Evaluating the Performance Employee Using TOPSIS

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Abstract. The aim of this study is to make a decision support system using the Technique for Ordered Preference By Similarity To Ideal Solution (TOPSIS) method for evaluating the performance employee of BJB bank. The system was developed with the waterfall development model and the PHP programming language. This study use a TOPSIS Method that is is a Multi Criteria decision making method to identify this study. The final results of the system in the form of an alternative sequence of data (ranking) of the best employees based on preference values obtained from the calculation results. This decision support system will be used by BJB bank as a supporter in making decisions to determine the best employees in the office.

1. Introduction
BJB bank successfully posted net profit growth in September 2016 of 55.6% year on year (y-o-y) The achievement was inseparable from the quality of Human Resources (HR) owned by the BJB bank. In Q3 2016, the number of BJB bank employees was 7,535 employees and to support better HR performance, BJB bank always provided training and development of knowledge and expertise. Human aspects are key and important indicators in a company, one of which is an effort to develop business and strengthen corporate organizations [1]. The fundamental goal of HR in an organization is to effectively manage its employees by encouraging positive attitudes like increasing productivity, job satisfaction, motivation, organizational citizenship behavior, and reducing negative employee attitudes like increased turnover, absenteeism, and deviant work place behaviour. These factors collectively describe an individual employee’s performance at work [2]. Human resources of an organization are considered as important resources especially in banking sector. To make use of people as a valuable resources attention must be given to the employees and to attain organizational based performance [3]. Related performance can influence in taking a decision regarding the efficiency of employee performance and it can also influence the decision of the seniors either he would consider his employee for the promotion or not [4]. It is generally considered that employees with higher emotional intelligence will have higher job satisfaction. This is because the employees with higher emotional intelligence are able to develop strategies to overcome the possible consequences which may arise out of stress whereas those with less emotional intelligence won’t be in a position to overcome the stress situations [5]. Company need employees who have high performance in developing company, performance plays an important role to promote the company [6]. Workplace diversity refers to the concept where an organization has different cultures and employees with different characteristics represented. This leads to cultural diversity in working area. People might be diverse in several aspects which include the range of ways in which people experience a unique group identity [7].
Many studies have reported how to evaluating the performance employee as shown by Ali Osman Asim S, Ali Osman Ahmed S [2], Yang Liu, Xia Huang [3], Sunsheng Guo, Lan Cai, Hongmei Tan [4], Randrup L. Nils, Briggs R. O. [5], Paul Kumar S., and Ahmed I. [6]. Although the model they have been referred to by many research reports, they still have limitations, particularly to using TOPSIS method.

The purpose of this study is to analyze and determine models of TOPSIS to produce results for the evaluating employee of BJB bank with high accuracy [8]. TOPSIS method was chosen because it has several advantages, namely the concept is simple and easy to understand, efficient computation, and has the ability to measure the relative performance of decision alternatives in a simple mathematical form [11].

2. Method

TOPSIS method was first introduced by Yoon and Hwang in 1981. In general, TOPSIS procedure follows steps to make normalized decision matrix, weight normalization, positive ideal solutions (PIS), and negative ideal solutions (NIS). The distance between the alternative values are positive and negative matrices, and it determines the preference value for each alternative decision. This TOPSIS method required A1 alternative in each normalized C1 criteria [7, 8, 9]. TOPSIS is based on a concept that each better alternative has shortest distance from positive ideal solution (PIS) and the one having the largest distance is the negative ideal solution (NIS) [9]. PIS presents the best solution which maximizes the benefit attribute and minimalizes the cost attribute whereas NIS presents the converse, i.e. negative solution minimizing benefits attribute and maximizing cost attribute [10].

3. Results and Discussion

In Table 1 displays employee data that is used simultaneously which will be used as calculation data using TOPSIS for each criterion.

