

Site Determination of Decision Support System Pelita Nusantara STMIK Campus Branch With the Electre Method

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ABSTRACT

The problem that is often faced by the campus is ineffective in determining strategic locations. Failure to determine the location will be detrimental to the campus, resulting in the closure of the campus. To avoid this problem, analysis and appropriate methods are needed to assist in determining strategic campus locations. The Electre method is a decision-making method based on the Outranking concept that produces various alternatives to assist management in dealing with structured and unstructured problems, based on pairwise comparisons with alternatives that match the criteria and those that do not match the criteria will be eliminated. This method is needed as a Decision Support System (SPK) that can help the STMIK Pelita Nusantara campus, Medan in determining strategic campus locations. This study aims to apply the Electre method and build a Decision Support System for determining the location of the STMIK Pelita Nusantara branch campus. The method used in this study is the electre method to determine Population Density weighting, transportation access, location security, distance to other campuses, and high school / vocational school level education. Based on the analysis using the electro method, it is known that the strategic location of the campus branch can be used as an alternative, namely Medan Johor

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1. Introduction

Determining the location is one of the most important marketing strategy activities that affect the marketing success of a campus. The problem that is often faced by the campus is ineffective in determining strategic locations. Locations that become strategic campus branch alternatives in this study include: Medan Helvetia, Medan Johor, Medan Marelan, Medan Tembung, Medan Tuntung.

Failure to determine a strategic location will be detrimental to the campus, resulting in closure. The more strategic the location of the campus is chosen, the higher the level of desire of students to study at that campus. But if the location chosen is not strategic, students will feel hesitant to continue their education on campus, so a Decision Support System is needed which can help the campus in determining a strategic location, namely by using the Electre Method.

This study aims to implement and build a location decision support system that functions as a decision-making tool for strategic branch location decisions. So that there will be no more errors in location selection that result in losses and closures.

A Decision Support System is a Decision Support System (DSS) or a Decision Support System (DSS) is a system that is able to provide problem-solving and communication capabilities for problems with semi-structured and unstructured conditions. This system is used to assist decision making in semi-structured and unstructured situations, where no one knows exactly how decisions should be made (Turban, 2001).

The Electre method is a multi-criteria decision-making method based on the concept of Outranking using pairwise comparisons of alternative alternatives based on each appropriate criterion (Janko and Bernoider, 2005: 11). An alternative is said to dominate the other alternatives if one or more of its criteria exceeds (compared to the criteria of the other alternatives) and is the same as the remaining criteria (Kusumadewi et al, 2006).

The steps of the Electre method are:

- 1) Normalization of the decision matrix.
- 2) The weighting of the matrix that has been normalized.
- 3) Determining Concordance and Discordance.

- 4) Calculating the Concordance and Discordance matrices.
- 5) Determine the Dominant Concordance and Discordance Matrix.
- 6) Determine the dominant aggregate matrix.
- 7) Elimination of alternatives.

2. Research Methods

The stages in this study are described as follows:

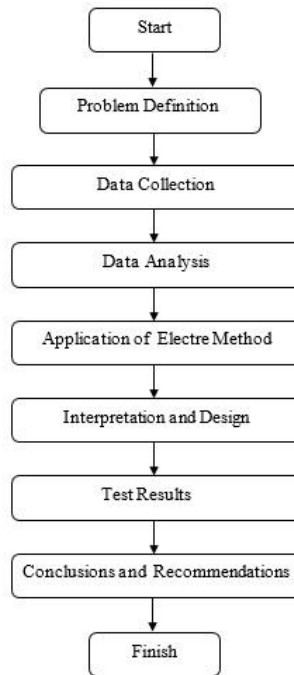


Fig 1. Research framework

3. Results and Analysis

A. Electre Method Analysis

After determining and planning the criteria in determining the location according to each alternative then analyzed by the Electre Method, where alternatives that do not match the criteria are eliminated, and suitable alternatives can be generated. Data collected from 5 determining the location of the campus branch in Medan city at the District level.

Table 1
Location Determination

No.	Alternative	Population density	Access to Transportation	Location Security	Distance to other campuses	SMA / SMK level education
1	Helvetia Field	11701	Transportation access is adequate	Medium crime rate and moderate risk	4.3 km	36
2	Medan Johor	9333	Transportation access is adequate	Medium crime rate and moderate risk	7.5 km	28
3	Marelan Medan	7240	Transportation access is adequate	Low crime rate and low risk	13 km	21
4	Convex Field	17382	Transportation access is adequate	Low crime rate and low risk	2.7 km	25
5	Lucky Field	4252	Transportation access is adequate	Low crime rate and low risk	2.9 km	16

Table 2
Location Determination Criteria

No.	Criteria Code	Name Criteria	Weight
1	C1	Population density	4
2	C2	Access to Transportation	5
3	C3	Location Security	4
4	C4	Distance to Other Campuses	3
5	C5	High school education	5

Table 3
Location Determination Alternative

No.	Alternative Code	Alternative name
1	A1	Helvetia Field
2	A2	Medan Johor
3	A3	Marelan Medan
4	A4	Convex Field
5	A5	Lucky Field

Determining the suitability rating for each alternative on each criterion is rated with one to five, namely:

- 1 = Very Bad
- 2 = Bad
- 3 = Enough
- 4 = Fine
- 5 = Very good

Table 4
Fitness Rating of Each Alternative on Each Criteria.

