The Analysis of the ELECTREE II Algorithm in Determining the Doubts of the Community Doing Business Online

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Abstract. Online businesses are no stranger to the community where online businesses are increasingly in demand by the public because of the various supporting factors in which the public does not need to plunge into places to buy the desired items simply through online media but the lively online media in the community cannot be separated from various frauds. Other business people are still many who are reluctant to switch to online business that is inseparable from various factors or reasons they still stick with the old business method. It is very easy to play online recently in various circles of students and even housewives, can be used as additional capital. To find out what factors are the main reason people still hesitate to do business with online methods realized by the application of a decision support system determines the doubts of the online business community with the ELECTRE II method. It is hoped that research can find factors that cause public doubt in online business, so that later the output of this system can be a good evaluation material for the community in doing business. ELECTRE II method can be applied in the case of determining the failure factor of students in the main subject of community doubt in online business by considering several alternatives and criteria. Which alternatives are Cost Expenses (A1), Faced Risks (A2), and Difficult / Doubt to start the business to be run (A3). Data taken from the questionnaire respondents to STIKOM Tunas Bangsa Pematangsiantar students. From the results of this study, it was concluded that (A1) Cost Expenses with a value of 1.0238. For further research, criteria and alternatives can be added, so that the data entered is more varied. In addition, the ELECTRE II method can be compared with other methods. Research as a recommendation for business people who want to enter the world of online business.

1. Introduction

At present, the world has entered the industrial revolution era 4.0, an era where there are the latest automation and data exchange in factory technology that includes cyber-physical systems, the internet for everything, cloud computing, to cognitive computing. The Indonesian industrial world must prepare itself from human resources, infrastructure and telecommunications media technology, government regulations that can protect domestic industries, to shift industry orientation from manufacturing to the service sector [1]. And online business development with internet media is increasingly mushrooming in Indonesia. This is marked by the transition of conventional trading transactions to the online system. The contribution of the 4.0 Economic Encouraging Industrial Revolution [2], [3].

Ease This online system is one of the benefits that are gained directly from the online airline ticket business by consumers. Because it is enough to use a computer or gadget that is connected to the internet network, flight service users can easily purchase flight tickets wherever and whenever you are [4], [5]. As well as convenience in marking with users of online ticket transportation services such as
airline tickets and train tickets, there is no need to queue and jostle with other passengers. The online flight ticket and train ticket sales system are real-time and can accurately notify the prevailing prices, available seats, and the latest flight departure schedule. For security issues, users of transportation services with online systems need not worry anymore. In addition to requiring users to log in, there is only one person with one name registered to access the service. The online ticketing service provider has also used HTTPS security-based web systems as well as SSL channels to support security [2]. The potential of online business in Indonesia is very large and profitable. This makes many people start an online business. But the problem they have is not thinking about obstacles in doing business online. The biggest obstacle of online business people in Indonesia is not having the knowledge to develop an online business [4]. Even there are still many people who are still blind to the internet. The limitations of knowledge owned by online businesses make them run a business in an ineffective way. This makes their business not maximal and doesn't even produce anything. When you go into business online, you must realize that competition or competition in online business is very tight. The online business world in Indonesia is now crowded with online businesses including serious business people or just trial and error. For example, you want to sell clothes online so you will find many online shops selling clothes including large and small online shops [6], [8]. To overcome this competition, you must have the right marketing strategy so that you can overcome it. Online shop marketing strategies are usually done by setting prices for goods that are cheaper than other competitors, especially for your products that have intense competition. Or you can market unique products that are not owned by competitors. This, of course, you will be easier to compete in the market. But you must still choose unique products that have demand and appeal to consumers [2].

