

Decision Support System for Web-Based Employee Candidates at PT.Indomarco Prismatama Using the ELECTRE Method

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ABSTRACT

Indomaret or PT.Indomarco Prismatama is one of the largest franchised minimarket companies in Indonesia which is engaged in services and sales. Indomaret is a subsidiary of the Salim Group. The number of Indomaret Stores continues to grow, so PT.Indomarco Prismatama will need a lot of employees so PT.Indomarco has opened job vacancies to meet the specified number of employees. In recruiting prospective employees, Indomaret takes a long time to recruit prospective employees because they have to make decisions fairly and appropriately. The purpose of this study is to design and build a decision support system for recruitment of prospective employees. This system is designed using UML and is built with the programming languages PHP, HTML, CSS, Javascript and MySql as the database. Then determine the prospective employees who successfully passed the selection of employee admissions at PT.Indomarco Prismatama using the ELECTRE method. The ELECTRE (*Elimination and Choice Expressing Reality*) method is one of the methods of ranking concept decision making, namely by using pairwise comparisons between alternatives on the appropriate criteria. The research result obtained is the decision to determine the applicants who successfully passed the selection. Of the 5 samples of potential applicants, namely A1, A2, A3, A4 and A5 the applicants who successfully passed were A5 because they had the highest score compared to the other samples.

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1. Introduction

The franchise business in Indonesia is developing very rapidly which makes it an attractive investment form. The franchise business aims to introduce the brand by allowing others to distribute its products with the same quality assurance anywhere. Franchising is an agreement based on voluntary will, to achieve a profitable goal (*economic prospective*) which is considered fair to the parties [1]. One of the franchise businesses that is growing very rapidly in Indonesia is Indomaret. Indomaret or PT. Indomarco Prismatama is one of the largest franchised minimarket companies in Indonesia which is engaged in services and sales. The number of Indomaret Stores that continues to grow, PT. IndomarcoPrismatama will require many employees so that PT. Indomarco has opened job vacancies to meet the specified number of employees. Human resources in a company are very important to support the progress and quality of the company in achieving its goals [2].

Based on the results of previous research in 2016 with the title Decision Support System for Employee Acceptance at PT.SULTRA INTI RODA PERKASA using the *Weighted Product (WP)* and *Simple Additive Weighting (SAW) Methods*. discuss about the recruitment process still involves considerations that lead to making inappropriate decisions, so employee hiring there are several criteria used, namely Education, Work Experience, Basic Ability Tests, Skill Tests and Interview Tests. The result of the research is an application of decision support for employee recruitment in the ranking process for recruiting prospective employees has the same result value, if the two methods have the same weight value [3].

In recruiting prospective employees, Indomaret takes a long time to recruit prospective employees because they have to make decisions fairly and accurately by comparing several opinions from superiors in the company. To make it easier for Indomaret to perform automatic selection, of course this will greatly save time and reduce the risk of errors in the required position, namely the



Decision Support System [4]. Decision Support System is a further development of a computerized management information system (*Computerized Management Information System*), which is designed in such a way that it is interactive with its users. Interactive information systems that provide information, modeling and data manipulation [5]. Recruitment and selection system at PT. Indomarco Prismatama not only covers the recruitment of external employees but also increases the company's effectiveness [6]. The achievement of company goals is very dependent on the quality of human resources and to obtain such resources, every company must have standard recruitment and selection of employees based on the core of the company's activities [7]. In work life, employees are also the most important value [8].

In this study, a web-based Decision Support System was built using the ELECTRE method. The ELECTRE (*Elimination and Choice Expressing Reality*) method is one of the methods of ranking concept decision making, namely by using pairwise comparisons between alternatives on the appropriate criteria [9]. The ELECTRE method was chosen because it has a good performance for analyzing policies that involve the criteria for recruiting prospective employees at Indomaret. This algorithm works by processing the weighted value of each criterion and candidate employees and producing an absolute value that is easy to use for making decisions [10]. Electre method is widely known for high performance policy analysis involving qualitative and quantitative criteria. However, the critical advantage of the Electre method is its ability to show the right actions of the decision maker and suggest an appropriate evaluation approach [11].

