relationships                          |
| 4  | Managerial                    | Group work and cooperation                      |
| 5  | Cognitif                      | Analytical thinking                             |
|    |                               | Conceptual thinking                             |
|    |                               | Technical / Professional / Managerial expertise |
|    |                               | Self-control                                    |
| 6  | Personal Effectiveness        | Confidence                                      |
|    |                               | Flexibility / Ability to adapt                  |
|    |                               | Commitment to the organization                  |

Based on Table 1, it is shown that there are six groups of spencers consisting of 15 competencies that will be used in performance appraisal. After the criteria are grouped according to the Spencer criteria grouping, hierarchies of employee performance appraisals are made.

Analytical Hierarchy Process (AHP) is a method used to obtain the weight of each competency criterion. Ordering the 15 criteria of competence from the highest score to the lowest value seen in Table 2.

**Table 2.** Competency Criteria of the Highest Weight to the Lowest

| No | Criteria                                   | Weight Competency Criteria |
|----|--------------------------------------------|----------------------------|
| 1  | Concern for customer satisfaction          | 0.1325                     |
| 2  | Group work and cooperation                 | 0.1324                     |
| 3  | Technical Expertise                        | 0.0826                     |
| 4  | Confidence                                 | 0.0688                     |
| 5  | Self-control                               | 0.0683                     |
| 6  | Building relationships                     | 0.0658                     |
| 7  | Organizational Awareness                   | 0.0639                     |
| 8  | Information Collection                     | 0.0636                     |
| 9  | Conceptual Thinking                        | 0.0589                     |
| 10 | Analytical thinking                        | 0.0545                     |
| 11 | Excitement to Achievement                  | 0.0499                     |
| 12 | Flexibility                                | 0.0444                     |
| 13 | Initiative / Proactive                     | 0.0442                     |
| 14 | ommitment to the Organization              | 0.0362                     |
| 15 | Attention, quality, thoroughness, tidiness | 0.0338                     |

After obtaining the weight of each criterion, then designed an employee performance appraisal format. The performance appraisal format using Spencer criteria can be seen in Table 2 and Table 3.

The calculation of priority weighting for alternatives are done to determine which alternatives are selected from the lowest level and then proceed to the next level. Recapitulation of weights at each level. Having obtained the criteria of general competence criteria, then designed employee performance appraisal system that is able to reduce weaknesses and provide convenience when

compared with previous employee performance. This will make it easier for assessors to value employees more objectively.

The proposed scoring scale is based on the Rating Scales rating method, Spatially:  
Range = Highest value - Lowest value

Number of interval classes = 5

Based on the formula above then the interval class length is The interval class length =  $(5 - 1)/5 = 0.8$ .

The grouping of employee performance based on the grade range is shown in Table 3.

**Table 3.** Grouping Employee Performance

| Scoring Scale | Information                       |
|---------------|-----------------------------------|
| 1.00-1.79     | <i>Unsatisfactory Performance</i> |
| 1.80-2.59     | <i>Improvement Needed</i>         |
| 2.60-3.39     | <i>Meets Expectation</i>          |
| 3.40-4.19     | <i>Exceeds Expectation</i>        |
| 4.20-5.00     | <i>Outstanding Performance</i>    |

After obtaining the weight of each criterion, then designed an employee performance appraisal format. The format of performance appraisal using Spencer criteria can be seen in Table 4.

**Table 4.** Employee Performance Appraisal Format Using Spencer Criteria

| Grouping Criteria              | Weight of Group Criteria | Criteria                                        | Parcial Weight | Weight | Weight of Group Criteria |
|--------------------------------|--------------------------|-------------------------------------------------|----------------|--------|--------------------------|
| 1 Action and Success           | 0.1916                   | Passion for achievement                         | 0.3320         | 0.0636 | 0.1916                   |
|                                |                          | Attention to tidiness. quality and thoroughness | 0.2604         | 0.0499 |                          |
|                                |                          | Initiative/ Proactive                           | 0.1766         | 0.0338 |                          |
|                                |                          | Spooler information. problem definition         | 0.2309         | 0.0442 |                          |
|                                |                          |                                                 |                |        |                          |
| 2 Helpin and Serving Consumers | 0.1325                   | Concern for customer satisfaction               | 0.1325         | 0.1325 | 0.1325                   |
| 3 Impact and Influence         | 0.1297                   | Awareness of organization                       | 0.4924         | 0.0639 | 0.1297                   |
|                                |                          | Building relationships                          | 0.5076         | 0.0658 |                          |
| 4 Managerial                   | 0.1324                   | Group work and cooperation                      | 0.1324         | 0.1324 | 0.1324                   |
| 5 Cognitive                    | 0.1961                   | Analytical thinking                             | 0.2781         | 0.0545 | 0.1961                   |
|                                |                          | Conceptual thinking                             | 0.3005         | 0.0589 |                          |
|                                |                          | Technical expertise/ Professional/ Managerial   | 0.4214         | 0.0826 |                          |
|                                |                          |                                                 |                |        |                          |
| 6 Personal Effectiveness       | 0.2177                   | Self – control                                  | 0.3138         | 0.0683 | 0.2177                   |
|                                |                          | Confidence                                      | 0.3159         | 0.0688 |                          |
|                                |                          | Flexibility/ ability to adapt                   | 0.2039         | 0.0444 |                          |
|                                |                          | Commitment to the organization                  | 0.1664         | 0.0362 |                          |

