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# Application of Elimination Et Choix Transduisant La Realita (ELECTRE) in Hotel Selection in Palembang City

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ABSTRACT

This study develops software for hotel selection using *Elimination Et Choix Transduisant La Realita* (ELECTRE). In *Elimination Et Choix Transduisant La Realita* (ELECTRE) multi-criteria decision-making is based on the concept of Outranking by using paired alternative comparisons based on criteria. The test is carried out by determining the normalization of the decision matrix, weighting the normalized matrix, determining concordance and discordance, calculating the concordance matrix, calculating the discordance matrix, determining the dominant concordance and discordance matrix, determining the aggregate dominance matrix, and eliminating less favorable alternatives. After calculating the *Elimination Et Choix Transduisant La Realita*, the system was tested using the Technology Acceptance Model (TAM). The test results as measured by the Technology Acceptance Model (TAM) method obtained a value of 87.06% for the use of technology (*perceived usefulness*) and 85.33% for the ease of use of technology (*perceived ease of use*).

## 1. Introduction

Palembang City is the capital city of South Sumatra Province, which has many adequate facilities. Such as port facilities, education, health, shopping, and business areas. Because, the city of Palembang is a city of tourism and the city of Palembang was once an icon of the Southeast Asian Games or Sea Games, making tourism levels increase. Based on data from the Central Bureau of National Statistics, during January to December 2014, the number of domestic and foreign tourist visits to national tourist attractions reached 9.4 million people or exceeded the target of 9.3 million people. This number increased by 7.2% compared to the same period in 2015 [1].

The higher the level of tourists, making the city of Palembang continue to grow, especially the growth of hotels from jasmine to star types. The diversity of hotels makes it often difficult for tourists to determine hotels according to their needs and criteria, so there is a need for applications that can support decision making in helping users determine hotels with a method. According to Anita 2014, I-2 Prioritization of hotel selection requires accurate computer-based data as the basis for every decision making in hotel selection. Through a computerized application, decision analysis can be assisted by computer analysis. This system is known as a Decision Support System or DSS. DSS uses data, provides an easy user interface and can incorporate decision-making thinking. One of the DSS methods is *Elimination Et Choix Transduisant La Realita* (ELECTRE).

ELECTRE is a multi-criteria decision-making method based on the concept of outranking by using pairwise comparisons of alternatives based on each appropriate criterion. The workings of the ELECTRE method are used in conditions where alternatives that do not meet the criteria are eliminated, and suitable alternatives can be generated. In other words, ELECTRE is used for cases with many alternatives but few criteria involved. An alternative is said to dominate other alternatives if one or more of its criteria exceeds (compared to the criteria of other alternatives) and is the same as the other remaining criteria [2].

In previous research, the ELECTR method was used to select the right home industry small business for students [3]. In another study, the ELECTRE method was used to provide recommendations for the selection of high school and equivalent in Malang City, the results of the accuracy test of the accuracy of high school selection were 82.98% [4].

The ELECTRE method was chosen, because this method is very suitable for problems in hotel selection, namely being able to conduct research and ranking I-3 based on the advantages and disadvantages of each alternative on the criteria that have been selected by each *user*.

In this study, the *Elimination Et Choix Traduisant La Realita* (ELECTRE) method was applied. And will provide an explanation of the theory and related research related to the research topic.

## 2. Literature Study

A. *Elimination Et Choix Tranduisant La Realita* (ELECTRE)

ELECTRE is a multi-criteria decision-making method based on the concept of Outranking by using pairwise comparisons of alternatives based on each appropriate criterion [5]. The ELECTRE method is often used in conditions where alternatives that do not meet the criteria are eliminated, and a suitable alternative can be generated [6]. In other words, ELECTRE is used for cases with many alternatives but few criteria involved. An alternative is said to dominate if another alternative if one or more of the criteria exceeds and equals the other remaining criteria [7].

The steps taken in solving the problem using the ELECTRE method are as follows [8] :

**1.** Normalization of the decision matrix

In this procedure, each attribute is converted into a comparable value. Any normalization of the value of xij can be done with the formula:

$$r_{11} = \frac{x_{11}}{\sqrt{\sum_{i=1}^{m} x^2 ij}} \quad (1)$$

For i = 1, 2, 3, ..., n and j = 1, 2, 3, ..., n.