2. Method

2.1 Research Framework

To help in the preparation of this study, it is necessary to be a clear framework of the stages. This framework is the steps to be done in the completion of the problem to be discussed. Here are the steps done according to the artwork of the study of the authors as seen in Figure 1.

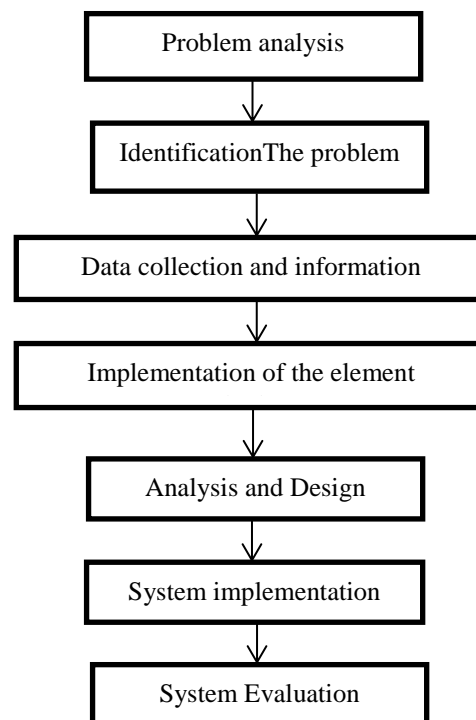


Figure 1. Research Framework

2.2 Data collection

Collecting the necessary data for research needs, including by conducting *observations* and interviews conducted by researchers directly at PT. Indomarco Prismatama by asking some problems that occur in the recruitment of prospective employees [12]. Then collect data and information in the



process of entrepreneurial receipt, the data collected is the criteria data used in acceptance of employees in PT.Indomarco Prismatama is age, height, status, communication, appearance, psychotes test, interview test and health test. Research conducted will accurate information in which information collection also uses journals, books, internet or other media.

2.3 Analysis by ELECTRE Method

The method of electre used is on conditions where alternatives are less in accordance with the criteria eliminated, and the appropriate alternatives can be generated. Used for cases with many alternatives but only a few criteria are involved. An alternative is said to dominate other alternatives if one or more criteria exceed (compared to the criteria of other alternatives) and the same as the criterion other left [13].

The steps done in solving problems using the ELECTRE method is as follows [14]:

Step 1:

Normalization of decision matrix. In this procedure, each attribute is converted to a comparable value. Any normalization of the value of r_{ij} can be done with the formula:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{l=1}^n x_{il}^2}} \quad (1)$$

For $i = 1, 2, 3, \dots, M$ and $j = 1, 2, 3, \dots, N$

So the acquired matrix r result of normalization,

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \dots & \dots & \dots & \dots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix}$$

R is a normalized matrix, where M declare the alternative, n claiming criteria and R_{ij} is the normalization of choice measurements of the i alternative in relation to the j criteria.

Step 2:

Weighting on the matrix that has been normalized. After normalized, each column of the R matrix is multiplied by weight-bobs (W) specified by the decision maker. Thus, Weighted Normalized Matrix is $V = RW$ written in the following formula:

$$V = \begin{bmatrix} v_{11} & v_{12} & \dots & v_{1n} \\ v_{21} & v_{22} & \dots & v_{2n} \\ \dots & \dots & \dots & \dots \\ v_{m1} & v_{m2} & \dots & v_{mn} \end{bmatrix} = RW = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \dots & w_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \dots & w_n r_{2n} \\ \dots & \dots & \dots & \dots \\ w_1 r_{m1} & w_2 r_{m2} & \dots & w_n r_{mn} \end{bmatrix} \quad (2)$$

Where w is:

$$W = \begin{bmatrix} w_1 & 0 & 0 & \dots & 0 \\ 0 & w_2 & 0 & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & 0 & 0 & \dots & w_n \end{bmatrix} \text{ and } \sum_{i=1}^n w_i = 1$$

Step 3:

Determine the *concordance* and *discordance set*. For each pair of alternatives k and l ($k, l = 1, 2, 3, \dots, m$ and $k \neq l$) the set of criteria J is divided into two subsets, namely *concordance* and *discordance*.

