JOIN (Jurnal Online Informatika)
Volume 5 No.1 | June 2020: 121-129
DOI: 10.15575/join.v5i1.606
p-ISSN: 2528-1682
e-ISSN: 2527-9165

Decision Support System for Employee Recruitment Using El Chinix Traduisant La Realite (Electre) and Weighted Product (WP)

Mohamad Irfan[1], Undang Syaripudin[2], Cecep Nurul Alam[3], Muhammad Hamdani[4]
[1,2,3,4]Department of Informatics, UIN Sunan Gunung Djati Bandung, Indonesia

Article Info

Article history:

Received Sep 3, 2019
Revised May 17, 2020
Accepted June 28, 2020
Published July 31, 2020

Keywords:

Decision Support System
Employee Recruitment
Elimination Et Choix Traduisant La Realite
Weighted Product.

ABSTRACT

Management of human resources (HR) is important to achieve company goals. One of the activities in HR management is recruitment, selection, and training. Recruitment and selection are usually made not using a system so that the calculations are still done manually. But by processing data using the system can produce a decision in recommending prospective employees that can have a positive impact on the company. The company selection process is carried out through two stages: official selection and final selection in the form of psychological test assessment, interviews, ability tests, and communication. The use of the Elimination Et Choix Traduisant La Realite (ELECTRE) method in the official selection stage and the Weighted Product (WP) method in the final selection stage is a discovery made to get the best decision following the required criteria. By using this method, the final results will be obtained, namely the recommendation of several prospective employees who are fit to work in the company. The performance results of this system reach one hundred percent; the data from the system is in accordance with the expected calculation.

Corresponding Author:

Mohamad Irfan,
Department of Informatics,
UIN Sunan Gunung Djati Bandung,
Jl. AH. Nasution No. 105 Bandung, Indonesia
Email: Irfan.bahaf@uinsgd.ac.id

1. INTRODUCTION

Generally, the leadership of each company expects its employees to have excellent performance in carrying out their work. Therefore, the level of quality of human resources needs to be developed so that the company's goals in managing human resources are efficient and effective. One of the activities in managing human resources in a company is recruitment, selection, and training [1], [2].

According to several sources, the selection is a series of activity steps used in deciding whether an applicant is accepted or not in the proposed company [3]–[6]. Other sources conclude that selection is an activity of determining whether a prospective employee is accepted or rejected based on certain specifications according to the company's needs [7]–[9].

Employees are people who work as workers in a company or institution to repay in the form of money to carry out workplace operations. Employees have duties by what has been determined by the supervisor or leader of the workplace. Generally, employees work by carrying out the tasks instructed by the company and can express their creativity according to the instructions at work [7].

The recruitment and selection process is always carried out by a company to improve quality HR and can advance and develop a company [10].

A banking company in Indonesia needs new employees who are expected to be able to meet the assessment criteria set by the company. The selection and recruitment process carried out by the company is carried out in two stages of the selection process for the first stage, namely the administrative selection process and for the second stage is the psychological test and interview stage. To fulfill both phases of the selection process, a system is needed to recommend and choose candidates who are suitable to work in the company.

This is very beneficial for the company because the time in selecting prospective employees who pass the selection and are eligible to work in the company is faster and more efficient and helps the HR in calculating the results of the selection, which is usually done manually.

The purpose of this research is to build a decision support system to help the company management in determining applicants who are suitable to work in the company. This work uses Elimination Et Choix Traduisant La Realite (ELECTRE) and Weighted Product (WP) as a method to be used in DSS. In previous work, both method show good accurate value and performance [11]–[18].

Based on observations, the assessment criteria used consisted of at least age, education, work experience, psychological testing, interviews, field, and language proficiency tests, in this case, using the TOEFL standard.