So that the normalized R matrix is obtained, as follows

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

Description :

R = normalized matrix
M = alternative
N = criteria
$R_{ij}$ = normalization of choice measurement from the i-th alternative in relation to the j criterion.

**2.** Weighting on the normalized matrix

After normalization, each column of the matrix R is multiplied by the weights (wj) determined by the decision maker. So, the weighted normalized matrix is:

$$V = RW$$

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

$$R = \begin{bmatrix} w_1 r_{11} & w_1 r_{12} & \dots & w_1 r_{21} & w_2 r_{22} & \dots & \vdots & \vdots & \dots & w_n r_{1n} & w_n r_{2n} & \vdots & w_1 r_{m1} & w_2 r_{m2} & \dots & w_n r_{mn} \end{bmatrix}$$

Where W is

$$w = \left[ w_1\ 0\ \ldots\ v_{21}\ w_2\ \ldots\ \vdots\ \vdots\ \ldots\ 0\ 0\ \vdots\ 0\ 0\ \ldots\ w_n \right] \quad (2)$$

**3.** Determine *concordance* and *discordance*

For each pair of alternatives k and 1 (k,1=1, 2, 3, …, m and k≠1) the set of criteria J is divided

in to two subsets, namely concordance and discordance. Where a criterion in an alternative including concordance is:

$$C_{kl} = \{j,\ y_{kj} \geq y_{lj}\}$$

For j = 1, 2, 3, ..., n.

So the resulting *concordance* matrix is:

$$C = \left[ -\ c_{12}\ c_{13}\ c_{21}\ -\ c_{23}\ \vdots\ \vdots\ \ldots\ c_{1n}\ c_{2n}\ \vdots\ c_{m1}\ c_{m2}\ c_{m3}\ -\ \right]$$

On the other hand, the complement of this subset is *discordance*, that is, if:

$$D_{kl} = \{j,\ y_{kj} \geq y_{kj}\}$$

For j = 1, 2, 3, ..., n.

$$C = \left[ -\ d_{12}\ d_{13}\ d_{21}\ -\ d_{23}\ \vdots\ \vdots\ \ldots\ d_{1n}\ d_{2n}\ \vdots\ d_{n1}\ d_{n2}\ d_{n3}\ -\ \right] \quad (3)$$

Calculate *the concordance* and *discordance* matrices

a. Calculating *the concordance matrix*

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

$$C_{kl}\Sigma_j \in c_{kl} w_j \quad (4)$$

b. Calculating *discordance* matrix

$$D_{kl} = \frac{max\{|v_{kj} - v_{ij}|\}j \in D_{KJ}}{max\{|v_{kj} - v_{ij}|\}\forall j} \quad (5)$$

c. Determine the dominant *concordance* and *discordance* matrix

*4. Concordance*

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

$$C_{kl} \geq c \quad (6)$$

With the threshold value (c) is

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

So that the elements of the matrix G are determined as follows:

$$f_{kl}\{1,\ jika\ c_{kl} \geq c\ 0,\ jika\ c_{kl} < c\} \quad (7)$$

5. *Discordance*

To build the dominant *discordance* matrix, we also use the help of the *threshold* value, namely:

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

So that the elements of the matrix G are determined as follows:

$$g_{kl}\{1,\ jika\ d_{kl} \geq d\ 0,\ jika\ d_{kl} < d\} \quad (8)$$

d. Determine the aggregate dominance matrix

The next step is to determine the *aggregate dominance matrix* as matrix E, where each element is a product of the elements of the matrix F and the elements of the matrix G. As follows :

$$E_{kl} = f_{kl} \times g_{kl} \quad (9)$$

e. Elimination of less favorable alternatives

Matrix E provides a sequence of choices from each alternative, that is, if $e_{kl} = 1$ then alternative $A_k$ is a better choice than $A_1$ so that the row in matrix E that has the least number of $e_{kl} = 1$ can be eliminated. Thus, the best alternative is the one that dominates the other alternatives.

*B. Technology Acceptance Model* (TAM)

The Technology Acceptance Model method was first introduced by Davis in 1986. This method is an adoption method of The Theory of Reasoned Action (TRA) which is specially made for modeling user acceptance of information systems. According to Davis (1986) this method has the main purpose of providing a basis for tracing the influence of external factors on the beliefs, attitudes, and goals of users. TAM considers that 2 individual beliefs, namely perceived usefulness (*perceived usefulness*, abbreviated as PU) and perceived youthfulness of use (*perceived easy of use*, abbreviated as PEOU) are the main influences for computer acceptance behavior.