When a criterion in an alternative including *concordance* is:

$$C_{kl} = \{j, y_{kj} \geq y_{lj}\}, \text{ for } j = 1, 2, 3, \dots, n \quad (3)$$

Conversely, the complementary of this subset is *discordance*, which is when:

$$D_{kl} = \{j, y_{kj} < y_{lj}\} \text{ for } j = 1, 2, 3, \dots, n \quad (4)$$

Step 4:

Calculate the matrix *concordance* and *discordance*.

a. Concordance

To determine the value of the elements in the matrix concordance is to add the weights included in the subset concordance, mathematically is the formula:

$$c_{kl} = \sum_{j \in C_{kl}} w_j \quad (5)$$



So matrix *concordance* that the resulting is :

$$C = \begin{bmatrix} - & c_{12} & c_{13} & \dots & c_{1n} \\ c_{21} & - & c_{23} & \dots & c_{2n} \\ \dots & & & & \\ c_{m1} & c_{m2} & c_{m3} & \dots & - \end{bmatrix}$$

b. *Discordance*

To determine the value of the elements in the matrix discordance is to divide the maximum difference in the value of the criteria included in the discordance subset by the maximum difference in the values of all existing criteria, mathematically is

$$D_{kl} = \frac{\{\max(v_{mn} - v_{mn} - l_n)\}; m, n \in D_{kl}}{\{\max(v_{mn} - v_{mn} - l_n)\}; m, n = 1, 2, 3, \dots} \quad (6)$$

Obtain the matrix *discordance*:

$$D = \begin{bmatrix} - & d_{12} & d_{13} & \dots & d_{1n} \\ d_{21} & - & d_{23} & \dots & d_{2n} \\ \dots & & & & \\ d_{m1} & d_{m2} & d_{m3} & \dots & - \end{bmatrix}$$

Step 5:

Determine the dominant *concordance* and *discordance*.

a. *Concordance*

Dominant matrix *concordance* can be constructed with the help of the value *threshold*, namely by comparing each value of the matrix element *concordance* with the value *threshold*.

$C_{kl} \geq c$ with a threshold value (c), is: (7)

$$c = \frac{\sum_{k=1}^n \sum_{l=1}^n c_{kl}}{m * (m - 1)} \quad (8)$$

And the value of each element of the F matrix as the dominant matrix is *concordance* determined as follows:

$f_{kl} = 1$, if $c_{kl} \geq c$ and $f_{kl} = 0$, if $c_{kl} < c$

b. *Discordance*

To build a dominant matrix discordance values are also used threshold, namely:

$$d = \frac{\sum_{k=1}^n \sum_{l=1}^n d_{kl}}{m * (m - 1)} \quad (9)$$

and the value of each element for the matrix G as the dominant matrix is *discordance* determined as follows:

$g_{kl} = 0$, jika $c_{kl} \geq d$ dan $g_{kl} = 1$, jika $c_{kl} < d$ (10)

Step 6:

Determine the *aggregate dominance matrix*. The next step is to determine the *aggregate dominance matrix* as an E matrix, where each element is the multiplication of the F matrix elements with the G matrix elements, as follows:

$e_{kl} = f_{kl} \times g_{kl}$ (11)

Step 7:

Elimination of alternatives *less favorable*. Matrix E provides the order of choice for each alternative, that is, if $e_{kl} = 1$ then alternative A_k is a better choice than A_l . So that rows in matrix E which have the



least number of $ecl = 1$ can be eliminated. Thus the best alternative is one that dominates the other alternatives.

3 Results and discussions

3.1 Analysis and the application of the ELECTRE method

Method The ELECTRE (*Elimination and Choice Expressing Reality*) method is one of the decision-making methods for the ranking concept, namely by using pairwise comparisons between alternatives on the appropriate criteria. The Electre method is used in conditions where alternatives that do not meet the criteria are eliminated, and suitable alternatives can be generated.