| Alternative | Name          | NIP         | Position       |
|-------------|---------------|-------------|----------------|
| A1          | Employee x1   | 90.64.xxx   | Vice President |
| A2          | Employee x2   | 92.64.xxx   | Vice President |
| A3          | Employee x3   | 92.65.xxx   | Vice President |
| A4          | Employee x4   | 92.66.xxx   | Vice President |
| A5          | Employee x5   | 12.60.xxx   | Vice President |
| A6          | Employee x6   | 01.73.xxx   | Group Head     |
| A7          | Employee x7   | 02.76.xxx   | Group Head     |
| A8          | Employee x8   | 03.78.xxx   | Group Head     |
| A9          | Employee x9   | 03.79.xxx   | Group Head     |
| A10         | Employee x10  | 92.69.xxx   | Group Head     |
| A11         | Employee x11  | 01.68.xxx   | Manager        |
| A12         | Employee x12  | 02.77.xxx   | Manager        |
| A13         | Employee x13  | 02.79.xxx   | Manager        |
| A14         | Employee x14  | 84.61.xxx   | Manager        |
| A15         | Employee x15  | 06.79.xxx   | Manager        |
3.1 Definition of Criteria

Based on the results of interviews and analysis with BJB bank, the Human Capital Division obtained nine assessment criteria from the previous 14 criteria. From each criterion, we will determine the weights which consist of five fuzzy numbers, namely Special / Extraordinary with a weight of 90-100, satisfying weighing 80-89, both weighing 70-79, need repairs with a weight of 60-69, and not as expected with a weight of 0-59 [11]. After determining the weight of each criterion as in the tables above, the next step is to make the preference weight or the level of importance of each criterion set by BJB Bank, with a maximum preference weight of 500 and referring to the mapped variable information.

3.2 Representation of Hierarchical Structures

The hierarchy structure in the explanation of the case study above can be seen in Figure 1.

![Figure 1. Hierarchical structure of Employee Performance Assessment](image)

After the data is entered (data criteria and employee data), a representation is made into the hierarchical structure. The problem that must be formulated in building a hierarchical structure is the goal as the end of the decision [12-13]. Goals are the most important decision in a case. The purpose to be achieved in this thesis is the assessment of employee performance. The identification of selection criteria for employee performance can be initialized as a symbol C (criteria). The alternative identification stage is identifying employees who are the object of assessment and the employee's performance goals.
3.3 Normalization decision matrix

Calculation of Z parameter can be seen in Figure 2.

\[ z_{ij} = \frac{r_{ij} - \mu_j}{S_j}, \quad j = 1, 2, ..., m; i = 1, 2, ..., n \]

Figure 2. Calculation of Z parameter

In this study normalized decision matrix by a using concepts of normal distribution. In fact, represent the statistical normalization method. Here is definition of the steps of this method with its result decision matrix, It's obvious that normal distribution convert basic value of different statistics to standard value between -3.59 and +3.59 by decreasing mean of meter and dividing the result of this function on the standard deviation of data as show in Figure 2.

Calculation of Z parameter can be seen in Figure 3.

\[ S_i = \sqrt{\frac{(r_{ij} - \mu_j)^2}{n-1}}, \quad j = 1, 2, ..., m; i = 1, 2, ..., n \]

Figure 3. Calculation of Z parameter

Zij is the standard value of each data, mj is more favourable and rational content of each criterion that has been defined by experts of organization and is standard deviation of each criterion that calculates in Figure 3.

Z matrix in Table 2 that contains Z value of each data.

3.4 Weighted Normalization

After calculating standard value for each parameter by using standard distribution formula, it's time to calculate the probability of occurrence of standardized content. In this part we apply the below formula to obtain probability of occurrence of each criteria [14]. For example, when we convert the content of first strategy (codification strategy) for first criterion (top management support) to probability of their occurrence, we actually calculated how much percent top management of organization support from implementing codification strategy and so on [15]. Also we can use normal distribution table and calculate Probability of any standard content. It is important to mention that after such convert, the value of all content will become between 0 and 1 and in this time, we can continue extant steps of TOPSIS [16]. Multiply the columns of normalized decision matrix by the associated weights from entropy method. As can be seen in table 2.
Calculation of weighted and normalized decision matrix can be seen in Figure 4.

\[ V_i = p_{ij}w_j \quad ; \quad j = 1, 2, ..., m \; ; \; i = 1, 2, ..., n \]

**Figure 4.** Calculation of weighted and normalized decision matrix

The weighted and normalized decision matrix is obtained as figure 4 and Weighted and normalized decision matrix is shown in Table 3.