Kang (1998) added, TAM is an improvement method of the TRA model (*Theory of Reasoned Action*), TAM itself adopts the fixed components of the general TRA model and applies these components as a special domain of computer technology and others for information technology. However, what distinguishes the two (TRA and TAM) is the placement of the attitude factors of TRA, where TAM II-7 introduces two key variables, namely perceived ease of use and perceived usefulness, which have central relevance for predicting user acceptance of computer technology.

According to Davis (1989), the level of acceptance of IT users is determined by 6 constructs, namely: external variables (*external variables*), user perceptions of (*perceived ease of use*), user perceptions of (*perceived usefulness*), and (*attitudes toward using*), attention to use (behavioral intention to use) and actual usage (*actual usage*). These six criteria were formulated because they have strong values and are very suitable for measuring the level of user satisfaction (*end users*).

## 3. Methodology

The limitations of the problem taken in this study are as follows:

1. The data used is data from the Palembang city government, the Tourism Office in 2019 with

alternatives in it such as: hotel name, hotel type, cost, facilities the author also adds distance alternatives using data from Traveloka, the distance used is measured from the grand mosque to the destination hotel.

2. The weight can be set by the user according to the user's own needs.

## 4. Result and Discussion

In this section, we will display a table of the stages of the ELECTRE calculation and also a table of results using the TAM method.

**Table 1.** *Data original before normalization*

| | Type/Star | Travel Time / KM | Price | Facilities (swimming pool, spa, gym, meeting room, air conditioning, breakfast, wifi) | Number of rooms |
|---|---|---|---|---|---|
| The Arista | 5 | 14 | 11 | 3 | 4 |
| The Arya Duta | 5 | 12 | 15 | 3 | 4 |
| Novotel | 4 | 8 | 12 | 3 | 4 |
| The 101 Rajawali | 4 | 12 | 17 | 2 | 3 |
| Swarnadwipa | 3 | 14 | 18 | 2 | 2 |

**Table 2.** After done *Normalizing the Decision Matrix*

| | Type/Star | Travel Time / KM | Price | Facilities (swimming pool, spa, gym, meeting room, air conditioning, breakfast, wifi) | Number of rooms |
|---|---|---|---|---|---|
| The Arista | 10 | 28 | 22 | 6 | 8 |
| The Arya Duta | 10 | 24 | 30 | 6 | 8 |
| Novotel | 8 | 16 | 24 | 6 | 8 |
| The 101 Rajawali | 8 | 24 | 34 | 4 | 6 |
| Swarnadwipa | 6 | 28 | 36 | 4 | 4 |
| **Total** | **42** | **120** | **146** | **26** | **34** |
| **Akar** | **6,480740698** | **10,95445115** | **12,08304597** | **5,09902** | **5,830951895** |

**Table 3.** Table of results from dividing the original data by the root

| | Type/Star | Travel Time / KM | Price | Facilities (swimming pool, spa, gym, meeting room, air conditioning, breakfast, wifi) | Number of rooms |
|---|---|---|---|---|---|
| The Arista | 0,77151675 | 1,278019301 | 0,910366477 | 0,588348 | 0,685994341 |
| The Arya Duta | 0,77151675 | 1,095445115 | 1,241408833 | 0,588348 | 0,685994341 |
| Novotel | 0,6172134 | 0,730296743 | 0,993127066 | 0,588348 | 0,685994341 |
| The 101 Rajawali | 0,6172134 | 1,095445115 | 1,406930011 | 0,392232 | 0,514495755 |
| Swarnadwipa | 0,46291005 | 1,278019301 | 1,489690599 | 0,392232 | 0,34299717 |