2. METHOD

In this study, data, and information obtained by conducting interviews with the management of a banking company and also direct observation. The data used in this system is taken from the data of prospective employees who register for the receipt that has been opened by the HR department. In the ELECTRE Method to determine prospective employees who passed the initial selection, potential employee data is needed to be taken from the registration stage conducted by prospective employees. The following are the criteria for prospective employees explained in table 1.

Table 1. Criteria for Prospective Employees Early Selection

Initial	*Description*	*Weight*
C1	Age	4
C2	Educational Background	4
C3	Experience	2

In the WP Method to determine the prospective employees who are accepted and pass in the final selection assessment criteria are determined and adjusted by the admin. The following are the criteria for evaluating the prospective employee's final selection explained in table 2.

Table 2. Criteria for Evaluating Prospective Employees for Final Selection

Criteria	Initial	Weight
Psychological	C1	25
Skill and ability	C2	35
TOEFL	C3	20
Interview	C4	20

In understanding application design using data that has been obtained and implementing the model desired by the user. Application modelling in the form of database design is accompanied by making use-case, activity diagrams, class diagrams, sequence diagrams, and flowcharts to facilitate subsequent processes.

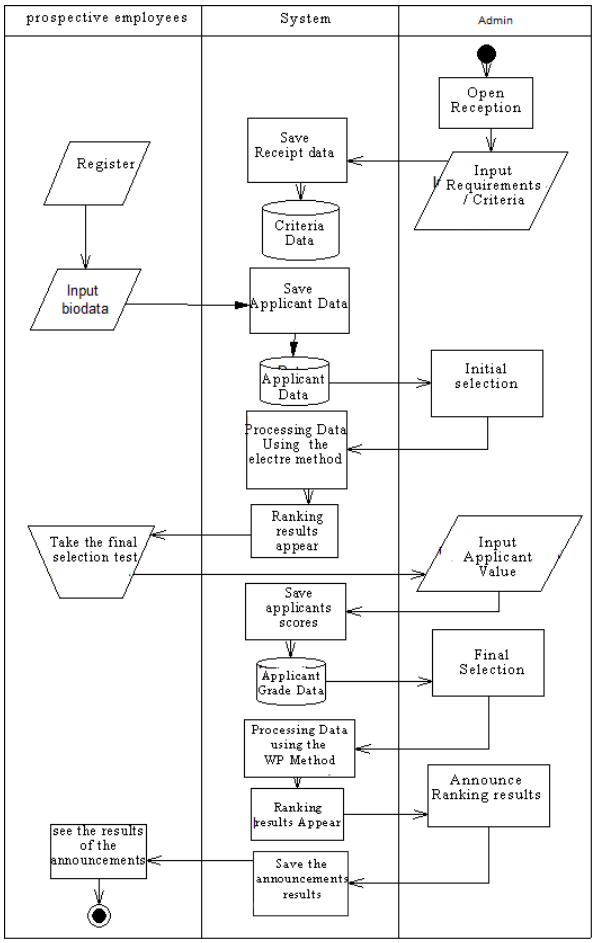

Figure 1. Proposed Flowchart System

Figure 1 explains the proposed system flowchart there are two stages of the selection process, namely the initial selection and the final selection in which has the appraisal feature on each prospective employee so that the best potential employee is obtained from the top rank.

UML provides a standard for writing a blueprint system, which includes components in the system, database schema, business process concepts, and writing classes in a specific program language [19].