### Table 2. Normalization

|   | C1   | C2   | C3   | C4   | C5   | C6   | C7   | C8   | C9   |
|---|------|------|------|------|------|------|------|------|------|
| A1| 0.29081| 0.28984| 0.25104| 0.25417| 0.27823| 0.32338| 0.25218| 0.2524| 0.25235|
| A2| 0.29408| 0.30272| 0.286| 0.29547| 0.27823| 0.24254| 0.2774| 0.28395| 0.2839|
| A3| 0.26141| 0.25763| 0.25422| 0.25417| 0.24731| 0.40423| 0.25218| 0.2524| 0.25235|
| A4| 0.27774| 0.27373| 0.25422| 0.25417| 0.26277| 0.24254| 0.25218| 0.26817| 0.26813|
| A5| 0.27774| 0.27695| 0.27647| 0.28594| 0.27823| 0.40423| 0.28371| 0.28395| 0.28074|
| A6| 0.27448| 0.28017| 0.286| 0.27641| 0.27514| 0.32338| 0.25218| 0.2524| 0.25235|
| A7| 0.29081| 0.28662| 0.25422| 0.25417| 0.24731| 0.32338| 0.25218| 0.2524| 0.28074|
| A8| 0.19605| 0.22543| 0.21609| 0.25417| 0.24731| 0.16169| 0.23957| 0.2524| 0.25235|
| A9| 0.2516| 0.24797| 0.24469| 0.24463| 0.24731| 0.16169| 0.25218| 0.24924| 0.2492|
| A10| 0.22873| 0.22543| 0.22244| 0.25417| 0.24731| 0.16169| 0.25218| 0.24609| 0.2492|
| A11| 0.21893| 0.21577| 0.286| 0.21604| 0.26895| 0.16169| 0.27425| 0.27764| 0.21765|
| A12| 0.22873| 0.22543| 0.22244| 0.22239| 0.2164| 0.16169| 0.24903| 0.24609| 0.24604|
| A13| 0.28755| 0.2834| 0.27647| 0.25417| 0.27514| 0.24254| 0.28055| 0.2524| 0.28074|
| A14| 0.22219| 0.21577| 0.25422| 0.25417| 0.24731| 0.16169| 0.25218| 0.24609| 0.24604|
| A15| 0.24507| 0.24153| 0.27329| 0.28594| 0.24731| 0.16169| 0.24588| 0.2524| 0.25235|

### Table 3. Weighted Normalization

|   | C1   | C2   | C3   | C4   | C5   | C6   | C7   | C8   | C9   |
|---|------|------|------|------|------|------|------|------|------|
| A1| 0.03155| 0.033| 0.02525| 0.02758| 0.03019| 0.03509| 0.03098| 0.03034| 0.02738|
| A2| 0.03191| 0.03447| 0.02876| 0.03206| 0.03019| 0.02632| 0.03408| 0.03413| 0.0308|
| A3| 0.02836| 0.02934| 0.02557| 0.02758| 0.02683| 0.04386| 0.03098| 0.03034| 0.02738|
| A4| 0.02482| 0.02567| 0.02237| 0.02758| 0.02683| 0.01754| 0.03098| 0.02958| 0.02704|
| A5| 0.02375| 0.02457| 0.02876| 0.02344| 0.02918| 0.02632| 0.03059| 0.03337| 0.02362|
| A6| 0.02482| 0.02567| 0.02237| 0.02413| 0.02348| 0.01754| 0.03059| 0.02958| 0.0267|
| A7| 0.0312| 0.03227| 0.0278| 0.02758| 0.02985| 0.02632| 0.03447| 0.03034| 0.03046|
| A8| 0.02411| 0.02457| 0.02557| 0.02758| 0.02683| 0.01754| 0.03098| 0.02958| 0.0267|
| A9| 0.02659| 0.0275| 0.02748| 0.03102| 0.02683| 0.01754| 0.03021| 0.03034| 0.02738|
| A10| 0.03191| 0.03447| 0.02876| 0.03206| 0.03019| 0.02632| 0.03408| 0.03413| 0.0308|
| A11| 0.02836| 0.02934| 0.02557| 0.02758| 0.02683| 0.04386| 0.03098| 0.03034| 0.02738|
| A12| 0.03014| 0.03117| 0.02557| 0.02758| 0.02851| 0.02632| 0.03098| 0.03223| 0.02909|
| A13| 0.03014| 0.03154| 0.0278| 0.03102| 0.03019| 0.04386| 0.03485| 0.03413| 0.03046|
| A14| 0.02978| 0.0319| 0.02876| 0.02999| 0.02985| 0.03509| 0.03098| 0.03034| 0.02738|
| A15| 0.03155| 0.03264| 0.02557| 0.02758| 0.02683| 0.03509| 0.03098| 0.03034| 0.03046|
3.5 Ideal Solution Matrix