No.	Alternative	Population density	Access to Transportation	Location Security	Distance to other campuses	High school level education
1	Helvetia Field	5	4	3	3	5
2	Medan Johor	5	4	3	4	5
3	Marelan Medan	4	4	4	5	4
4	Convex Field	5	4	4	2	4
5	Lucky Field	3	4	4	2	4

Application of the Electre Method

a) Normalization of the decision matrix

Obtained Normalization results:

$$R = \begin{bmatrix} 0,5 & 0,4472 & 0,3692 & 0,3939 & 0,5051 \\ 0,5 & 0,4472 & 0,3692 & 0,5252 & 0,5051 \\ 0,4 & 0,4472 & 0,4923 & 0,6565 & 0,4041 \\ 0,5 & 0,4472 & 0,4923 & 0,2626 & 0,4041 \\ 0,3 & 0,4472 & 0,4923 & 0,2626 & 0,4041 \end{bmatrix}$$

b) Weighting on the normalized matrix.

$$V = \begin{bmatrix} 2 & 2,2361 & 1,4768 & 1,1818 & 2,5254 \\ 2 & 2,2361 & 1,4768 & 1,5757 & 2,5254 \\ 1,6 & 2,2361 & 1,9692 & 1,9696 & 2,0203 \\ 2 & 2,2361 & 1,9692 & 0,7878 & 2,0203 \\ 1,2 & 2,2361 & 1,9692 & 0,7878 & 2,0203 \end{bmatrix}$$

c) Specifies the concordance and discordance set Based on calculations up to C55, the set of concordances is obtained as follows:

Table 5
Concordance Association

Ckl	The set
C11	1,2,3,4,5
C12	1,2,3,5
C13	1,2,5
C14	1,2,4,5
C15	1,2,4,5
C21	1,2,3,4,5
C22	1,2,3,4,5
C23	1,2,5
C24	1,2,4,5
C25	1,2,4,5
C31	2,3,4
C32	2,3,4
C33	1,2,3,4,5
C34	2,3,4,5
C35	1,2,3,4,5
C41	1,2,3
C42	1,2,3
C43	1,2,3,5
C44	1,2,3,4,5
C45	1,2,3,4,5
C51	2,3
C52	2,3
C53	2,3,5
C54	2,3,4,5
C55	1,2,3,4,5

Table 6
Discordance Association

Dkl	The set
D12	4
D13	4
D14	3
D15	3
D23	4
D24	3
D25	3
D31	1.5
D32	1.5
D34	1
D41	4.5
D42	4.5
D43	4
D51	1,4,5
D52	1,4,5
D53	1.4
D54	1

d) Calculate concordance and discordance matrices.

Table 7
Matrix Concordance

	1	2	3	4	5
1	-	18	14	17	17
2	21	-	14	17	17
3	12	12	-	17	21
4	13	13	18	-	21
5	9	9	14	17	-
Total					311
Threshold C					15,55

Table 8
Discordance Matrix

	1	2	3	4	5	
1	-	1	1	0,4924	0,6155	
2	0	-	0,9750	0,6250	0,6155	
3	0,6411	1	-	0,3385	0	
4	1	1	1	-	0	
5	1	1	1	1	-	
Total						14,303
Treshold D						0,7151

Table 9
Concordance Dominant Matrix

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

Table 10
Discordance Dominant Matrix

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

e) Determine the dominant concordance and discordance matrices.

Table 11
Aggregate Dominant Matrix

A	1	2	3	4	5	Jumlah
1	-	0	0	1	1	2
2	1	-	0	1	1	3
3	0	0	-	1	1	2
4	0	0	0	-	1	1
5	0	0	0	0	-	0

f) Elimination of less favorable alternatives.

Table 12
Alternative Elimination

A	1	2	3	4	5	total	
1	-	0	0	1	1	2	Elimination
2	1	-	0	1	1	3	
3	0	0	-	1	1	2	Elimination
4	0	0	0	-	1	1	Elimination
5	0	0	0	0	-	0	Elimination

The application of the Electre Method in the decision making for the location of the campus branch is carried out by eliminating another alternative, namely the alternative number of eclips with a value of 1. The alternative chosen is the better alternative. Based on table 4.12, the dominating value of each alternative is in row 2 or alternative A2, while A1, A3, A4 and A5 are eliminated.

B. System Implementation

Implementation serves to present the program results in thesis writing which is the process of applying the Electre method which is designed on a web basis and testing whether the program is running well

C. Login Form Implementation

The first display that appears when the program is first run is the Login Form. Admin must enter a username and password to enter the Admin page.

