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Integration of Operational Competitiveness Rating Analysis (OCRA) Methods and Rank Order Centroid (ROC) in Selection The Best Chatting Apps

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Abstract−As technology develops, social media is very useful for the people of Indonesia, especially in North Sumatra in interacting and communicating without knowing distance, place and time. Social media that is often popular and always used by all circles of society is a chat application where the chat application in the current era is very useful for people, both young and old, and those who are far away can only communicate via cellphone. Chat applications can not only send a typed message, but chat applications can also be used for telephone calls, video calls, voice messages, document files, photo files and so on. In this study, the aim was to build a decision support system (DSS). Which has a function as a tool to determine decision making in the process of selecting the absolute best chat application. By applying the ROC (Rank Order Centroid) and OCRA (Operational Competitiveness Rating Analysis) methods, it is possible to produce weight values and alternative preference values that are ranked first. So that it can be the best chat application found in the A1 alternative, namely Whatsapp with a value of 2.05.

Keywords: Social Media; Chat Application; DSS; ROC Method; OCRA Method

1. INTRODUCTION

In an era of rapid technological advancement, such as the prevalence of social media, which has become vital in the Indonesian society, especially in North Sumatra, social media plays a crucial role. Social media makes it easier for people to interact regardless of location, distance, or time. In today's digital age, not only teenagers but people of all ages, both young and old, can enjoy social media using just an Android device[1]. Social media also ensures the security of personal and national data, protecting it from third-party surveillance. One of the most beloved social media platforms in Indonesia, especially in North Sumatra, is messaging applications like Facebook, Instagram, Twitter, YouTube, and more. Social media is a digital platform that enables users to communicate directly through text, voice, and other media, transcending geographical boundaries. One of the most favored social media platforms is messaging applications. With messaging apps, people can engage in real-time interactions, send instant messages, and exchange information swiftly without being restricted by geographic barriers[2].

Messaging is a technology that allows users to send and receive messages within a network. Messaging applications serve as a means of communication that connects people without geographical constraints. These applications are popular because they offer various advantages, such as bridging distances, enabling communication without time limitations, and fostering relationships without the need for physical meetings. Messaging apps are not limited to text messages; they also serve as tools for making calls, video calls, and more. Furthermore, messaging applications have evolved rapidly. In the past, they only allowed calls to one person, but now they can support group calls[3]. egarding messaging applications, the research focuses on selecting the best messaging application. With the current technological advancements, messaging applications come in various forms, such as WhatsApp, Instagram, Telegram, Messenger, and more. The study aims to evaluate and compare these applications to determine the best among them. To achieve this, a decision support system (DSS) is required[4].

The decision support system (DSS) involves calculations to help choose the best messaging application based on criteria such as rating, feature status, internet data usage, visual interaction, and app features. DSS is a technological science that aids in solving problems and making accurate decisions based on non-manipulable data, ensuring the use of accurate results[5]–[8]. In this study, DSS employs the Operational Competitiveness Rating Analysis (OCRA) method and the Rank Order Centroid (ROC) method. These methods are chosen because of their simplicity and efficiency in handling subjective aspects due to their efficient weighting of the best messaging application[9]. DSS offers several methods, including MOORA, SAW, MOOSRA, AHP, WP, WASPAS, OCRA, TOPSIS, PSI, MAUT, ROC, and PSI[10].

Starting from previous research that can be used as a reference in writing this article, which discussed the Operational Competitiveness Rating Analysis (OCRA) method and the Rank Order Centroid (ROC) method conducted by Kairunnisa and Efori Bulolo in 2021 to determine the best immune-boosting supplements during the Covid-19 pandemic based on predefined criteria. There are 5 criteria, including certificates and permits, content, dosage (mg), contraindications, and packaging price. The chosen ranking result was alternative 3 with a value of 0.337[11]. Research conducted by Surya Sintami Hasibuan in 2021 discusses the use of the Operational Competitiveness Rating Analysis (OCRA) method to determine employee job mutation. There are 6 criteria, including job knowledge, productivity, work, teamwork, communication, responsibility, warnings, and reprimands.

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The ranking result was alternative 8 with a value of 0.45[12]. Research conducted by Indini et al. in 2021 on the determination of the best online learning media using the OCRA and ROC methods. The best result was Moodle with a value of 2.296[13]. Research conducted by Toruan in 2021 on selecting the best news anchor using the OCRA and ROC methods. The best news anchor was determined with a value of 1.665[14]. These related studies serve as appropriate references for the creation of this research.