Many branches of computer science can solve complex problems. This is evidenced by several studies in the field of data mining [9] [10] - [11] [14], the field of artificial neural networks [15] - [19], in the field of decision support systems [20] - [23]. Researchers used a decision support system with the ELECTRE Method as one of the MADM methods widely recognized as having good performance for analyzing policies involving qualitative and quantitative criteria. The ELECTRE method has evolved through a number of versions (I, II, III, IV, V). All versions are based on the same basic concept but are operationally different. The ELECTRE I method is designed for selection while ELECTRE II is used for ranking. Both versions use a simple criteria type, meaning that the threshold values are the same for all criteria while the other versions use pseudo criteria whose threshold values are not the same for all criteria. By using alternatives, and different criteria from the research above, this study aims to develop a decision support system using the ELECTRE II method to search for the doubts of the community in doing business online from several alternatives. It is hoped that this research will contribute to the community and the government in improving online media by giving strict sanctions so that the community receives a sense of security in online business and is more careful to do business online using ELECTRE II [8]. In this study, the ELECTRE II method will be used as a method for determining the doubts of society's online business factors. ELECTRE II method was chosen because of its ability in the existing alternatives. So that this method is very appropriate to be used to search for the doubts of the public doing business online [23].

2. Methodology
The data collection stage, this research was conducted at STIKOM Tunas Bangsa Pematangsiantar. The research data was obtained by conducting direct interviews and giving questionnaires to respondents to find out what factors caused them to fail in the main course. The total sample of data used was 20 respondents. The data that has been collected is then processed to obtain the factors that cause student failure in the main course. Decision making is intelligence, design, choice, and implementation. Usually, researchers will choose one of the methods that are considered the most suitable or in accordance with the data that will be obtained, goals, and problems to be solved.

3. Result And Discussion
The alternative obtained from the main course failure is the burden of the costs faced against the business (A1), the risks faced (A2), difficult/hesitant to start a business run (A3), and some sample criteria data obtained from respondents who answered a questionnaire.
The process of applying the ELECTRE II method can be seen below. By using the Rating System Method to Obtain Weight: This procedure involves decision makers who initially assess criteria in the order of their importance. Each criterion is then given a score based on its rank, with one criterion, the first rank is given a score of "1", the second rank is scored "2" and so on. in terms of binding criteria for the same ranking, the average score is given to them. The least important criteria will end with a score of n, where n is the number of criteria. The normalized importance for each criterion can be calculated using the formula:

\[ w_i = \frac{n - r_i + 1}{\sum_{i=1}^{n}(n - r_i + 1)} \]  

(1)

Where \( w \) is the normalization weight for each criterion, as is the ranking score for each criterion, and \( n \) is the number of decision criteria. The author agrees to rank these criteria from the most important to the least important. The number of criteria being considered is 20, therefore \( n = 20 \). Therefore the weights obtained are as follows:

### Table 2. Search Value Weight

| Criteria | Rank Position | Rank Score ri | n-ri+1 | wi  |
|----------|---------------|---------------|--------|-----|
| C1       | 1             | 1             | 20     | 0.0952 |
| C2       | 2             | 2             | 19     | 0.0905 |
| C3       | 3             | 3             | 18     | 0.0857 |
| C4       | 4             | 4             | 17     | 0.0810 |
| C5       | 5             | 5             | 16     | 0.0762 |
| C6       | 6             | 6             | 15     | 0.0714 |
| C7       | 7             | 7             | 14     | 0.0667 |
| C8       | 8             | 8             | 13     | 0.0619 |
| C9       | 9             | 9             | 12     | 0.0571 |
| C10      | 10            | 10            | 11     | 0.0524 |
| C11      | 11            | 11            | 10     | 0.0476 |
| C12      | 12            | 12            | 9      | 0.0429 |
| C13      | 13            | 13            | 8      | 0.0381 |
| C14      | 14            | 14            | 7      | 0.0333 |
| C15      | 15            | 15            | 6      | 0.0286 |
| C16      | 16            | 16            | 5      | 0.0238 |
| C17      | 17            | 17            | 4      | 0.0190 |
| C18      | 18            | 18            | 3      | 0.0143 |
| C19      | 19            | 19            | 2      | 0.0095 |
| C20      | 20            | 20            | 1      | 0.0048 |

After the weights have been obtained then the next step is to start the calculation process to determine which alternatives cause doubt in the online business community, here are the steps of the calculation process:

a. Determine normalized decision matrix

In this procedure, each attribute is changed to a comparable value. Any normalization of rij values can be done with Equation (1):

\[ x_1 = \sqrt{(4,4)^2 + (3,25)^2 + (4)^2} = 30,9625 \]

\[ R_{11} = \frac{4,4}{30,9625} = 0,1421 \]

\[ R_{21} = \frac{3,25}{30,9625} = 0,1050 \]

\[ R_{31} = \frac{4}{30,9625} = 0,1292 \]

And so on up to X20, so the following matrix is generated in table 3.