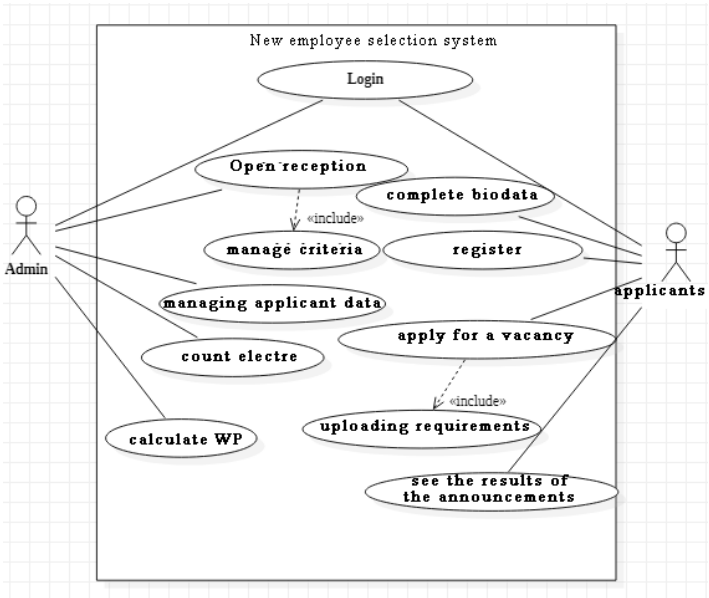

Figure 2. Use Case Diagram

Based on figure 2, the admin has access to login, open vacancies for employees while managing vacancy criteria, manage applicant data, and calculate initial and final selection using both methods.

2.1 ELECTRE Implementation

The ELECTRE method is a multi-criteria decision-making analysis method originating in Europe in 1960. According to Janko and Bernoider, the ELECTRE method is one of the criteria for outranking multi-criteria by using alternative comparisons based on criteria appropriate to those needed, but in its use, there are many alternatives, but only a few criteria used [20]. The steps that are used by the ELECTRE method are as follows:

1. Normalization of the matrix
2. The normalized weighting of the matrix
3. Determine the concordance and discordance set
4. Calculate the concordance and discordance matrices
5. Determine the concordance and discordance dominant matrices
6. Determine the aggregate dominance matrix
7. Eliminate less favorable alternatives

The temporary data of prospective employees and the criteria that will become candidates at this stage are:

Table 3. Prospective Employee Data and Criteria

Candidate	Criteria	Weight
A1	C1 = Age	4
A2	C2= Education	4
A3	C3= Experience	2

To get a table of criteria values from each alternative as in table 4. Then, the weight update is done first from the previous weight W = (0.4,0.4,0.2).

Table 4. List of Alternative Values

Candidate	**Criteria**		
	C1	**C2**	**C3**
A1	4	4	6
A2	2	2	5
A3	3	3	4

1) Normalization of the provision matrix can be changed to a comparable value $R_{ij=}\frac{x_{ij}}{\sqrt{\Sigma_{i=i}^{m}\ x_{ij}^2}}$ for i=1,2,3,….,m and j=1,2,3,…n

$$X = \begin{bmatrix} 4 & 4 & 6 \\ 2 & 2 & 5 \\ 3 & 3 & 4 \end{bmatrix}$$

a. Normalization of alternative age criteria

$$|X_1| = \sqrt{4^2 + 2^2 + 3^2} = \sqrt{29} = 5{,}385$$
$$R_{11} = \frac{x_{11}}{x_1} = \frac{4}{5{,}385} = 0{,}3713$$
$$R_{21} = \frac{x_{21}}{x_1} = \frac{2}{5{,}385} = 0{,}557$$
$$R_{31} = \frac{x_{31}}{x_1} = \frac{3}{5{,}385} = 0{,}7427$$

b. Normalization of alternative education criteria

$$|X_2| = \sqrt{2^2 + 3^2 + 4^2} = \sqrt{29} = 5{,}385$$
$$R_{12} = \frac{x_{12}}{x_2} = \frac{2}{5{,}385} = 0{,}3713$$
$$R_{22} = \frac{x_{22}}{x_2} = \frac{3}{5{,}385} = 0{,}5570$$
$$R_{32} = \frac{x_{32}}{x_2} = \frac{4}{5{,}385} = 0{,}7427$$

c. Normalization of alternative experience criteria

$$|X_2| = \sqrt{5^2 + 4^2 + 6^2} = \sqrt{77} = 8{,}774$$
$$R_{12} = \frac{x_{12}}{x_2} = \frac{5}{8{,}774} = 0{,}5698$$
$$R_{22} = \frac{x_{22}}{x_2} = \frac{4}{8{,}774} = 0{,}4558$$
$$R_{32} = \frac{x_{32}}{x_2} = \frac{6}{8{,}774} = 0{,}6837$$