1. Determine the criteria for recruitment of prospective employees at PT. Indomarco Prismaatama:

- a. Age (C1)
- b. Height (C2)
- c. Status (C3)
- d. Communication (C4)
- e. Appearance (C5)
- f. Psychotes test (C6)
- g. Interview test (C7)
- h. Medical check up(C8)

2. Alternate to:

The names of prospective employees who have passed the Selection of Administration files at PT. Indomarco Prismaatama.

3. Specifies the alternative weight on each criteria, namely:

- 1 = very less
- 2 = less
- 3 = enough
- 4 = Good
- 5 = very good

a. Age Criteria (C1)

Table 1
Age Criteria

Age	Variable	Weight
19-20 years	Good	4
21-22 years	Enough	3
23-25 years	Less	2

b. High Criteria (C2)

Table 2
High Criteria

Height	Variable	Weight
≥ 160 cm	Very good	5
156-159 cm	Good	4
151-155 cm	Less	2
≤ 150 cm	Very less	1

c. Criteria Status (C3)

Table 3
Status Criteria

Status	Variabel	Weight
Single	Very good	5
Married	Enough	3



d. Communication Criteria (C4)

Table 4

Communication Criteria	
Communication	Weight
Very good	5
Good	4
Enough	3
Less	2
Very less	1

e. Performance Criteria(C5)

Table 5

Performance Criteria	
Performance	Weight
Very good	5
Good	4
Enough	3
Less	2
Very less	1

f. Psychotes test (C6)

Table 6

Psychotes test Criteria		
Psychotes test	Variable	Weight
≥ 90	Very good	5
71-89	Good	4
66-70	Enough	3
51-65	Less	2
≤ 50	Very less	1

g. Interview Test Criteria (C7)

Table 7

Interview test Criteria		
Interview test	Variable	Weight
≥ 90	Very good	5
80-89	Good	4
70-79	Enough	3
51-69	Less	2
≤ 50	Very less	1

h. Medical check up Criteria (C8)

Table 8

Medical check up Criteria	
Medical check up	Weight
Very good	5
Good	4
Enough	3
Less	2
Very less	1

Criteria data that have been obtained from observations and interviews with PT. Indomarco Prismatama in the decision support system for recruiting prospective employees at PT.Indomarco Prismatama using the ELECTRE method.

Table 9

Data Candidate Employee

Alternative	Age	High (cm)	Status	Communication	Performance	Psycho The test	Interview	Medical Check up
Ika	23	155	Single	Good	Good	80	87	Good
Rima	24	158	Married	Enough	Good	90	80	Enough
Dimas	22	160	Single	Enough	Good	89	85	Good
Great	22	165	Single	Good	Good	88	83	Good
Lisda	23	159	Married	Good	Enough	90	88	Good



Based on the weight that has been determined for each criteria, the table below shows the suitability rating of each alternative on each criteria.

Table 10
Compatibility ratings

Alternative	C1	C2	C3	C4	C5	C6	C7	C8
A1	2	2	5	4	4	4	4	4
A2	2	4	3	3	4	5	4	3
A3	3	5	5	3	4	4	4	4
A4	3	5	5	4	4	4	4	4
A5	2	4	3	4	3	5	4	4

The step for completing the ELECTRE Methods as follows:

a. Normaze decision matrix.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{l=1}^{ad} x_{lj}^2}}$$

So the acquired matrix R is normalization.

R =	0,365	0,216	0,518	0,492	0,468	0,404	0,447	0,468
	0,365	0,431	0,311	0,369	0,468	0,505	0,447	0,351
	0,548	0,539	0,518	0,369	0,468	0,404	0,447	0,468
	0,548	0,539	0,518	0,492	0,468	0,404	0,447	0,468
	0,365	0,431	0,311	0,492	0,351	0,505	0,447	0,468

b. Weighting on the matrix that has been normalized. Where the decision-making weight is $W = \{C1 = 4, C2 = 4, C3 = 3, C4 = 3, C5 = 5, C6 = 5, C7 = 4 \text{ and } C8 = 3\}$.