### Table 3. Normalization of matrix values

| C1   | C2   | C3   | C4   | C5   | C6   | C7   | C8   | C9   | C10  | C11  | C12  | C13  | C14  | C15  | C16  | C17  | C18  | C19  | C20  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.14 | 0.10 | 0.11 | 0.17 | 0.11 | 0.11 | 0.10 | 0.12 | 0.11 | 0.11 | 0.07 | 0.25 | 0.11 | 0.12 | 0.12 | 0.12 | 0.11 | 0.11 | 0.17 | 0.14 |
| 0.10 | 0.11 | 0.11 | 0.14 | 0.10 | 0.13 | 0.10 | 0.12 | 0.10 | 0.10 | 0.09 | 0.18 | 0.12 | 0.09 | 0.10 | 0.11 | 0.10 | 0.09 | 0.16 | 0.12 |
| 0.13 | 0.09 | 0.11 | 0.13 | 0.10 | 0.11 | 0.09 | 0.11 | 0.09 | 0.10 | 0.10 | 0.13 | 0.09 | 0.13 | 0.12 | 0.09 | 0.10 | 0.12 | 0.12 | 0.12 |

b. Weighting on the normalized matrix.

The matrix \( V \) is the result of multiplication \( R \) with \( W \) (weight), where \( w \) (weight) can be seen in table 4.
Tabl 4. Weighting in the matrix after normalization (R * W)

|    | C1  | C2  | C3  | C4  | C5  | C6  | C7  | C8  | C9  | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | C19 | C20 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0.014 | 0.009 | 0.009 | 0.014 | 0.009 | 0.008 | 0.006 | 0.007 | 0.005 | 0.006 | 0.003 | 0.011 | 0.004 | 0.004 | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 |
| 0.010 | 0.010 | 0.010 | 0.011 | 0.008 | 0.009 | 0.007 | 0.007 | 0.005 | 0.004 | 0.008 | 0.004 | 0.003 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 |
| 0.012 | 0.008 | 0.009 | 0.010 | 0.008 | 0.006 | 0.007 | 0.005 | 0.005 | 0.006 | 0.003 | 0.004 | 0.003 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 |

c. Determines the concordance and discordance index set.

The concordance set as in Equation (3), so that the concordance set is obtained in table 5.

Tabl 5. Concordance set

| Concordance | A1                  | A2                  | A3                  |
|-------------|---------------------|---------------------|---------------------|
| A1          | 1,4,5,8,9,10,12,14,15,16,17,18,19,20 | 1,2,3,4,5,7,8,9,10,12,13,15,16,17,19,20 | 1,5,10,11,14,15,17,18,20 |
| A2          | 2,3,6,7,11,13       | -                   | 1,5,10,11,14,15,17,18,20 |
| A3          | 6,3,8,18            | 2,3,4,5,6,7,8,9,10,12,13,16,17,19,20 | -                   |

d. Determine the discordance set as in Equation (4), so that the concordance set is obtained in table 6.

Tabl 6. Discordance Set

| Discordance | A1                  | A2                  | A3                  |
|-------------|---------------------|---------------------|---------------------|
| A1          | -                   | 2,3,6,7,11,13       | 6,3,8,18            |
| A2          | 1,4,5,8,9,10,12,14,15,16,17,18,19,20 | -                   | 2,3,4,5,6,7,8,9,10,12,13,16,17,19,20 |
| A3          | 1,2,3,4,5,7,8,9,10,12,13,15,16,17,19,20 | 1,5,10,11,14,15,17,18,20 | -                   |

e. Calculate concordance and discordance matrices.