Drawing from these earlier studies and the problems described above, the author aims to conduct research on selecting the best messaging application using the Operational Competitiveness Rating Analysis (OCRA) and Rank Order Centroid (ROC) methods. Implementing these methods helps determine the best reference values from a range of alternatives and predefined criteria. This research aims to provide a fair and absolute value in solving the identified problem, ensuring the results meet expectations[15].

2. RESEARCH METHODOLOGY

2.1 Research Stages

This research consists of several phases that will ultimately yield data as follows:

a. Analisa Masalah
   Problem analysis is highly beneficial in solving existing problems and can provide insight into the data before conducting calculations.
b. Pengumpulan Data
   Observation is useful for understanding the processes involved in selecting the best chat application.
c. Studi Literatur
   Literature review enhances the researcher's insights and understanding of Decision Support Systems (DSS).
d. Analisa dan Penerapan Metode
   This research phase dissects the problem of selecting the best chat application. It begins by determining the criteria weight using the ROC (Rank Order Centroid) method and then elaborates on the calculations using the OCRA (Operational Competitiveness Rating Analysis) method.
e. Laporan Penelitian
   This research phase represents the final report of all the research conducted, followed by drawing conclusions from the research.

The following provides an overview of the explanation of the above research stages:

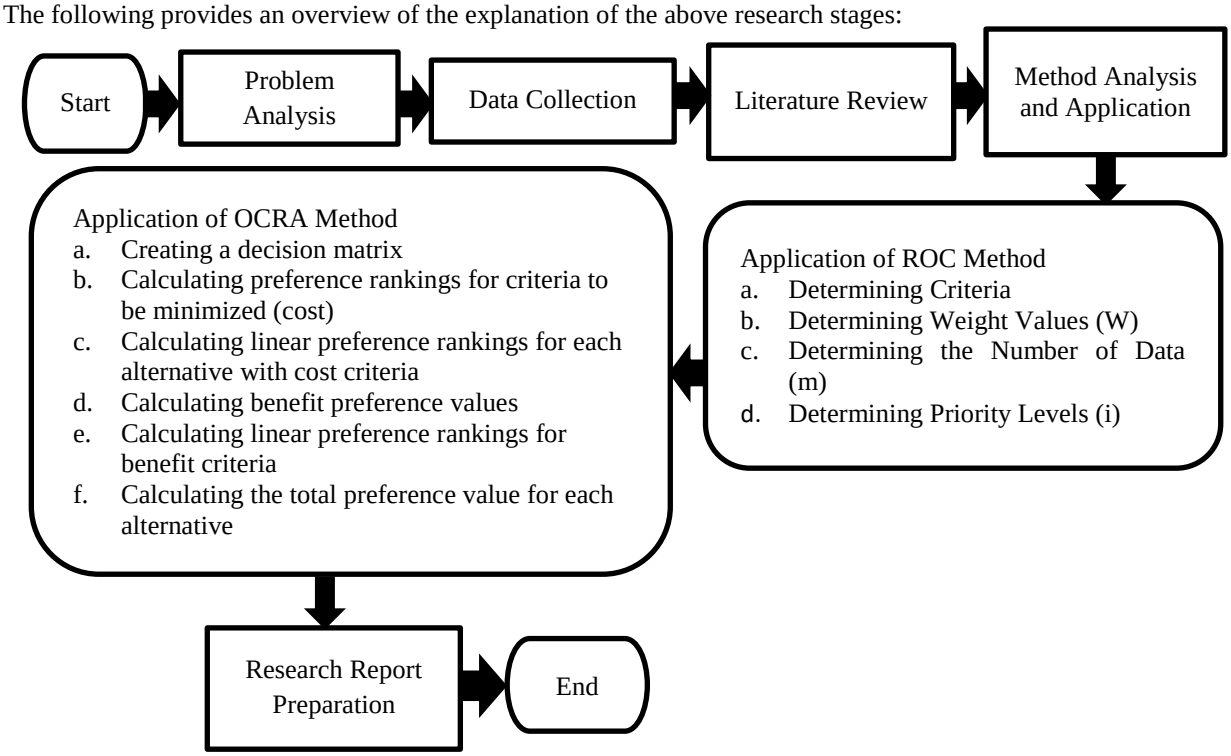

Figure 1. Research Framework

2.2 Chatting Applications

Chatting applications are programs that use internet connections to exchange messages between individuals. Chatting applications are effective and efficient communication tools. With the current technological advancements, these applications offer more than just text messaging; they can also send voice messages, emojis, animations, video calls, and much more. Chatting applications help people in their work, allowing them to send documents, videos,

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photos, and other files. The presence of chatting applications provides many benefits to humanity, making interaction more convenient, regardless of distance and time[16][17].