So we get the normalized R matrix as shown below:

$$R = \begin{bmatrix} 0{,}3713 & 0{,}3713 & 0{,}5698 \\ 0{,}5570 & 0{,}5570 & 0{,}4558 \\ 0{,}7427 & 0{,}7427 & 0{,}6837 \end{bmatrix}$$

2) Weighting in a normalized matrix. After normalizing, the column of matrix R will be multiplied with the weights (wj) that have been determined by the decision-maker. Knowing each other's predetermined criteria W=(0.4,0.4,0.2).
   a. Weighting the alternative matrix for age criteria
   $$V_{11} = R\ x\ W = 0{,}3713\ x\ 0.4 = 1{,}2$$
   $$V_{21} = R\ x\ W = 0{,}5570\ x\ 0.4 = 1{,}8$$
   $$V_{31} = R\ x\ W = 0{,}7427\ x\ 0.4 = 1{,}2$$
   b. Weighting alternative matrices of educational criteria
   $$V_{12} = R\ x\ W = 0{,}3713x\ 0.4 = 1{,}0692$$
   $$V_{22} = R\ x\ W = 0{,}5570\ x\ 0.4 = 1{,}0692$$
   $$V_{32} = R\ x\ W = 0{,}7427\ x\ 0.4 = 2{,}138$$
   c. The weighting of alternative matrices of experience criteria
   $$V_{13} = R\ x\ W = 0{,}5698\ x\ 0.2 = 1{,}8352$$
   $$V_{23} = R\ x\ W = 0{,}4558\ x\ 0.2 = 0{,}9176$$
   $$V_{33} = R\ x\ W = 0{,}6837\ x\ 0.2 = 1{,}8352$$
   From the above calculation, get the matrix results below:

$$V = \begin{bmatrix} 0{,}3713 & 0{,}3713 & 0{,}5698 \\ 0{,}5570 & 0{,}5570 & 0{,}4558 \\ 0{,}7427 & 0{,}7427 & 0{,}6837 \end{bmatrix}$$

3) Calculate the concordance and discordance matrices

If the values specified for the concordance matrix of the elements are the weights that will be added together are included in the concordance set with the formula below:

$$C_{kl} = \sum_{j \varepsilon C_{kl}}^{n} W_j \qquad (1)$$

Calculate the concordance of the first alternative:

C_{12} = W2 + W3 + W4
= 0+ 0 + 0 = 0
C_{13} = W1 + W3 + W5
= 0.4 + 0.4 + 0 =0.8
C_{14} = W1 + W4 + W5
= 0.4 + 0.4 + 0.2 = 1

Calculate the concordance of the second alternative:

= W1 + W2 +W3
C_{21} = 0.2+ 0+ 0 = 0.2
C_{23} = W1 + W8 +W3
= 0 + 0 + 0 = 0
C_{24} = W1 + W8 +W3
= 0.2 + 0.4 + 0.4 = 1

Calculate the concordance of the third alternative:

C_{31} = W1 + W2 + W3
= 0 + 0+ 0 = 0
C_{32} = W2 + W3 + W4
= 0 + 0 + 0 = 0
C_{34} = W1 + W2 + W4
= 0 + 0 + 0 = 0

Based on the above calculation, the concordance matrix is obtained below:

$$C = \begin{bmatrix} - & 0.2 & 0 \\ 0.8 & - & 0 \\ 1 & 1 & - \end{bmatrix}$$

To determine the value of the elements in the discordance matrix is to divide the maximum of the different criteria included in the set of discordance parts by the maximum of the difference in the value of all existing criteria by the formula below:

$$D_{kl} = \frac{\max\{|v_{kj} - v_{lj}|\} j \varepsilon D_{kl}}{\max\{|v_{kj} - v_{lj}|\} \forall j} \quad (2)$$