So that: $V_{IJ} = R_{IJ} * W_j$

V _{IJ} =	0,365	0,216	0,518	0,492	0,468	0,404	0,447	0,468	
	0,365	0,431	0,311	0,369	0,468	0,505	0,447	0,351	
	0,548	0,539	0,518	0,369	0,468	0,404	0,447	0,468	= 4 4 3 3 5 5 4 3
	0,548	0,539	0,518	0,492	0,468	0,404	0,447	0,468	
	0,365	0,431	0,311	0,492	0,351	0,505	0,447	0,468	

So obtained the matrices V result of multiplication R and W.

W =	1,461	0,863	1,555	1,477	2,341	2,020	1,789	1,404
	1,461	1,725	0,933	1,108	2,341	2,525	1,789	1,053
	2,191	2,157	1,555	1,108	2,341	2,020	1,789	1,404
	2,191	2,157	1,555	1,477	2,341	2,020	1,789	1,404
	1,461	1,725	0,933	1,477	1,756	2,525	1,789	1,404

c. Determine the Concordance and Discordance Set.

Concordance is:

$$C_{.k1} = \{J, Y_{kj} \geq Y_{1j}\}, \text{ for } J = 1, 2, 3, \dots, N$$

Table 11
The set concordance

Ck1	The set							
C11	1	2	3	4	5	6	7	8
C12	1		3	4	5		7	8
C13			3	4	5	6	7	8
C14			3	4	5	6	7	8
C15	1		3	4	5		7	8
C21	1	2			5	6	7	
C22	1	2	3	4	5	6	7	8
C23				4	5	6	7	
C24					5	6	7	
C25	1	2	3		5	6	7	
C31	1	2	3		5	6	7	8
C32	1	2	3	4	5		7	8



C33	1	2	3	4	5	6	7	8
C34	1	2	3		5	6	7	8
C35	1	2	3		5		7	8
C41	1	2	3	4	5	6	7	8
C42	1	2	3	4	5		7	8
C43	1	2	3	4	5	6	7	8
C44	1	2	3	4	5	6	7	8
C45	1	2	3	4	5		7	8
C51	1	2		4		6	7	8
C52	1	2	3	4		6	7	8
C53				4		6	7	8
C54				4		6	7	8
C55	1	2	3	4	5	6	7	8

Discordance is:

$$D_{k1} = \{J, Y_{kj} < Y_{1j}\}, \text{ for } J = 1, 2, 3, \dots, N$$

Table 12
The set *discordance*

Dk1	The set							
D11								
D12		2				6		
D13	1	2						
D14	1	2						
D15		2				6		
D21			3	4				8
D22								
D23	1	2	3					8
D24	1	2	3	4				8
D25				4				8
D31				4				
D32						6		
D33								
D34				4				
D35				4		6		
D41								
D42						6		
D43								
D44								
D45						6		
D51			3		5			
D52					5			
D53	1	2	3		5			
D54	1	2	3		5			
D55								

d. Count the matrix *concordance* and *discordance*

Concordance:

Table 13
Matrix *concordance*

	1	2	3	4	5
1	-	22	23	23	22
2	22	-	17	14	25
3	28	26	-	28	23
4	31	26	31	-	26
5	23	26	15	15	-

Discordance:

Table 14
Matrix *discordance*

	1	2	3	4	5
1	-	1,385	3,501	0	1,385
2	0,721	-	1,45	1,45	0,63
3	0,285	0,691	-	0	0,691
4	0	0,691	0	-	0,691
5	0,721	1,585	1,45	1,45	-



e. Determine the matrix *concordance* and *discordance*

Concordance:

$$c = \frac{22 + 23 + 23 + 22 + 22 + 17 + 14 + 25 + 28 + 26 + 28 + 23 + 31 + 26 + 31 + 26 + 23 + 26 + 15 + 15}{5(5-1)} = \frac{466}{20} = 23,3$$

Table 15
Calculation of the threshold value *c*

-	22	23	23	22
22	-	17	14	25
28	26	-	28	23
31	26	31	-	26
23	26	15	15	-
The total				466
Threshold (c)				23,3