2.3 Rank Order Centroid (ROC) Method

The Rank Order Centroid (ROC) method is a technique used to calculate weight values for specific criteria in decision support systems. The ROC method is easy to understand because it is based on a fundamental concept of importance, as shown in the formula below[18]–[24]:

$$C_1 > C_2 > C_3 > C_m \quad (1)$$

To determine the weight value (W), the following formula is used:

$$wm = \frac{1}{m}\sum_{1}^{m} = 1\binom{1}{i} \quad (2)$$

2.4 Operational Competitiveness Rating Analysis (OCRA) Method

The Operational Competitiveness Rating Analysis (OCRA) method is used to address recurring work-related problems. Here are some steps in solving problems using the OCRA method for decision-making[25]–[28]:

a. Creating a decision matrix X_{ij}, where X_{ij} represents an alternative i for criterion j.

$$X = [X_{ij}]_{mxn} = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \dots & \dots & \dots & \dots \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} i = 1,\dots m\ j = 1, 2, \dots, n \quad (1)$$

b. Preference rankings are closely related to cost criteria. In this step, the values of alternatives for a criterion that can be reduced and estimated through beneficial and non-considered criteria. The total performance of alternatives regarding non-beneficial criteria can be calculated using the formula below:

$$\bar{I}_i = \sum_{j=1}^{g} wj \frac{\max(x_{ij})}{\min(x_{ij})} (i=1,2,\dots,m\ j=1,2,\dots g) \quad (2)$$

c. Preference rankings for non-beneficial criteria can be calculated using the formula below:

$$\bar{I}_i = \bar{I}_i \min(\bar{I}_i) \quad (3)$$

d. Preference rankings with a relationship between criteria can then be determined. For beneficial criteria, alternatives with higher values are better. The ranking of the total alternatives i for all criteria can be calculated using the formula below:

$$\bar{\bar{O}}_i = \sum_{j=g+1}^{n} wj \frac{x_{ij} - \min(x_{ij})}{\min(x_{ij})} (i=1,2,\dots,m\ j=g+1,g+2,\dots n) \quad (4)$$

e. Linear preference rankings are calculated if criteria have a benefit with the formula below:

$$\bar{\bar{O}}_i = \bar{O}_i - \min(\bar{O}_i) \quad (5)$$

f. The total value of each preference for alternatives is calculated using the formula below:

$$P_1 = (\bar{\bar{I}}_i + \bar{\bar{O}}_i) - \min(\bar{\bar{I}} + \bar{\bar{O}})\ i = 1,2,\dots m \quad (6)$$

2.5 Social Media

Social media is a digital platform that provides facilities for various social activities for its users. The presence of social media has enormous benefits, as it helps eliminate the concept of distance among people. Social media also serves as a tool for building relationships among individuals. It is very popular and essential in today's era. With social media, people can interact through text, images, and audio in an online network without the need for face-to-face meetings[29]–[31].

3. RESULT AND DISCUSSION

3.1 Selection of Alternatives

In order to make a decision to determine the best chat application, supporting data such as criteria data, weights, and alternatives are crucial. Six chat application alternatives are used, as seen in Table 1 below:

Table 1. Alternatives

Alternative Code	Alternative
A_1	Whatsapp
A_2	Messenger

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Alternative Code	Alternative
A_3	Telegram
A_4	Instagram
A_5	Wechat
A_6	Line

3.2 Selection of Criteria

The criteria used to determine the best chat application consist of five criteria, as shown in Table 2 below:

Table 2. Criteria

Criteria	Description	Type
C1	Rating	Benefit
C2	Feature Status	Benefit
C3	Internet Data Usage	Cost
C4	Visual Interaction	Benefit
C5	Application Features	Benefit

Attribute Descriptions in Table 2:
Rating : Application popularity level.
Feature Status : Features available in the application.
Internet Data Usage : The amount of data used by the application.
Visual Interaction : User-to-user communication.
Application Features : Characteristics found in the application.

