Decision Support System for Performance Appraisal Using Elimination Method and Translation Reality Choices (ELECTRE)

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Abstract

The development of a company can be seen and greatly influenced by the number of employees owned by the company. The big number of employees and the difference of each performance, making the company more difficult to see the performance of good employees and have high productivity that will affect the progress Radio Republik Indonesia Palembang Broadcasting company in conducting employee performance appraisal is still done conventionally, where performance appraisal data is recorded on sheets of paper consisting of employee data and criteria data that is in the form of job target, service orientation, integrity, commitment, discipline, cooperation, work achievement, and employee work period. Employee performance appraisal problems in the Human Resources Division of LPP Radio Republik Indonesia (RRI) Palembang using Elimination and Choice Translation Reality (ELECTRE) method. The ELECTRE method will process the assessment based on the criteria specified by the company. After the data data value of these criteria have been processed using the method, the results of the assessment will be used in giving recommendations to the leadership in determining the promotion of employment of RRI Palembang employees.

Keywords: elimination method, DSS, ELECTRE

Introduction

The development of information technology today can improve performance and enable various activities to be implemented quickly, precisely and accurately, so as to provide significant progress in various fields such as the emergence of various types of information technology-based activities, applications and information systems on several types of business needs. (Maharsi, 2000)

The development of a company can be seen and greatly influenced by the number of employees owned by the company. The development of employees in each company can be seen from the number of new employees who increase each year. The large number of employees and the differences in their performance makes it more difficult for a company to see good employee performance and have high productivity that will impact the company's progress, according to the agency and determine its priorities (Lestari, 2013).

LPP Radio Republik Indonesia (RRI) as an independent, neutral and noncommercial public broadcasting institution that serves to provide information system services, education, healthy entertainment, social control, and maintain the positive image of the nation in the international world. LPP Radio of the Republic of Indonesia of Palembang in conducting employee performance appraisal is still done conventionally where performance appraisal data is recorded on paper sheet consisting of employee data and criteria data that is in the form of job target, service orientation, integrity, commitment, discipline, cooperation, work achievement, and period of employment. The data is then stored in a filing cabinet. In this process, there are some disadvantages such as assessments might be engineered and be inconsistent in the assessment results set. With the rapid development of technology nowadays, it is necessary to apply an information system that will be a reference and recommendation in assessing employee performance in RRI Palembang. The system developed is a system in the form of software that helps decision makers that data is the data of Human Resources (employees) RRI. To identify employee performance appraisal problems in the LPP Radio Republik Indonesia (RRI) Palembang HR section utilize Elimination and Choice Translation Reality (ELECTRE) method. One of the decision-making techniques used in policy

analysis. In essence the method of ELECTRE can be used in assessing and ranking based on advantages and disadvantages through pairwise comparisons on the same criteria. (Figueira, et al., 2005). Assessment using this method will check and analyze HR data based on performance appraisal documents that have been filled by all employees and head of division of each division in LPP Radio Republik Indonesia (RRI) Palembang. The ELECTRE method will process assessments based on the criteria set by the company. After the data value of these criteria have been processed using the method, the results of the assessment will be used in giving recommendations to the leadership in determining the promotion of employment of RRI Palembang employees.

THEORETICAL BASIS

Decision Support System according to Wibowo (2011) decision support system is the decision-making process assisted using computers to assist decision makers using some data and certain models to solve some unstructured problems. The existence of SPK to companies or organizations is not to replace the tasks of decision makers but as a tool that helps them in decision making. By using data that is processed into information to take the decision of the problem of semi-structured. In the implementation of DSS, the results of the decisions of the system is not a standard, decision-making remains on the decision maker. The system produces only output that calculates the data-dat as judged by a decision maker. So the decision maker's work in considering the decision can be simplified.

