

# Decision Support System for Determining the Best Coffee Shop Applying the OCRA Method using ROC Weighting

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**Abstract**—The place of coffee sales, or more commonly known as a coffee shop, not only offers coffee but also serves a variety of hot and cold beverages. Many individuals, especially young people and students, choose to spend their time in modern coffee shops to sit and relax. Currently, coffee shops are often used as places for discussions, exchanging ideas, or simply relieving stress after activities. Coffee shops have become centers of social interaction with adequate service facilities. Although coffee shops are widespread, many people are not careful in choosing them. When choosing a coffee shop, it is important to select one that not only provides a comfortable environment but also serves the best-tasting coffee. The process of choosing the best coffee shop involves considerations such as price, taste quality, service, atmosphere, and cleanliness. To address this challenge, the author deems it essential to implement a Decision Support System (DSS). DSS is a field of science that utilizes technology to assist in problem-solving and accurate decision-making, without being manipulable. In the context of this research, the author uses the OCRA and ROC methods, as both are known as objective and easily understood methods. By applying the OCRA and ROC methods, the research results show that Gen's Semar Cafe, with a score of 1.594, is selected as the best coffee shop.

**Keywords:** Coffee Shop; DSS; ROC Method; OCRA Method

## 1. INTRODUCTION

In the current evolving era of modern times, there are numerous business opportunities emerging, and one of them is the crafting of coffee beverages, commonly known as a coffee shop. Nowadays, there are many cafes throughout Indonesia, particularly in North Sumatra. It has become addictive for young people and students, not just limited to them, as people from all walks of life flock to these places for relaxation and to savor a cup of coffee. In the language of today's youth, it's called 'nongkrong' or 'nongki.' The evolution of time has had a significant impact on society because coffee shops have become a sought-after place, especially with the development and offering of creative concepts that provide a new atmosphere for customers[1].

Coffee shops, as businesses, are not solely focused on selling coffee but also offer a variety of hot and cold beverages. Many young people and students use coffee shops as a place to spend time, either gathering with friends or simply relaxing alone. Currently, coffee shops are often chosen as venues for discussions, exchanging ideas, or unwinding after daily activities, whether it be work or study. Although there are many other places that can serve as public spaces, coffee shops have a unique charm due to their distinctive characteristics, setting them apart from other public places[3]. Despite the title "Selection of the Best Coffee Shop" being chosen for discussion, the author acknowledges that not all seemingly good coffee shops offer delightful coffee. Therefore, the author believes that a Decision Support System (DSS) is necessary to assist in choosing a coffee shop based on individual preferences. The development of time has taken coffee shops everywhere, but the lack of detail in the selection process often poses a problem in society. With a Decision Support System, the author hopes to provide better guidance for choosing a coffee shop that not only provides a comfortable environment but also serves the best-tasting coffee[4].

The Decision Support System (DSS) was obtained through calculations that greatly assisted the author in choosing the best coffee shop by meeting applicable criteria such as price, taste quality, service assessment, atmosphere, and cleanliness. DSS is a science that studies technology and can help solve problems and make more accurate decisions without being manipulable[5]–[8]. In this research, the author uses the Operational Competitiveness Rating Analysis (OCRA) method and Rank Order Centroid (ROC) because these methods are known for their ease of understanding and objectivity, offering various techniques such as ROC, ENTROPY, PSI, SWARA, WASPAS, ARAS, AHP, TOPSIS, MAUT, OCRA, and others[9], [10].