Calculate the discordance of the first alternative:

$$D_{12} = \frac{\max\{|0{,}3713 - 0{,}5570|\}}{\max\begin{Bmatrix} |0{,}3713 - 0{,}3570|; |0{,}3713 - 0{,}5570|; \\ |0{,}5698 - 0{,}4558| \end{Bmatrix}}$$

$$= \frac{\max\{0{,}1856\}}{\max\{0{,}1856\}} = 1$$

$$D_{13} = \frac{\max\{|0{,}3713 - 0{,}7427|\}}{\max\begin{Bmatrix} |0{,}3713 - 0{,}7427|; |0{,}3713 - 0{,}7427|; \\ |0{,}5698 - 0{,}6837| \end{Bmatrix}}$$

$$= \frac{\max\{0{,}3713\}}{\max\{0{,}3713\}} = 1$$

Calculate the discordance of the second alternative:

$$D_{21} = \frac{\max\{|0{,}4558 - 0{,}5698|\}}{\max\begin{Bmatrix} |0{,}5570 - 0{,}3713|; \\ |0{,}5570 - 0{,}3713|; |0{,}4558 - 0{,}5698| \end{Bmatrix}}$$

$$= \frac{\max\{0{,}1139\}}{\max\{0{,}1856\}} = 0.6136$$

$$D_{22} = \frac{\max\{|0{,}4558 - 0{,}6837|\}}{\max\{|0{,}5570 - 0{,}7427|; |0{,}5570 - 0{,}7427|; |0{,}4558 - 0{,}6837|\}}$$

$$= \frac{\max\{0{,}2279\}}{\max\{0{,}2279\}} = 1$$

Calculate the discordance of the third alternative:

$$D_{31} = \frac{\max\{|0{,}6837 - 0{,}5698|\}}{\max\begin{Bmatrix} |0{,}7427 - 0{,}3713|; |0{,}7427 - 0{,}3713|; \\ |0{,}6837 - 0{,}5698| \end{Bmatrix}}$$

$$= \frac{\max\{0{,}1139\}}{\max\{0{,}3713\}} = 0{,}3068$$

$$D_{32} = \frac{\max\{|0{,}7427 - 0{,}3713|\}}{\max\begin{Bmatrix} |0{,}7427 - 0{,}3713|; |0{,}7427 - 0{,}3713|; \\ |0{,}6837 - 0{,}568| \end{Bmatrix}}$$

$$= \frac{\max\{0{,}1856\}}{\max\{0{,}2279\}} = 0{,}8147$$

$$D = \begin{bmatrix} - & 1 & 1 \\ 0{,}6136 & - & 1 \\ 0{,}3068 & 0.8147 & - \end{bmatrix}$$

4) Determine the concordance and discordance dominant matrices

The F matrix as the dominant concordance matrix can be designed with the help of a threshold value, namely by comparing each element value of the concordance matrix with the threshold value.

$$C = \begin{bmatrix} - & 0.2 & 0 \\ 0.8 & - & 0 \\ 1 & 1 & - \end{bmatrix}$$

Threshold value with the following formula:

$$C_{ij} = \subseteq$$

$$\subseteq = \frac{0.8 + 0.2 + 0 + 0 + 1 + 1}{3(3-1)} = \frac{3}{6} = 0{,}5$$

So the concordance matrix is obtained as follows:

$$F = \begin{bmatrix} - & 0 & 0 \\ 1 & - & 0 \\ 1 & 1 & - \end{bmatrix}$$

Matrix G, as the dominant discordance matrix, can be built with the help of a threshold value d.

$$D = \begin{bmatrix} - & 1 & 1 \\ 0{,}6136 & - & 1 \\ 0{,}3068 & 0.8147 & - \end{bmatrix}$$