3.3 Application of ROC Method (Rank Order Centroid)

In Table 2, the criteria do not yet have weight values. To determine the weight values, the Rank Order Centroid (ROC) method is used, and the calculation to obtain the desired weight values can be seen in the following equations:

$$W_1 = \frac{1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}456$$

$$W_2 = \frac{0+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}256$$

$$W_3 = \frac{0+0+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}156$$

$$W_4 = \frac{0+0+0+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}09$$

$$W_5 = \frac{0+0+0+0+\frac{1}{5}}{5} = 0{,}04$$

From the calculations above, the weight values for the criteria are obtained as follows: W_1= 0,456, W_2= 0,256, W_3= 0,156, W_4= 0,09, W_5= 0,04. The following table shows the criteria and their respective weights.

Table 3. Criteria and Weights

Criteria	Description	Weight	Type
C1	Rating	0,456	Benefit
C2	Feature Status	0,256	Benefit
C3	Internet Data Usage	0,156	Cost
C4	Visual Interaction	0,09	Benefit
C5	Application Features	0,04	Benefit

The sample data used in selecting the best chat application consists of 6 samples, and can be seen in Table 4 below:

Table 4. Chat Application Alternatives

Alternative	C_1	C_2	C_3	C_4	C_5
Whatsapp	Excellent	Good	Good	Excellent	Excellent
Messenger	Good	Excellent	Excellent	Good	Good
Telegram	Good	Fair	Good	Excellent	Good
Instagram	Good	Excellent	Good	Good	Good
Wechat	Fair	Poor	Fair	Good	Good

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Alternative	C_1	C_2	C_3	C_4	C_5
Line	Poor	Good	Fair	Good	Fair

In Table 4, the Chat Application sample data requires weighted values based on the established criteria, as shown in Table 4 below:

Table 4. Weighted Criteria Values

Description	Weight Value
Excellent	4
Good	3
Fair	2
Poor	1

After matching the Chat Application sample data with the criteria weight values, Table 5 below shows the compatibility rating data.

Table 5. Compatibility Rating Data

Alternative	C_1	C_2	C_3	C_4	C_5
A_1	4	3	3	4	4
A_2	3	4	4	3	3
A_3	3	2	3	4	3
A_4	3	4	3	3	3
A_5	2	1	3	3	3
A_6	1	3	2	3	2

3.4 Application of the Operational Competitiveness Rating Analysis (OCRA) Method

The following are the steps used to obtain the compatibility rating using the Operational Competitiveness Rating Analysis (OCRA) method:

1. Forming the decision matrix:

$$X = [x_{ij}]_{mxn} = \begin{bmatrix} 4 & 3 & 3 & 4 & 4 \\ 3 & 4 & 4 & 4 & 3 \\ 3 & 2 & 3 & 4 & 3 \\ 3 & 4 & 3 & 3 & 3 \\ 2 & 1 & 3 & 3 & 3 \\ 1 & 3 & 2 & 3 & 2 \end{bmatrix}$$

2. Calculate preference rankings for the criteria to be minimized (cost) for C3:

$$\bar{I}_1 = \sum \left(0.156 \frac{4-3}{1}\right) = 0.156$$

$$\bar{I}_2 = \sum \left(0.156 \frac{4-4}{1}\right) = 0.000$$

$$\bar{I}_3 = \sum \left(0.156 \frac{4-3}{1}\right) = 0.156$$

$$\bar{I}_4 = \sum \left(0.156 \frac{4-3}{1}\right) = 0.156$$

$$\bar{I}_5 = \sum \left(0.156 \frac{4-3}{1}\right) = 0.156$$

$$\bar{I}_6 = \sum \left(0.156 \frac{4-2}{1}\right) = 0.312$$

3. Calculate linear preference rankings for each non-beneficial criterion (cost):

$$\bar{\bar{I}}_1 = 0.156 - 0.00 = 0.156$$

$$\bar{\bar{I}}_2 = 0.000 - 0.00 = 0.000$$

$$\bar{\bar{I}}_3 = 0.156 - 0.00 = 0.156$$

$$\bar{\bar{I}}_4 = 0.156 - 0.00 = 0.156$$

$$\bar{\bar{I}}_5 = 0.312 - 0.00 = 0.156$$

$$\bar{\bar{I}}_6 = 0.312 - 0.00 = 0.312$$

4. Calculate preference rankings for the criteria to be maximized (benefit) for C1, C2, C4, and C5:

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$\overline{O}_1 = \sum\left(0.456\frac{4-1}{1}\right) + \left(0.256\frac{3-1}{1}\right) + \left(0.09\frac{4-3}{1}\right) + \left(0.04\frac{4-2}{1}\right) = \sum 1.368 + 0.512 + 0.09 + 0.08 = 2.05$