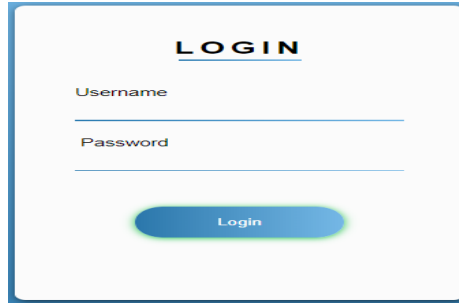


Fig 2. Login Form

D. Main Menu Form Implementation

In the main form menu there are several menus such as User, Criteria, Branch Location, Electre Process and Logout. The main menu form functions to make it easier for users to call forms that have been created in one application.

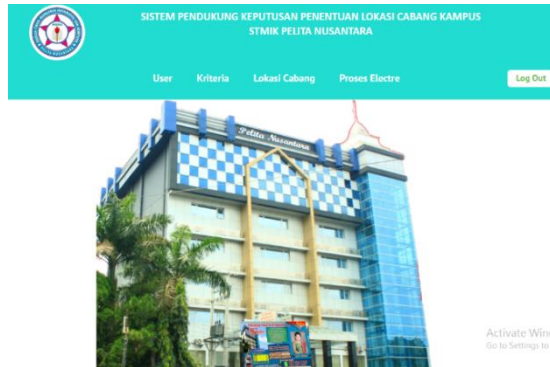


Fig 3. Main Menu Form

E. Implementation of the Criteria Data

Form In the criteria data form is used to display information in the form of a data table of criteria and weighting of each criterion. In the criteria data form there is a menu Add, Edit and delete Criteria



No	Kode Kriteria	Nama Kriteria	Bobot	Cara Penilaian	Detail	Edit	Hapus
1	C1	Kepastian Prerekuisit	4	Pilihan	Detail	Edit	Hapus
2	C2	Akses transportasi	5	Pilihan	Detail	Edit	Hapus
3	C3	Kesamanan Lokasi	4	Pilihan	Detail	Edit	Hapus
4	C4	Jarak Dengan Kampus Lain	5	Pilihan	Detail	Edit	Hapus
5	C5	Pendidikan Tingkat S1/s2	5	Pilihan	Detail	Edit	Hapus

Fig 4. Criteria data form

F. Implementation of Alternative Data Forms

The alternative data form is used to display alternative data used in determining the location of the campus branch. The steps that can be used are adding alternative data by pressing the button add branch location and if you want to change the data you can select edit, and choose delete if you want to delete alternatives that are not needed.



≡ List Lokasi Cabang
+ Tambah Lokasi Cabang

No. Alternatif	Kode Alternatif	Nama Alternatif	Detail	Edit	Hapus
1	A1	Medan Helvetia			
2	A2	Medan Johor			
3	A3	Medan Marelan			
4	A4	Medan Tembung			
5	A5	Medan Tuntungan			

Fig 5. Alternative Data Form

G. Implementation of Process

Form The process form is used to display the steps and results of calculations using the Electre method.

No. alternatif	Kriteria				
	C1	C2	C3	C4	C5
A1	5	4	3	3	5
A2	5	4	3	4	5
A3	4	4	4	5	4
A4	5	4	4	2	4
A5	3	4	4	2	4

Step 2: Bobot Kriteria (W)

Nama Kriteria	Bobot (W)
C1	4
C2	5
C3	4
C4	3
C5	5

Fig 6. Electre Process Form

H. Implementation of the Output Form (Output)

In the output form, it can be seen the results of the calculation process using a method where alternatives will be sorted or alternatives that are not suitable will be eliminated.

Rangking

No	Alternatif	Nilai akhir
1	A2 (Medan Johor)	3
2	A3 (Medan Marelan)	2
3	A4 (Medan Tembung)	1
4	A1 (Medan Helvetia)	1
5	A5 (Medan Tuntungan)	0

Kesimpulan :

Berdasarkan hasil perhitungan dengan Metode Electre penentuan lokasi cabang kampus STMIK Pelita Nusantara diperoleh hasil lokasi dengan urutan teratas adalah Medan Johor (A3) dengan nilai 3

Fig 7. Output Form

4. Conclusion

Based on the results of research and Testing of Decision Support Systems, the determination of the location of the campus branch using the Electre method, several conclusions can be drawn, namely:

- 1) By applying the Electre method, it can help the STMIK Pelita Nusantara campus in determining the location of the campus branch, based on established criteria such as population density, transportation access, location security, distance from other campuses, high school / vocational school level education to determine the alternative to be selected. The results of calculations using the Electre method can be used as a recommendation that can be used by the campus to determine

the location of the campus branch. The recommended location for a strategic campus branch is Medan Johor.

- 2) Decision Support Systems are designed using UML (Unified Modeling Language) which consists of use case diagrams, activity diagrams, class diagrams. Decision Support Systems are built based on a website designed using sublime text software, MySQL Database Management System (DBMS), XAMPP, and using the PHP programming language.

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