Table 16
Dominant matrix *concordance*

	1	2	3	4	5
1	-	0	0	0	0
2	0	-	0	0	1
3	1	1	-	1	0
4	1	1	1	-	1
5	0	1	0	0	-

Discordance:

$$d = \frac{1,385 + 3,501 + 1,385 + 0,721 + 1,45 + 1,45 + 0,63 + 0,285 + 0,691 + 0,691 + 0,691 + 0,691 + 0,721 + 1,585 + 1,45 + 1,45}{5(5-1)} = \frac{18,777}{20} = 0,938$$

Table 17
Calculation of the threshold value *d*

-	1,385	3,501	0	1,385
0,721	-	1,45	1,45	0,63
0,285	0,691	-	0	0,691
0	0,691	0	-	0,691
0,721	1,585	1,45	1,45	-
The total				18,777
Threshold (d)				0,938

Table 18
Dominant matrix *discordance*

	1	2	3	4	5
1	-	1	1	0	1
2	0	-	1	1	0
3	0	0	-	0	0
4	0	0	0	-	0
5	0	1	1	1	-

f. Determine the *Aggregate Dominance Matrix*

-	0	0	0	0	-	1	1	0	1
0	-	0	0	1	0	-	1	1	0
1	1	-	1	0	*	0	0	-	0
1	1	1	-	1	0	0	0	-	0
0	1	0	0	-	0	1	1	1	-

Table 19
Dominant matrix *aggregate*

A	1	2	3	4	5	Total
A1	-	0	0	0	0	0
A2	0	-	0	0	0	0
A3	0	0	-	0	0	0
A4	0	0	0	-	0	0
A5	0	1	0	0	-	1



g. Alternative elimination

Table 20

Alternative elimination

A	1	2	3	4	5	Total	Decision
Ika	-	0	0	0	0	0	Do not pass
Rima	0	-	0	0	0	0	Do not pass
Dimas	0	0	-	0	0	0	Do not pass
Great	0	0	0	-	0	0	Do not pass
Lisda	0	1	0	0	-	1	Pass

Based on table 20 values that dominate from any alternatives selected as employees in PT.INDOMARCO Prismaatama is a 5 or alternate line alia alternative A1, A2, A3, and A4 alternimed or not passed.

3.2 Design and application of systems

a. Use case

Use case diagramis a technique used in the developmentDecision support systems use the Electre method to get the functional needs of the system. On Use Case will explain the interaction that occurs between actors –inisiator from the decision support system [15].

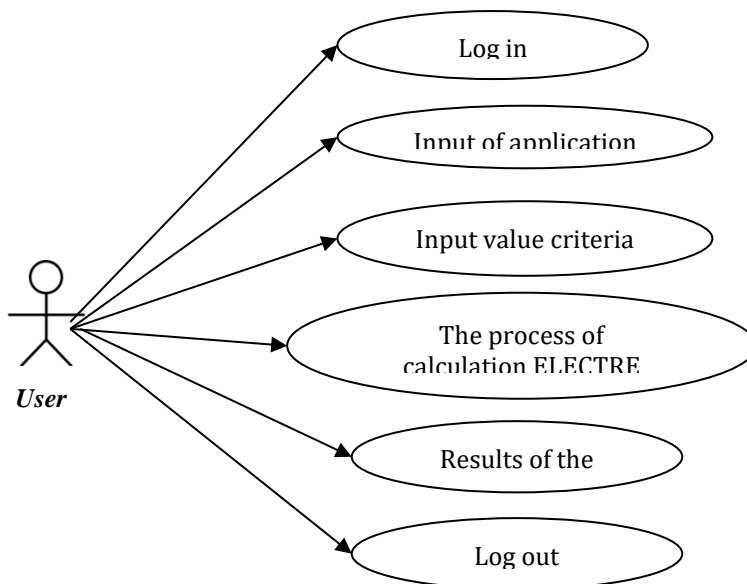


Figure 2. Use case

Table 21

Information Use case

Name Use case	Description
Log in	Start the system
Input of application of data	Enter the name of the applicant candidates
Input value criteria	Showing the weight of the criteria
The calculation process of the electr method	Showing the overall calculation results by performing the calculation according to the measure of the method of electr
Results of the decision	Showing the decision results of the system
Log out	Out system



b. The design between interface adjacent is a picture of the hierarchy structure and the overall system view. The initial design and the main menu.