The mathematical model of performance appraisal can be formulated as follows.

For example:  $Y = \text{Work Performance Value}$

$X = \text{Compentency criteria}$

$Y = f(X)$

$$Y = 0.0636 X_1 + 0.0499 X_2 + 0.0338 X_3 + 0.0442 X_4 + 0.1325 X_5 + 0.0639 X_6 + 0.0658 X_7 + 0.1324 X_8 + 0.0545 X_9 + 0.0589 X_{10} + 0.0826 X_{11} + 0.0683 X_{12} + 0.0688 X_{13} + 0.0444 X_{14} + 0.0362 X_{15}$$

If the Y result or Work Performance Value  $\leq 3,000$  then the value of Y is considered to be 0 because the value is below the standard value of the company's incentives, so that the employee is not entitled to receive the incentive.

From the value of achievement is then being calculated incentives received by employees of production PT Z. Calculation of the incentives of both chopstick production and paper production prayer (joss paper).

The source of funds for incentive division comes from the profits owned by the company. Profit achieved by the company reflects the achievement of the company and the achievement of the company itself can be achieved if the employee performance is good even increased.

$$\sum WPV = WPV_1 + WPV_2 + WPV_3 + \dots + WPV_n$$

$$EI_1 = \frac{WPV_1}{\sum WPV} = \text{Employee incentive index 1}$$

Then obtained,

$$\text{Employee incentive index} = \frac{WPV_1}{\sum WPV} \times TI$$

Or,

$$\text{Employee incentive index} = EI_1 \times TI$$

Explanation:

TI = Total Incentives given (Rp)

WPV<sub>1</sub> = Work Performance Value 1

The amount of incentive fund distributed by the company is the same, but giving incentives based on the acquisition of Work Performance Values (WPV) has more impact on the development of potential and employee work.

It shows the higher the value of performance achievement, then the employees will get a greater incentive.

#### 4. Conclusion

The weighting results shown that the criteria that have the highest weight of awareness of customer satisfaction has the highest weight (0.1325). Companies require employees to be more sensitive to the needs of consumers so as to support the success of the company in serving the needs of consumers. Then followed by the criteria of group work / cooperation (0.1324). The importance of exchanging information so as to form employees who work in teams at each work station can smoothen the way its production process. Criteria of technical expertise (0.0826). The company requires employees who have practical skills in managing and proficiency in operating the production equipment. The calculation of incentives used by the company has shown a fluctuating result between incentive calculation based on WPV and incentive calculation by the company. From the calculation result, employee D who has the biggest incentive gain increment value incentive based on WPV that is Rp200.675 compared to the original incentive by the company. The amount of incentive fund distributed by the company is IDR 10,000,000 but the incentives based on the acquisition of Work Performance Value (WPV) give more impact to the development of the potential and the work of the employees.

#### References

- [1] Anagnostopoulos K P, Vavatsikos A P *Operational Research. Anais: An International Journal* **6** 333-346
- [2] Balubaid M, Alamoudi R 2015 *American Journal of Industrial and Business Management* **5**

- 581-589
- [3] Dobi K, Gugic J, Kancijan D 2010 *The 32nd International Conference on Information Technology Interfaces (ITI 2010)*
  - [4] Li Y, Nie X, Chen S 2007 *Journal of Construction Engineering and Management ASCE* **133** 40-49
  - [5] Padhi S S, Mohapatra P K J 2009 Contractor Selection in Government Procurement Auctions: A Case Study *European Journal of Industrial Engineering* **3** 170-186
  - [6] Triantaphyllou E, Man S H *Inter'l Journal of Industrial Engineering: Applications and Practice* **2(1)** 35-44
  - [7] Verma S D, Pateriya A 2013 *International Journal of Engineering Trends and Technology (IJETT)* **4**
  - [8] Wang W C, Yu W D, Yang I T, Lin C C, Lee M T, Cheng Y Y 2013 *Journal of Civil Engineering and Management* **19** 24-36
  - [9] Fong P S, Choi S K 2007 Final Contractor Selection Using the Analytical Hierarchy Process *Construction Management and Economics* **18** 547-557