The threshold value obtained is the following matrix elements:

$$G_{ij} = 1\ jika\ G_{ij} \geq d\ dan\ 0\ jika\ G_{ij} < d$$

$$d = \frac{0{,}6136 + 0{,}3068}{3(3-1)} = \frac{0{,}8147 + 1 + 1 + 1}{6} = \frac{4{,}7352}{6} = 0{,}7892$$

So the discordance matrix obtained is as follows:

$$G = \begin{bmatrix} - & 1 & 1 \\ 0 & - & 1 \\ 0 & 1 & - \end{bmatrix}$$

5) Determine the dominant aggregate matrix

The E matrix as the dominant aggregate matrix is a matrix where each element is a multiplication of the elements of the matrix F with the elements of the matrix G corresponding to the following formula:

$$E_{kl} = F_{kl}\ X\ G_{kl}$$

$$E = \begin{bmatrix} - & 0 & 0 \\ 1 & - & 0 \\ 1 & 1 & - \end{bmatrix} X \begin{bmatrix} - & 1 & 1 \\ 0 & - & 1 \\ 0 & 1 & - \end{bmatrix}$$

$$E = \begin{bmatrix} - & 0 & 0 \\ 0 & - & 0 \\ 0 & 1 & - \end{bmatrix}$$

6) Eliminate less favorable alternatives

The results of calculations with the Electre method then obtained the highest rank, namely: A3, A2, A1. because if it indicates that the alternative E = 1 is the chosen alternative.

2.2 Weighted Product Implementation

Weighted Product is a method of Fuzzy Multi-Attribute Decision Making (FMADM), where it works to evaluate several alternative criteria where the criteria are not interdependent with each other. The Weighted Product method requires the normalization process by multiplying the results of the assessment of each attribute then divided by the standard values [12], [21]–[23].

The weighted Product calculation method is done with the following steps:

1. Repairing weights
2. Vector Calculations
3. The relative preference of each alternative

After meeting the qualification standards and administrative requirements, the next stage is selected based on the criteria needed by the company. The criteria used in the assessment as shown in table 5.

Table 5. Criteria and Final Weighting Selection

Criteria	Initial	Weight
Psychological Test	C1	25
Ability and Skill	C2	35
TOEFL	C3	20
Interview	C4	20

After determining the criteria weights then the next stage determines alternative values according to the criteria that have been given, as shown in Table 6 below.

Table 6. List of Alternative Values Criteria

Candidate	Criteria			
	C1	C2	C3	C4
A1	80	90	80	75
A2	88	85	76	87
A3	75	83	77	72

In calculating the WP method, first of all the weighting of the criteria is made. Criteria weights C1 = 25, C2 = 35, C3 = 20 and C4 = 20. Where the initial weight W = (25, 35, 20,20) will be corrected so that the total weight ∑wj = 1, by:

$$W_j = \frac{W_j}{\sum W_j} \quad (3)$$

$$W_1 = \frac{25}{25 + 35 + 20 + 20} = \frac{25}{100} = 0{,}25$$

$$W_2 = \frac{35}{25 + 35 + 20 + 20} = \frac{35}{100} = 0{,}35$$

$$W_3 = \frac{20}{25+35+20+20} = \frac{20}{100} = 0{,}20$$
$$W_4 = \frac{20}{25+35+20+20} = \frac{20}{100} = 0{,}20$$

Calculate the value of vector S by referring to the formula. Where WJ is a positive value rank for the type of benefit criteria and a negative value for the type of cost criterion. The solution is as follows:

$S_1 = (80^{0,25})(90^{0,35})\ (80^{0,20})\ (75^{0,20}) = 82{,}2977$
$S_2 = (88^{0,25})\ (85^{0,35})\ (76^{0,20})\ (87^{0,20}) = 84{,}233$
$S_3 = (75^{0,25})\ (83^{0,35})\ (77^{0,20})\ (72^{0,20}) = 77{,}4632$

Determine the value of vector V by referring to formula (2) where the highest V value will be the chosen alternative. The method of settlement is as follows:

$$V_1 = \frac{82.2977}{243.9939} = 0{,}3372$$
$$V_2 = \frac{84.233}{243.9939} = 0.3452$$
$$V_3 = \frac{77.4632}{243.9939} = 0{,}3174$$

The results after the calculation process using the WP method looks like in table 7.