$\overline{O}_2 = \sum\left(0.456\frac{3-1}{1}\right) + \left(0.256\frac{4-1}{1}\right) + \left(0.09\frac{4-3}{1}\right) + \left(0.04\frac{3-2}{1}\right) = \sum 0.912 + 0.768 + 0.09 + 0.04 = 1.81$

$\overline{O}_3 = \sum\left(0.456\frac{3-1}{1}\right) + \left(0.256\frac{2-1}{1}\right) + \left(0.09\frac{4-3}{1}\right) + \left(0.04\frac{3-2}{1}\right) = \sum 0.912 + 0.256 + 0.09 + 0.04 = 1.298$

$\overline{O}_4 = \sum\left(0.456\frac{3-1}{1}\right) + \left(0.256\frac{4-1}{1}\right) + \left(0.09\frac{3-3}{1}\right) + \left(0.04\frac{3-2}{1}\right) = \sum 0.912 + 0.768 + 0.000 + 0.04 = 1.72$

$\overline{O}_5 = \sum\left(0.456\frac{2-1}{1}\right) + \left(0.256\frac{1-1}{1}\right) + \left(0.09\frac{3-3}{1}\right) + \left(0.04\frac{3-2}{1}\right) = \sum 0.456 + 0.000 + 0.000 + 0.04 = 0.502$

$\overline{O}_6 = \sum\left(0.456\frac{1-1}{1}\right) + \left(0.256\frac{3-1}{1}\right) + \left(0.09\frac{3-3}{1}\right) + \left(0.04\frac{2-2}{1}\right) = \sum 0.000 + 0.512 + 0.000 + 0.000 = 0.512$

5. Calculate linear preference values for the beneficial criteria (benefit):

$\overline{\overline{O}}_1 = 2.05 - 0.00 = 2.05$

$\overline{\overline{O}}_2 = 1.81 - 0.00 = 1.81$

$\overline{\overline{O}}_3 = 1.298 - 0.00 = 1.298$

$\overline{\overline{O}}_4 = 1.72 - 0.00 = 1.72$

$\overline{\overline{O}}_5 = 0.502 - 0.00 = 0.502$

$\overline{\overline{O}}_6 = 0.512 - 0.00 = 0.512$

6. Calculate the total preference value for each alternative:

$P_1 = (0.156 + 2.05) - 0.156 = 2.05$

$P_2 = (0.000 + 1.81) - 0.156 = 1.568$

$P_3 = (0.156 + 1.298) - 0.156 = 1.298$

$P_4 = (0.156 + 1.72) - 0.156 = 1.72$

$P_5 = (0.156 + 0.512) - 0.156 = 0.512$

$P_6 = (0.312 + 0.512) - 0.156 = 0.668$

From the calculations above using the ROC and OCRA methods, alternative rankings can be obtained as shown in the Table 6 below:

Table 6. Preference Values

Alternative Code	Alternative	Preference Values	Rank
A_1	Whatsapp	2.05	1
A_2	Messenger	1.568	2
A_3	Telegram	1.298	3
A_4	Instagram	1.72	4
A_5	Wechat	0.512	5
A_6	Line	0.668	6

Based on the calculations of the six alternatives in Table 6, the chosen alternative for the best chat application is the first alternative (A1) - Whatsapp, with a preference value of 2.05.

4. CONCLUSION

Based on the discussion above, the author can draw the conclusion that ROC (Rank Order Centroid) is a highly influential method for determining weights in the evaluation of each alternative, which will be subsequently calculated. The use of the ROC method is highly beneficial in addressing the shortcomings and weaknesses of the Operational Competitiveness Rating Analysis (OCRA) method, resulting in more accurate and effective decision-making. The selection of the best chat application is a data point that is eligible to be proposed, designated, and nominated as the most outstanding and worthy of consideration for the Indonesian community, especially in North Sumatra. The highest-ranking result from this research is alternative A1 (Whatsapp) with a value of 2.05.

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