Based on previous research that can be used as a reference, Dewi and team (2022) investigated the application of the OCRA and ROC methods to determine the best online investment application, and the results showed that OVO scored the highest, namely 1.568[11]. Chandra and Ayunda (2022) also applied the OCRA and ROC methods to select the best coffee supplier, and the results showed that The Cold scored the highest, namely 1.2453[12]. Ardinsah and his colleagues (2022) used the OCRA and ROC methods to determine the best chat application, and the results showed that WhatsApp scored the highest, namely 128.3123[13]. Research by Dwina and team (2021) on the application of the OCRA and ROC methods in determining the best online learning media during the COVID-19 pandemic showed that alternative A3 ranked highest with a score of 2.296[14]. On the other hand, research by Mayadi and his colleagues (2021) regarding the analysis of the application of the OCRA and ROC methods in a decision support system to determine the best employees showed that alternative A5 was selected with a score of 1.347[15].

These various studies make a significant contribution to shaping the foundation for this research, illustrating the application of the OCRA method in different contexts. Therefore, the results of these studies are used as relevant references in designing the current research. The author intends to conduct research on the selection of the best coffee shop using the OCRA and ROC methods, making it a focal point in solving problems to obtain fair and absolute values that can be utilized.

## 2. RESEARCH METHODOLOGY

### 2.1 Decision Support System (DSS)

DSS is a form of information system that fundamentally utilizes computers in the fields of science and knowledge management. The primary goal of DSS is to provide support in decision-making within an organization. In other words, DSS can be interpreted as a system capable of processing data to generate useful information to support decision-making in specific problem contexts[16]–[20].

### 2.2 Coffee Shop

A coffee shop is a place that is easily found in various locations and cities throughout Indonesia and the world. Coffee shops, or more commonly known as cafes, refer to businesses that not only offer coffee but also provide various hot and cold beverages, as well as serving heavy and light meals. Many groups, such as teenagers, students, and workers, use their leisure time to sit or gather in coffee shops. This activity can be done either alone or with friends and family[21], [22].

### 2.3 OCRA Method

The OCRA method is an approach to measuring performance relatively through a non-parametric model. Introduced by Parkan in 1994, this method is simple and beneficial in analyzing sectors that can generate diverse decisions. Additionally, it has the advantage of comparing and monitoring the performance of a decision over time, a crucial aspect in its application.[27]–[31]. The steps to solving problems using the OCRA method include[32], [33]:

a. Creating the decision matrix  $X_{ij}$ , where it indicates alternative  $I$  for criterion  $j$ .

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

b. Calculating preference rankings for cost or cost-related criteria. In this step, alternative values for criteria can be reduced by computing non-beneficial criteria. The total performance of alternatives related to non-beneficial criteria can be calculated using the following formula:

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

c. Calculating preference rankings for non-beneficial or benefit-related criteria using the formula:

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

d. Determining preference rankings related to criteria. In favorable criteria, alternatives with higher values are considered better. The total ranking of alternative  $i$  for all criteria can be calculated using the following formula:

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

e. Calculating linear preference rankings for favorable criteria with the formula:

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

f. Calculating the total preference value for each alternative using the formula:

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

### 2.4 ROC Method

ROC is a method that generates weight values needed for the ranking process in DSS. The ROC method is relatively simple, prioritizing the importance of the first criterion over the second, the second over the third, and so on[19], [23]. Thus, criteria can be compared in the following order[24]–[26]:

$$C_1 > C_2 > C_3 > \dots > C_m \quad (7)$$

Weight values ( $W$ ) can be obtained using the formula:

$$W_m = \frac{1}{m} \sum_{i=1}^m \frac{1}{i} \quad (8)$$

### 2.5 Research Stages

This method involves several stages that result in data, as outlined in the figure below:

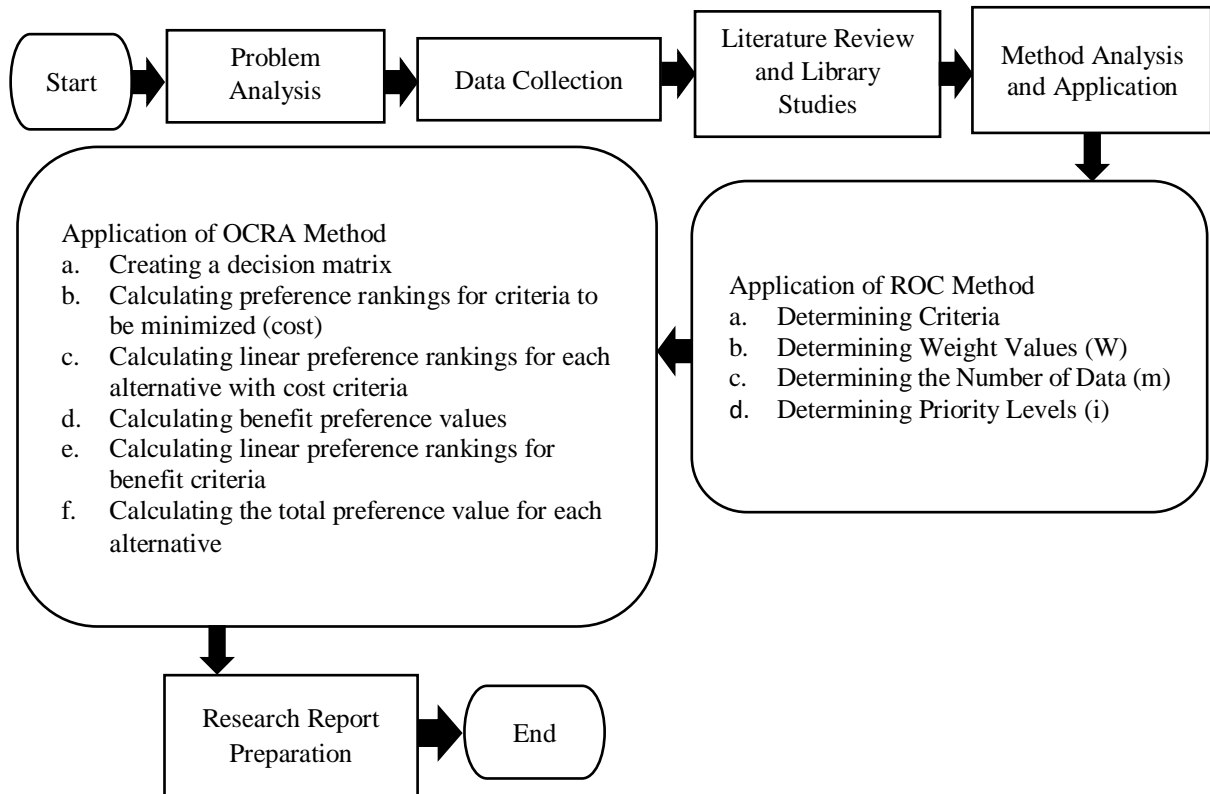


Figure 1. Research Framework

Explanation of the research stages in the figure:

- a. Problem Analysis  
This stage has many benefits in addressing existing problems and analyzing data before performing calculations.
- b. Data Collection  
Observation is useful for understanding the process in selecting the best coffee shop in terms of alternatives and criteria.
- c. Literature Review  
his study adds insight and understanding for researchers regarding the Decision Support System (DSS) in determining the best coffee shop.
- d. Method Analysis and Application  
This stage analyzes a problem in selecting the best coffee shop. It begins by determining the criterion weight values with the ROC method and then analyzing calculations using the OCRA method.
- e. Research Report  
This stage is the final report of the entire research conducted, followed by drawing conclusions from the study.

### 3. RESULT AND DISCUSSION

To make a decision in determining the best coffee shop using a Decision Support System (DSS), a certain amount of supporting data is required, including criteria, weights, and alternatives. There are five coffee shop data and five criteria used as alternatives. The details can be found in Table 1 below, which includes the necessary alternative data:

Table 1. Alternative

Alternative Code	Alternative
A1	Baily Beans Coffe
A2	Kopi Bababru
A3	Progress Coffe
A4	Kopitulang
A5	Gen's Semar Cafe

Below is the table of criteria required for the research to determine the best coffee shop, consisting of 5 criteria.