Calculation of the ideal and nadir ideal solutions can be seen in Figure 5.

\[
\{v'_1, v'_2, \ldots, v'_n\} = \{(\max v_j | j \in K), (\min v_j | j \in K) \} | i = 1, 2, \ldots, m \}
\]

\[
\{v''_1, v''_2, \ldots, v''_n\} = \{(\min v_j | j \in K), (\max v_j | j \in K) \} | i = 1, 2, \ldots, m \}
\]

**Figure 5.** Calculation of the ideal and nadir ideal solutions

Determine the ideal and nadir ideal solutions. The ideal values set and the nadir values set are determined as Figure 5. Where, \(K\) is the index set of benefit criteria and \(K'\) is the index set of cost criteria.

Calculation of two Euclidean distances for each alternative can be seen in Figure 6.

\[
S'_i = \left( \sum (v_j - v'_j)^2 \right)^{0.5} ; \quad j = 1, 2, \ldots, m \quad ; i = 1, 2, \ldots, n
\]

\[
S''_i = \left( \sum (v_j - v''_j)^2 \right)^{0.5} ; \quad j = 1, 2, \ldots, m \quad ; i = 1, 2, \ldots, n
\]

**Figure 6.** Calculation of two Euclidean distances for each alternative

Measure distances from the ideal and nadir solutions. The two Euclidean distances for each alternative are calculated as Figure 6, calculate the relative closeness to the ideal solution.

Calculation of relative closeness to the ideal solution can be seen in Figure 7.

\[
C_i = \frac{S''_i}{S'_i + S''_i} ; \quad i = 1, 2, \ldots, n \quad ; \quad 0 \leq C_i \leq 1
\]

**Figure 7.** Calculation of relative closeness to the ideal solution

The relative closeness to the ideal solution can be determined as Figure 7.

The author calculated the content of ideal and nadir ideal, distances of each alternative from the ideal and nadir for our problem, and the relative closeness to the ideal solution and represent results in Table 4.

**Table 4. Ideal Solution Matrix**

|     | C1   | C2   | C3   | C4   | C5   | C6   | C7   | C8   | C9   |
|-----|------|------|------|------|------|------|------|------|------|
| positif | 0.03191 | 0.03447 | 0.02876 | 0.03206 | 0.03019 | 0.04386 | 0.03485 | 0.03413 | 0.0308 |
| negatif | 0.02127 | 0.02457 | 0.02173 | 0.02344 | 0.02348 | 0.01754 | 0.02943 | 0.02958 | 0.02362 |
3.6 Ranking

We compute the sums for each line, by subtracting each alternative from the larger one and by subtracting each alternative from the smaller one. Based on the values of coefficients of decreasing rank, fifteen alternatives are ranked as in Table 4, then the alternative A13 is also the best solution [17].

The TOPSIS method can be used for ranking of banks in terms of their financial, non-financial and total performances [18], where one of them is for employee performance.

| Alternative | Name       | Total  | Ranking |
|-------------|------------|--------|---------|
| A13         | Employee x13 | 0.897  | 1       |
| A11         | Employee x11 | 0.723  | 2       |
| A14         | Employee x14 | 0.677  | 3       |
| A15         | Employee x15 | 0.66   | 4       |
| A1          | Employee x1  | 0.66   | 5       |
| A10         | Employee x10 | 0.572  | 6       |
| A7          | Employee x7  | 0.518  | 7       |
| A12         | Employee x12 | 0.47   | 8       |
| A9          | Employee x9  | 0.301  | 9       |
| A5          | Employee x5  | 0.259  | 10      |
| A3          | Employee x3  | 0.248  | 11      |
| A8          | Employee x8  | 0.205  | 12      |
| A4          | Employee x4  | 0.197  | 13      |
| A2          | Employee x2  | 0.173  | 14      |
| A6          | Employee x6  | 0.136  | 15      |

4. Conclusion

Based on the research results by applying the TOPSIS method on the process of evaluating employee performance more efficiently, based on measurements of employee performance results and compared with targets and standards. The assessment used is an assessment which is a criterion for measuring employee performance by comparing with other criteria, also candidates will be obtained who are in accordance with the criteria so that the assessment becomes objective, the employee performance appraisal is measured and becomes transparent and is expected not to be affected by outside judgments (political elements).

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