1) Calculate concordance

Calculate concordance using equation (5), as follows:

\[ C_{12} = w_1 + w_4 + w_5 + w_8 + w_9 + w_{10} + w_{12} + w_{14} + w_{15} + w_{16} + w_{17} + w_{18} + w_{19} + w_{20} = 0.0952 + 0.081 + 0.0762 + 0.0619 + 0.0571 + 0.0524 + 0.0333 + 0.0286 + 0.0238 + 0.019 + 0.0143 + 0.0095 + 0.0048 = 0.9619 \]

and so on until \( C_{20} \).

The value of the matrix component is arranged based on the concordance set with the weight \( (W) \) and summed up, resulting in the concordance matrix as follows:

Tabl 7. Concordance matrix

| Concordance | A1         | A2         | A3         |
|-------------|------------|------------|------------|
| A1          | -          | 0.9619     | 0.6905     |
| A2          | 0.2619     | -          | 0.2048     |
| A3          | 0.3667     | 0.8714     | -          |

2) Calculate discordance.

To calculate the value of an element in a discordance matrix is to divide the maximum difference in the value of the criteria included in the discordance subset with the maximum difference in value of all existing criteria, mathematically as in Equation (6), as follows:

Tabl 8. Matriks Discordance

| Discordance | A1         | A2         | A3         |
|-------------|------------|------------|------------|
| A1          | -          | 0.3026     | 1          |
| A2          | 1          | -          | 1          |
| A3          | 1          | 0.9070     | -          |

f. Determine the dominant matrix of concordance and discordance.

1) Dominant concordance matrix

Calculating the dominant matrix of the concordance threshold (7). So the dominant matrix:

Tabl 9. Concordance dominant matrix

| Concordance dominant matrix (F) | A1 | A2 | A3 |
|---------------------------------|----|----|----|
| A1                              | -  | 1  | 1  |
2) Discordance dominant matrix
Calculating the dominant matrix Disconcordance Threshold is obtained from the sum of all matrix elements divided by the matrix size contained in equation (8). So the dominant matrix is:

\[
\begin{pmatrix}
A1 & 0 & 1 \\
A2 & 0 & 0 \\
A3 & 0 & 0 \\
\end{pmatrix}
\]

2. Calculate pure concordance index and pure discordance.
1) Pure Concordance
To find the value of pure concordance can be seen in equation (9).

\[
C1 = 0.9619 + 0.6905 - (0.2619 + 0.3667) = 1.0238 \\
C2 = 0.2619 + 0.2048 - (0.9619 + 0.8714) = -1.3667 \\
C3 = 0.3667 + 0.8714 - (0.6905 + 0.2048) = 0.3429
\]

2) Pure discordance
To find pure discordance values can be seen in equation (10).

\[
D1 = 1 + 1 - (0.3026 + 1) = -1 \\
D2 = 1 + 1 - (0.3026 + 0.9070) = 0.7905 \\
D3 = 1 + 0.9070 - (1 + 1) = -0.2228
\]

After the two indices have been calculated, then to get the best alternative is to find the average value of both pure concordance index index and pure discordance. so that the following ranking is obtained based on table 11.

| Table 11. The best alternative calculation |
|-------------------------------------------|
| Faktor                                     | Pure Concordance | Ranking | Pure Discordance | Rank | Average Rank | Final rank |
|-------------------------------------------|------------------|---------|------------------|------|--------------|------------|
| Costs Exposed to Business                 | 1.0238           | 1       | -1               | 1    | 1            | 1          |
| Risk faced                                | -1.3667          | 3       | 0.7905           | 3    | 3            | 3          |
| Difficult / Doubtful To Start A Run Business | 0.3429          | 2       | 0.2228           | 2    | 2            | 2          |

So that based on the above table it is known that (A1) Cost Expenses with a value of 1.0238

4. Conclusion
Based on the results of the study and discussion of Planning Analysis of Failure Factors in the Main Computer Courses in the Information System Period with ELECTRE II Method as follows:
a. ELECTRE II method can be applied in the case of determining the failure factor of students in the main subject of community doubt in online business by considering several alternatives and criteria. Which alternative is the Cost Load, the Risk faced, and Difficult / Doubt to start the business that will be run and the criteria taken in the data of the respondent's data.
b. From the results of the study it can be concluded that (A1) Cost Expenses. For further research, criteria and alternatives can be added, so that the data entered is more varied. In addition, the ELECTRE II method can be compared with other methods.

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