**Table 2.** Criteria

Criteria	Description	Type
C1	Price	Cost
C2	Taste Quality	Benefit
C3	Service Evaluation	Benefit
C4	Ambiance	Benefit
C5	Cleanliness	Benefit

**3.1 Implementation of Rank Order Centroid (ROC)**

In Table 2 above, the criteria do not have weights assigned yet. To obtain the weights, the ROC method can be used. By using the calculations provided in the following equations, the desired weights can be obtained:

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

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

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

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

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

From the calculations provided, the weights for each criterion are obtained as follows:  $W_1 = 0,456$ ,  $W_2 = 0,256$ ,  $W_3 = 0,156$ ,  $W_4 = 0,09$ , and  $W_5 = 0,04$ , as seen in Table 3 below:

**Table 3.** Criteria and Weights

Criteria	Description	Weight
C1	Price	0,456
C2	Taste Quality	0,256
C3	Service Evaluation	0,156
C4	Ambiance	0,09
C5	Cleanliness	0,04

The sample data used in selecting the best coffee shop has 5 samples, as shown in the alternative table 4 below:

**Table 4.** Coffee Shop Alternatives

Alternative	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>
Baily Beans Coffe	Fair	Good	Fair	Excellent	Fair
Kopi Bababru	Good	Fair	Excellent	Good	Poor
Progress Coffe	Poor	Good	Fair	Excellent	Good
Kopitulang	Fair	Excellent	Good	Good	Good
Gen's Semar Cafe	Good	Excellent	Excellent	Excellent	Good

From the coffee shop sample data, a weight table is required, containing weight values to calculate suitability ratings for further Decision Support System (DSS) calculations. Below is the table required for each criterion:

**Table 5.** Weighted Criteria Values

Description	Weight Value
Excellent	4
Good	3
Fair	2
Poor	1

Based on the available weight table, when matched with the sample data table, the suitability rating data table is obtained:

**Table 6.** Suitability Rating Data

Alternative	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>
A1	2	3	2	4	2

Alternative	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>
A2	3	2	4	3	1
A3	1	3	2	4	3
A4	2	4	3	3	3
A5	3	4	4	4	3

### 3.2 Implementation of OCRA Method

Here are the steps that can be used to determine the best coffee shop using the OCRA method:

a. Create a decision matrix:

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

b. Calculate preference rankings for the cost criterion C1:

$$\bar{I}_1 = \sum \left( 0.456 \frac{3-2}{1} \right) = 0.456$$

$$\bar{I}_2 = \sum \left( 0.456 \frac{3-3}{1} \right) = 0.000$$

$$\bar{I}_3 = \sum \left( 0.456 \frac{3-1}{1} \right) = 0.912$$

$$\bar{I}_4 = \sum \left( 0.456 \frac{3-2}{1} \right) = 0.456$$

$$\bar{I}_5 = \sum \left( 0.456 \frac{3-3}{1} \right) = 0.000$$

c. Calculate linear preference rankings for each Cost-type alternative:

$$\bar{\bar{I}}_1 = 0.456 - 0.00 = 0.456$$

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

$$\bar{\bar{I}}_3 = 0.912 - 0.00 = 0.912$$

$$\bar{\bar{I}}_4 = 0.456 - 0.00 = 0.456$$

$$\bar{\bar{I}}_5 = 0.000 - 0.00 = 0.000$$

d. Calculate preference rankings for Benefit-type criteria:

$$\begin{aligned} \bar{O}_1 &= \sum \left( 0.456 \frac{3-2}{1} \right) + \left( 0.256 \frac{2-2}{1} \right) + \left( 0.09 \frac{4-3}{1} \right) + \left( 0.04 \frac{2-1}{1} \right) \\ &= \sum 0.456 + 0.000 + 0.09 + 0.04 \\ &= 0.586 \end{aligned}$$