Method of Elimination and Choice Translation Reality (ELECTRE)

Electre (Elimination and Choice Translation Reality) is a method of determining the order (priority) in multicriteria analysis. The key issues are simplicity, clarity, stability. (Tambunan, 2014) The method that strictly applies the definition of outranking relationships previously is the ELECTRE method. ELECTRE is a family of The MCDA method originated in Europe in the mid-1960s. The acronym ELECTRE stands for "Elimination Et Choix Traduisant la REalité" or in English can also be called Elimination and Choice Translation Reality. This method (first proposed by Bernard Roy who is widely known as his father - 1991) was originally designed to address the real-world choice issues of the company and enable decision makers beyond the weighted-average method. Now, The ELECTRE method is more widely known and has evolved into several expansions and utilizations. According to Figueira Et al (2013) the ELECTRE method has strengths and weaknesses. Its strengths include:

The ELECTRE method is able to take into account the qualitative nature of several criteria, allowing DM to consider the original data directly without the need for transformation.

The ELECTRE method can handle heterogeneous-scale criteria, preserving the original value of alternatives on each criterion without requiring normalization or estimation techniques.

While the main weaknesses of the ELECTRE method are as follows:

If the objective is to calculate the overall score for each alternative, then the ELECTRE method is not appropriate and other assessment methods should be applied.

Classical ELECTRE method assumes that all criteria are at the same generalization level and do not consider the possibility of working with a subset of criteria in a hierarchical structure. The steps taken in solving the problem using the electre method are as follows: Normalization of decision matrix. Electre starts from establishing a match rating table, ie pairwise comparison of each alternative on each criterion (X_{ij}). This value must be normalized to a comparable scale (r_{ij}), so it can be written in equation 2.1:

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{t=1}^{m} X^2{}_{ij}}}$$

Description:
r = normalized number X = criteria
i = 1,2,3..m
j = 1,2,3..n

Determine Table V Furthermore, decision making should provide the importance factor (weight) on each criterion that expresses its relative importance (W_i), so it can be written on the equation:

W = (w1, w2, … wn)

With $\sum_{t=1}^{n} W_i = 1$

This weight is then multiplied by a pairwise comparison matrix to form a metric V, so it can be written in the equation:
Vij = wj*Rij

Determining Concordance and Discordance Index concordance index and discordance index for each alternative pair is done through estimate of relation ranking. For each alternative pair Ak and Al (k, l = 1,2, ..., m and k1l), the decision matrix for criterion j, is divided into 2 subsets. First, the set of concordance index {Ckl} denotes the sum of the criteria weights that the alternative of Ak is better than the Al alternative, so it can be written in equation 2.4:

$$C_{kl} = (j | V_{kj} \geq V_{ij})$$

For j = 1,2, ..., n
Second, the set of concordance index {dkl} is given as follows so that it can be written in equation 2.5:
Dkl = (j | Vkl < Vij)

Calculate the Value of Concordance and Discordance of Each Alternative.
After being compared based on the concordance and discordance index, the total value of Concordance and Discordance will be calculated based on the weight of preference. The next ranking will be seen from the difference between Concordance and Discordance value on alternate. The alternative with the greatest value will get the top ranking.
Calculate Concordance matrix

$$C_{kl} = \sum\nolimits_{j \epsilon ckl} W_j$$

Calculate the Disordance matrix

$$D_{kl} = \frac{\max\left\{\left|v_{kj-v_{ij}}\right|\right\} j \in D_{kl}}{\max\left\{\left|v_{kj-v_{ij}}\right|\right\} \forall_j}$$

Determine the dominant matrix of concordance and discordance a. Concordance The matrix F as the dominant concordance matrix can be constructed using the help of the threshold value, by comparing each value of the concordance matrix element with the threshold value.

$$C_{kl} = \geq_c$$

With threshold value () is:

$$c = \frac{\sum_{k=1}^{m}\ \ \sum_{l=1}^{m} C_{kl}}{m\ (m-1)}$$

As the matrix element F is determined as follows:

$$F_{kl} = \{\frac{1, jika\ c_{kl \geq c}}{0, jika\ c_{kl < c}}$$

b. Discordance
The G matrix as the dominant discordance can be constructed using the help of the threshold value,

$$d = \frac{\sum_{k=1}^{m}\ \ \sum_{l=1}^{m} C_{kl}}{m\ (m-1)}$$

So the matrix element G can be determined as follows:

$$G_{kl} = \{\frac{1, jika\ d_{kl \geq d}}{0, jika\ d_{kl < d}}$$

Determine aggregate dominance matrix.
Matrix E as aggregate dominance matrix is a matrix whose each element is multiplication of matrix element F with element matrix G is formulated as follows:

$$e_{kl} = \ f_{kl}x_{g_{kl}}$$

Elimination of less favorable alternatives.
Matrix E gives a sequence of options from each alternative, ie when then alternative is a better choice than. So that the row in the matrix E which has the least amount can be eliminated. when the score matrix assigns a value of 1 to one of the predetermined criteria, the value 1 becomes dominant (the subjects are calculated using electre if it gets a score of 1 on one of the criteria, the subject will not be eliminated) otherwise if there is no one criterion on the subject worth 1 meal subject will be eliminated (Saragih, 2014).

RESULTS AND DISCUSSION

The calculation process begins with the input of employee data which will then be assessed by the assessment team, then the assessment will be used in the calculation of electre so as to get relevant employees according to the criteria of employees who have good criteria. Here are the steps taken in electre calculation:
1. Retrieve alternative data
2. Take the weight of each criterion
3. Calculate the weighted normalization matrix
4. Determining the set of concordance and discordance
5. Determining concordance and discordance matrices
6. Determine the dominant matrix of concordance and discordance
7. Determining the dominant aggregate matrix
8. Elimination of alternative less favorable
The rating of each alternative match on each criterion is rated from one to four, ie:
1 = less satisfactory
2 = quite satisfactory
3 = satisfactory
4 = Very satisfactory
While the level of importance criteria (preference weight) is also assessed with one to four, namely:
1 = Low
2 = Enough
3 = Height
4 = Very High
In this research method there are weights and criteria needed to determine the process of assessing the selection of employee performance

determination by the RRI Assessment team. The criteria are: C1 = Working Targets
C2 = Service Orientation
C3 = Integration
C4 = Commitment
C5 = Discipline
C6 = Cooperation
C7 = Work Performance
C8 = Work Period

In determining the range of scores on Work Objectives criteria, Service Orientation, Integration, Commitment, Discipline, Cooperation, Work Performance and Working Period obtained range of values from 10-100 in percent (%) the authors make the range of values as follows:
86% - 100% = Very Satisfactory
76% - 85% = Satisfactory
66% - 75% = Less Satisfactory
65% <= Very Less Satisfactor.

Table 3.1 Determining the Assessment Range

Range (%)	Value	weight
86-100	Very satisfactory	4
76-85	Satisfactory	3
66-75	Less satisfactory	2
65<	Very Less Satisfactory	1

The reference weight is as follows:

Table 3.2 Criterion Weight Value

Criteria	Weight(%)	The criterion weight value (w)
C1	40	W1= 40/100 = 0.4
C2	10	W2= 10/100 = 0.1
C3	5	W3= 5/100 = 0.05
C4	5	W4= 5/100 = 0.05
C5	10	W5= 10/100 = 0.1
C6	10	W6= 10/100 = 0.1
C7	10	W7= 10/100 = 0.1
C8	10	W8= 10/100 = 0.1

Table 3.3 Employee Value

Employees Criteria	C1	C2	C3	C4	C5	C6	C7	C8
Ahmad	3	3	4	3	3	3	3	3
Ucok	4	3	3	3	3	3	3	3
Bambang	4	4	3	3	4	4	4	4
Rendi	3	3	2	2	3	3	3	3
Sandi	4	3	3	4	4	4	4	4
Supar	4	3	3	4	4	4	4	4

The decision matrix formed from the match table is as follows:

$$X = \begin{bmatrix} 3 & 3 & 4 & 3 & 33 & 3 & 3 \\ 4 & 3 & 3 & 3 & 33 & 3 & 3 \\ 4 & 4 & 3 & 3 & 44 & 4 & 4 \\ 3 & 3 & 2 & 2 & 33 & 3 & 3 \\ 4 & 3 & 3 & 4 & 44 & 4 & 4 \\ 4 & 3 & 3 & 4 & 44 & 4 & 4 \end{bmatrix}$$

a. Step 1: Calculate the normalization matrix The normalization matrix formula uses the equation (1)

$$rij = \frac{xij}{\sqrt{\sum_{t=1}^{m} x^2 ij}}$$

The value of the normalization matrix (alternative i, criterion j) is the result of the division between the value of the decision matrix (alternative I, criterion j) with the root of the number of alternative values i on each criterion j. Then it can be calculated in the following way.