Table 7. Calculation Results for the WP Method

Alternatives	Vektor S	Vektor V
A1	82,8977	0,3372
A2	84,233	0.3452
A3	77,4632	0.3174

3. RESULTS AND DISCUSSION

The following is a recapitulation of the results of testing data between system calculations, and manual calculations can be seen in the following table 8:

Table 8. Testing Result

No	Candidate	Result
1	A01	Correct
2	A02	Correct
3	A03	Correct
4	A04	Correct
5	A05	Correct
6	A06	Correct
7	A07	Correct
8	A08	Correct
9	A09	Correct
10	A10	Correct
11	A11	Correct
12	A12	Correct
13	A13	Correct
14	A14	Correct
15	A15	Correct
16	A16	Correct
17	A17	Correct
18	A18	Correct
19	A19	Correct
20	A20	Correct

$$= \frac{20}{20} x\ 100\% = 100\%$$

Table 8 shows the results of testing the accuracy of the WP method, where the accuracy results reached 100, namely 20 experiments with accurate values The largest to smallest order results or the ranking of prospective new employees from manual testing with a very precise system.

4. CONCLUSION

The new recruitment recommendation system built using the ELECTRE and WP methods has a 100% accuracy rate in testing the accuracy of the system with manual calculations so that it can be applied and can help in selecting new prospective employees at this banking company. Further work, this system can be adapted to the development of the company and can be made more detailed down to the type of work up to the job level.

5. REFERENCES (10 PT)

[1] D. F. Levin, "Leadership and vision.," *Emphasis. Nurs.*, vol. 4, no. 2, pp. 21–22, 1993.

[2] E. Archambault *et al.*, "Leadership," in *International Encyclopedia of Civil Society*, New York, NY: Springer US, 2010, pp. 934–940.

[3] T. A. Aziz, M. S. Maarif, and A. Sukmawati, "Pengaruh Rekrutmen dan Seleksi Terhadap Kinerja," *J. Apl. Bisnis dan Manaj.*, vol. 3, no. 2, pp. 246–253, 2017.

[4] J. E. Coverdill and W. Finlay, "Fit and skill in employee selection: Insights from a study of headhunters," *Qual. Sociol.*, vol. 21, no. 2, pp. 105–127, 1998.

[5] R. N. Landers and G. B. Schmidt, *Social media in employee selection and recruitment: Theory, practice, and current challenges*. Springer International Publishing, 2016.

[6] R. N. Landers and G. B. Schmidt, "Social media in employee selection and recruitment: An overview," in *Social Media in Employee Selection and Recruitment: Theory, Practice, and Current Challenges*, Springer International Publishing, 2016, pp. 3–11.

[7] E. Kartodikromo, B. Tewal, and I. Trang, "Proses Rekrutmen, Seleksi, Pelatihan Kerja Dan Pengaruhnya Pada Kinerja Karyawan CV. Celebes Indonesia Sakti Mer 99 Mega Mas Manado," *J. Ris. Ekon. Manajemen, Bisnis dan Akunt.*, vol. 5, no. 2, pp. 363–372, 2017.

[8] P. HALLINGER and E. M. BRIDGES, "EMPLOYEE SELECTION," in *A Problem-based Approach for Management Education*, Springer Netherlands, 2007, pp. 287–308.

[9] J. Patalas-Maliszewska and I. Krebs, "A model of employee selection for SME based on innovation transfer," in *Lecture Notes in Business Information Processing*, 2010, vol. 57 LNBIP, pp. 57–66.