$$\begin{aligned} \bar{O}_2 &= \sum \left( 0.456 \frac{2-2}{1} \right) + \left( 0.256 \frac{4-2}{1} \right) + \left( 0.09 \frac{3-3}{1} \right) + \left( 0.04 \frac{1-1}{1} \right) \\ &= \sum 0.00 + 0.512 + 0.000 + 0.000 \\ &= 0.512 \end{aligned}$$

$$\begin{aligned} \bar{O}_3 &= \sum \left( 0.456 \frac{3-2}{1} \right) + \left( 0.256 \frac{2-2}{1} \right) + \left( 0.09 \frac{4-3}{1} \right) + \left( 0.04 \frac{3-1}{1} \right) \\ &= \sum 0.456 + 0.000 + 0.09 + 0.08 \\ &= 0.626 \end{aligned}$$

$$\begin{aligned} \bar{O}_4 &= \sum \left( 0.456 \frac{4-2}{1} \right) + \left( 0.256 \frac{3-2}{1} \right) + \left( 0.09 \frac{3-3}{1} \right) + \left( 0.04 \frac{3-1}{1} \right) \\ &= \sum 0.912 + 0.256 + 0.000 + 0.08 \\ &= 1.248 \end{aligned}$$

$$\begin{aligned} \bar{O}_5 &= \sum \left( 0.456 \frac{4-2}{1} \right) + \left( 0.256 \frac{4-2}{1} \right) + \left( 0.09 \frac{4-3}{1} \right) + \left( 0.04 \frac{3-1}{1} \right) \\ &= \sum 0.912 + 0.512 + 0.09 + 0.08 \end{aligned}$$

$$= 1.594$$

e. Calculate linear preference rankings for Benefit-type criteria:

$$\bar{O}_1 = 0.586 - 0.00 = 0.586$$

$$\bar{O}_2 = 0.512 - 0.00 = 0.512$$

$$\bar{O}_3 = 0.626 - 0.00 = 1.298$$

$$\bar{O}_4 = 1.248 - 0.00 = 1.248$$

$$\bar{O}_5 = 1.594 - 0.00 = 1.594$$

f. Calculate the total preference value for each alternative:

$$P_1 = (0.456 + 0.586) - 0.456 = 0.586$$

$$P_2 = (0.000 + 0.512) - 0.456 = 0.056$$

$$P_3 = (0.912 + 0.626) - 0.456 = 1.082$$

$$P_4 = (0.000 + 1.248) - 0.456 = 0.792$$

$$P_5 = (0.456 + 1.594) - 0.456 = 1.594$$

From the calculations conducted using the ROC and OCRA methods, the rankings for each coffee shop alternative are obtained, as shown in Table 7 below:

**Table 7.** Preference Values

Alternative	Description	Preference Value	Rank
A <sub>1</sub>	Baily Beans Coffe	0.586	4
A <sub>2</sub>	Kopi Bababru	0.056	5
A <sub>3</sub>	Progress Coffe	1.082	2
A <sub>4</sub>	Kopitulang	0.729	3
A <sub>5</sub>	Gen's Semar Cafe	1.594	1

Based on the calculations of the five alternatives listed in Table 7, the top-ranked alternative for the best coffee shop is the fifth alternative (A<sub>5</sub>), Gen's Semar Cafe, with a preference value of 1.594.

## 4. CONCLUSION

Based on the research findings, it can be concluded that the ROC weighting method and the OCRA method are highly objective and easy to understand. Both of these methods can yield significant weight and preference values associated with various criteria such as price, taste quality, service assessment, ambiance, and cleanliness. In the selection of the best coffee shop, the calculation results for the five alternatives in Table 6 show that the first alternative (A<sub>5</sub>), Gen's Semar Cafe, obtains the highest preference value of 1.594. This result is considered as a reference point in problem-solving, ensuring fairness and the validity of the obtained values.

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