**Table 4.** *Weighting The Normalizing The Decision Matrix*

| Weight | 0,15 | 0,2 | 0,35 | 0,1 | 0,2 |
|---|---|---|---|---|---|
| | Type/Star | Travel Time / KM | Price | Facilities (swimming pool, spa, gym, meeting room, air conditioning, breakfast, wifi) | Number of rooms |
| The Arista | 0,77151675 | 1,278019301 | 0,910366477 | 0,588348 | 0,685994341 |
| The Arya Duta | 0,77151675 | 1,095445115 | 1,241408833 | 0,588348 | 0,685994341 |
| Novotel | 0,6172134 | 0,730296743 | 0,993127066 | 0,588348 | 0,685994341 |
| The 101 Rajawali | 0,6172134 | 1,095445115 | 1,406930011 | 0,392232 | 0,514495755 |
| Swarnadwipa | 0,46291005 | 1,278019301 | 1,489690599 | 0,392232 | 0,34299717 |

**Table 5.** Table of multiplication results between *hotels* with *weighted* values

| Weight | 0,15 | 0,2 | 0,35 | 0,1 | 0,2 |
|---|---|---|---|---|---|
| | Type/Star | Travel Time / KM | Price | Facilities (swimming pool, spa, gym, meeting room, air conditioning, breakfast, wifi) | Number of rooms |
| The Arista | 0,115727512 | 0,255604 | 0,318628 | 0,058835 | 0,137198868 |
| The Arya Duta | 0,115727512 | 0,219089 | 0,434493 | 0,058835 | 0,137198868 |
| Novotel | 0,09258201 | 0,146059 | 0,347594 | 0,058835 | 0,137198868 |
| The 101 Rajawali | 0,09258201 | 0,219089 | 0,492426 | 0,039223 | 0,102899151 |
| Swarnadwipa | 0,069436507 | 0,255604 | 0,521392 | 0,039223 | 0,068599434 |

**Table 6.** *Concordance Set*

| | The Arista | The Arya Duta | Novotel | The 101 Rajawali | Swarnadwipa | |
|---|---|---|---|---|---|---|
| The Arista | 0 | 0,65 | 0,65 | 0,65 | 0,65 | |
| The Arya Duta | 0,8 | 0 | 1 | 0,65 | 0,45 | |
| Novotel | 0,65 | 0,3 | 0 | 0,45 | 0,45 | |
| The 101 Rajawali | 0,35 | 0,55 | 0,7 | 0 | 0,45 | |
| Swarnadwipa | 0,55 | 0,55 | 0,55 | 0,65 | 0 | Tot |
| | 2,35 | 2,05 | 2,9 | 2,4 | 2 | 11,7 |

**Table 7.** Result of comparison between *concordance* value with C-BAR

| | The Arista | The Arya Duta | Novotel | The 101 Rajawali | Swarnadwipa |
|---|---|---|---|---|---|
| The Arista | 0 | 1 | 1 | 1 | 1 |
| The Arya Duta | 1 | 0 | 1 | 1 | 0 |
| Novotel | 1 | 0 | 0 | 0 | 0 |
| The 101 Rajawali | 0 | 0 | 1 | 0 | 0 |
| Swarnadwipa | 0 | 0 | 0 | 1 | 0 |

**Table 8.** *Disconcordance Set*

| Weight | 0,15 | 0,2 | 0,35 | 0,1 | 0,2 |
|---|---|---|---|---|---|
| | Type/Star | Travel Time / KM | Price | Facilities (swimming pool, spa, gym, meeting room, air conditioning, breakfast, wifi) | Number of rooms |
| The Arista | 0,115727512 | 0,25560386 | 0,318628267 | 0,058835 | 0,137198868 |

| | | | | | |
|---|---|---|---|---|---|
| The Arya Duta | 0,115727512 | 0,219089023 | 0,434493092 | 0,058835 | 0,137198868 |
| Novotel | 0,09258201 | 0,146059349 | 0,347594473 | 0,058835 | 0,137198868 |
| The 101 Rajawali | 0,09258201 | 0,219089023 | 0,492425504 | 0,039223 | 0,102899151 |
| Swarnadwipa | 0,069436507 | 0,25560386 | 0,52139171 | 0,039223 | 0,068599434 |

**Table 9.** Result of comparison between *disconcordance* value with D-BAR

| | The Arista | The Arya Duta | Novotel | The 101 Rajawali | Swarnadwipa |
|---|---|---|---|---|---|
| The Arista | 0 | 1 | 0 | 1 | 1 |
| The Arya Duta | 0 | 0 | 0 | 1 | 0 |
| Novotel | 0 | 0 | 0 | 1 | 1 |
| The 101 Rajawali | 0 | 0 | 0 | 0 | 0 |
| Swarnadwipa | 0 | 0 | 0 | 0 | 0 |