[10] B. Pottale, "Pengaruh Proses Rekrutmen Dan Seleksi Terhadap Kinerja Karyawan Pada Pt Bank Sulutgo," *J. Berk. Ilm. Efisiensi*, vol. 16, no. 4, pp. 453–464, 2016.

[11] J. Kittur, "Optimal generation evaluation using SAW, WP, AHP and PROMETHEE multi - Criteria decision making techniques," in *Proceedings of IEEE International Conference on Technological Advancements in Power and Energy, TAP Energy 2015*, 2015, pp. 304–309.

[12] D. M. Khairina, M. R. Asrian, and H. R. Hatta, "Decision Support System For New Employee Recruitment Using Weighted Product Method," in *Proceedings - 2016 3rd International Conference on Information Technology, Computer, and Electrical Engineering, ICITACEE 2016*, 2017, pp. 297–301.

[13] C. Hernandez, C. Perdomo, and D. Giral, "Spectral opportunity selection based on the hybrid algorithm AHP-ELECTRE," *TELKOMNIKA (Telecommunication Comput. Electron. Control.*, vol. 18, no. 6, Dec. 2020.

[14] L. Fei, J. Xia, Y. Feng, and L. Liu, "An ELECTRE-Based Multiple Criteria Decision Making Method for Supplier Selection Using Dempster-Shafer Theory," *IEEE Access*, vol. 7, pp. 84701–84716, 2019.

[15] M. C. Wu and T. Y. Chen, "The ELECTRE multicriteria analysis approach based on intuitionistic fuzzy sets," in *IEEE International Conference on Fuzzy Systems*, 2009, pp. 1383–1388.

[16] F. Dammak, L. Baccour, A. Ben Ayed, and A. M. Alimi, "ELECTRE method using interval-valued intuitionistic fuzzy sets and possibility theory for multi-criteria decision making problem resolution," in *IEEE International Conference on Fuzzy Systems*, 2017.

[17] A. De Santis, "Status and prospects for Lorentz and CPT violation tests at KLOE and KLOE-2," in *Proceedings of the 5th Meeting on CPT and Lorentz Symmetry, CPT 2010*, 2011, vol. 1375, no. 1, pp. 89–93.

[18] S. Verma and K. Patel, "Weighted product taxonomy for mobile-commerce site in recommendation of product based on heuristic approach," in *2019 International Conference on Intelligent Computing and Control Systems, ICCS 2019*, 2019, pp. 1435–1440.

[19] R. A. Sukamto, *Rekayasa Perangkat Lunak*. Bandung: Informatika, 2015.

[20] F. M. Pematang, S. Menggunakan, and M. Electre, "Sistem pendukung keputusan dalam seleksi penyiar radio boss fm 102.8 pematang siantar menggunakan metode electre," vol. I, pp. 38–44, 2017.

[21] D. Dyah, S. Wiyono, and S. Mahardhika, "Penerapan Metode Weighted Product Untuk Sistem Pendukung Keputusan Penerima Beasiswa Politeknik Harapan Bersama Tegal," *J. Inform. J. Pengemb. IT*, vol. 3, no. 2, pp. 136–142, 2018.

[22] N. S. Fitriasari, S. A. Fitriani, and R. A. Sukamto, "Comparison of weighted product method and technique for order preference by similarity to ideal solution method: Complexity and accuracy," in *Proceeding - 2017 3rd International Conference on Science in Information Technology: Theory and Application of IT for Education, Industry and Society in Big Data Era, ICSITech 2017*, 2017, vol. 2018-January, pp. 453–458.

[23] B. Das, S. S. Bhunia, S. Roy, and N. Mukherjee, "Multi criteria routing in wireless sensor network using weighted product model and relative rating," in *Proceedings - International Conference on 2015 Applications and Innovations in Mobile Computing, AIMoC 2015*, 2015, pp. 132–136.