$$r_{11} = \frac{xij}{\sqrt{\sum_{t=1}^{m} x^2 i1}}$$
$$= \frac{3}{\sqrt{3^2 + 4^2 + 4^2 + 3^2 + 4^2 + 4^2}} = 0,333$$

$$v_{21} = w_1 r_{21} = (0.4)(0.441) = 0,176$$

$$v_{12} = w_2 r_{12} = (0.1)(0.384) = 0,038$$

$$v_{22} = w_2 r_{22} = (0.1)(0.384) = 0,038$$

c. Step 3: Determine the concordance and discordance set.
Concordance

$$r_{12} = \frac{xij}{\sqrt{\sum_{t=1}^{m} x^2 i2}}$$
$$= \frac{3}{\sqrt{3^2 + 3^2 + 4^2 + 3^2 + 3 + 3}} = 0,384$$

$$r_{21} = \frac{xij}{\sqrt{\sum_{t=1}^{m} x^2 i1}}$$
$$= \frac{4}{\sqrt{3^2 + 4^2 + 4^2 + 3^2 + 4^2 + 4^2}} = 0,441$$

$$r_{22} = \frac{xij}{\sqrt{\sum_{t=1}^{m} x^2 i2}}$$
$$= \frac{3}{\sqrt{3^2 + 3^2 + 4^2 + 3^2 + 3^2 + 3^2}} = 0,384$$

b. Step 2: Weighting the matrix is normalized The weighting formula on the matrix is normalized can be seen in Equation (2.2)
Vij = wj*Rij .... (2.2)

The weighted normalization matrix value (alternative i, criterion j) is the product of the normalized matrix (R) i, the criterion j with the weighted value (w) criterion j. So it can be calculated in the following way.

$$v_{11} = w_1 r_{11} = (0.4)(0.331) = 0,132$$

The determination of the concordance set can be done after the determination step of the weighted normalization matrix is completed, here is the weighted normalization matrix.
Discordance
Determination of the set of discordance is equal to the determination of the concordance set that can be done after the determination step of the weighted normalization matrix is done, here is the weighted normalization matrix.

Determining the set of concordance

Dkl = (j | Vkj < Vij)

Each value of the alternative k is compared with the alternative l in each criterion j. The comparison is done by: if the alternative value of criteria j< alternative value l criterion j, then the criterion j belongs to the set of discordance set (Dkl) or symbolized by the value j.

Step 4: Calculate concordance and discordance matrices

Step 5: Determining the dominant matrix of concordance and discordance

Step 6: Determine the dominant aggregate matrix. The dominant aggregate matrix value in row k of column l is the result of the multiplication of the concordance matrix value in row k of column l with the discordance matrix value on row k of column l.

Step 7: eliminating less favorable alternatives

Based on the value of aggregate dominance matrix that has been obtained before, with the provisions of each line that is on the aggregate dominance matrix represents every alternative Employee to k.

Based on the exposure in the previous step, then there are two groups of employees, the group of employees who assessed bad and good. The two groups can be seen in Table 3.4

Table 3.4 Conclusions

Alternative	*Employee Group*
Ahmad	*Bad*
Ucok	*Bad*
Bambang	*Bad*
Rendi	*Good*
Sandi	*Good*
Supar	*Good*

CONCLUSIONS

The conclusions can be drawn from the implementation of the final task performed and the results of the discussion described in the previous chapters can be drawn conclusions as follows:

1. The system built is a decision support system of performance appraisal LPP Radio Republik Indonesia (RRI) Palembang using Web-based Electre Method so it can simplify the process of employee performance appraisal.

2. The system built can simplify the process of data processing performance appraisal and can produce information abot the performance of employees.

3. The built system can know where the location of the shortcomings that have to improve performance in carrying out its duties.

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