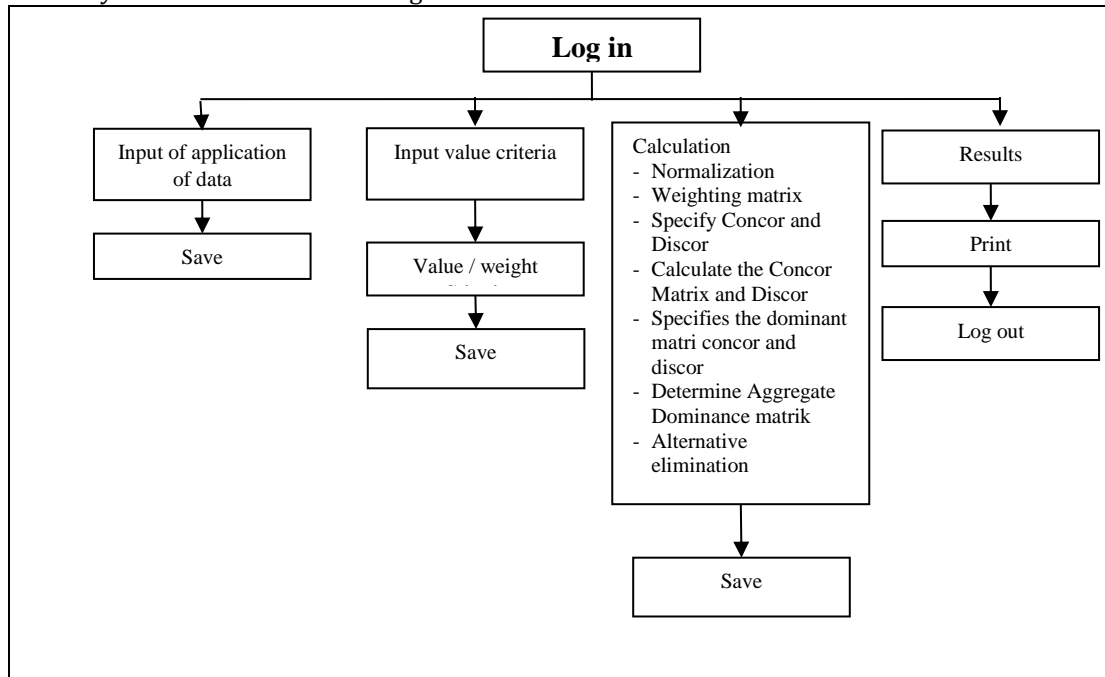


Figure 3. Interface design

c. Results View

Display results decision acceptance of employees from the system, then automatically appear Results of the decision By using the ELECTRE method. The appearance is as follows:

	1	2	3	4	5	Jumlah	Keputusan
TKA	0	0	0	0	0	0	Tidak Lulus
Rima	0	0	0	0	0	0	Tidak Lulus
Dimas	0	0	0	0	0	0	Tidak Lulus
Agung	0	0	0	0	0	0	Tidak Lulus
Lisda	0	1	0	0	0	1	Lulus

Figure 4. Skills Results



4. Conclusion

Based on the results of research and testing support system decision to accept the prescribing candidate at PT. Indomarco Prismisma Web-based Using by ELECTRE Method, it can be taken some conclusions, as follows:

- a. The decision support system is designed using UML, namely USECASE Diagram, Activity Diagram and Class Diagram and this system is built using PHP programming, CSS, JavaScript and MYSQL as a database.
- b. This decision support system is applied by the method of electret oneThe decision-making method of the concept of the branch, which is to use the comparison of inter-alternatives on the appropriate criteria.Of the 5 samples that have been tested, namely A1, A2, A3, A4 and A5 obtained results that decisions, namely A1, A2, A3 and A4 are eliminated and who successfully passed the selection with the highest score of A5.

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