**Table 10.** *Aggregation of Coercodance and discordance set*

| | The Arista | The Arya Duta | Novotel | The 101 Rajawali | Swarnadwipa |
|---|---|---|---|---|---|
| The Arista | 0 | 1 | 0 | 1 | 1 |
| The Arya Duta | 0 | 0 | 0 | 0 | 0 |
| Novotel | 0 | 0 | 0 | 0 | 0 |
| The 101 Rajawali | 0 | 0 | 0 | 0 | 0 |
| Swarnadwipa | 0 | 0 | 0 | 0 | 0 |

**Table 11.** The results of the *Elimination Et Choix Transduisant La Realita* (ELECTRE) Research Testing Method

| **Hotel Code** | **H1** | **H2** | **H3** | **…** | **H50** |
|---|---|---|---|---|---|
| **H1** | **-** | **1** | **0** | **…** | **1** |
| **H2** | **0** | **-** | **0** | **…** | **0** |
| **H3** | **1** | **0** | **-** | **…** | **0** |
| **…** | **…** | **…** | **…** | **…** | **…** |
| **H50** | **0** | **1** | **1** | **…** | **-** |

So it can be concluded that :

H1 -> H2 (H2 is dominated by H1)

H1 -> H50 (H50 is dominated by H1)

H3-> H1 (H1 is dominated by H3)

H50 -> H2 ( H2 is dominated by H50)

H50 -> H3 (H3 is dominated by H50)

Which is where it is dominated by hotels that get a value of 1, therefore it can be concluded that hotel a is better than hotel b, while the value of 0 is for hotels that do not achieve dominance compared to the comparison.

***5.*** **Table 12. System ELECTRE Test Results**

| No. | Statement | Score |
|---|---|---|
| **Benefit (*perceived usefulness*)** | | |
| 1. | The site for an emotionally supportive choice network using the ELECTRE strategy is very useful in helping to choose accommodation in the city of Palembang. | 88,40 % |
| 2. | Utilizing an emotionally supportive preferred network site with the ELECTRE strategy is beneficial in increasing time productivity when choosing lodging in Palembang. | 89,20 % |
| 3. | Utilizing a choice network site that supports emotions with the ELECTRE technique is an interesting (successful) thing in choosing lodging in Palembang. | 86,80 % |
| 4. | In general, the selection of an emotionally supportive network site using the ELECTER technique is very useful for clients in choosing lodging in the city of Palembang. | 86,00 % |
| **Total Score** | | 87,06 % |
| **Technology User Ease (*perceived ease of use*)** | | |
| 1. | Elements on the emotionally supportive website of choice using the ELECTRE technique make it easy to use. | 84,40 % |
| 2. | The selection of emotionally supportive network sites with the ELECTRE technique makes it easy for clients to do what I want to do (getting data on the best choice of suggestions in choosing lodging in Palembang). | 85,20 % |
| 3. | The choice of emotionally supportive networking sites using the ELECTRE strategy was clear and easy for me to understand. | 85,60 % |
| 4. | The means to introduce the best elective advice in choosing an emergency maternity clinic is very easy. | 84,80 % |
| 5. | The selection of an emotionally supportive network site with the ELECTRE strategy is not difficult to learn for the individual who engages it in an interesting way. | 85,20 % |
| 6. | The selection of an emotionally supportive network site using the ELECTRE strategy has a simple informational process. | 86,80 % |
| | **Total Score** | 85,33 % |

## 6. Conclusion

1. The software for hotel selection in Palembang has been successfully developed using the *Elimination Et Choix Tranduisant La Realita* (ELECTRE) method using 50 hotel data, where the result is a comparison of finding the best hotel by comparing 2 hotels. The results obtained from the comparison between 2 hotels are marked if hotel1 gets a value of "1" and hotel2 gets a value of "0" then hotel1 is better The results obtained from a comparison between 2 hotels are marked if hotel1 gets a value of "1" and hotel2 gets a value "0" then hotel1 is better.

2. The test results were measured by the TAM method with data from 50 respondents which got a value of 87.06%, on the use of technology (*Percieved Usefullness*) and 85.33% on the ease of use of technology (*Percieved Ease of Use*), which means the system strongly agrees when used using ELECTRE method.

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