

# Implementation of the Preference Selection Index (PSI) Method in Determining the Best Coffee Shop

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**Abstract**—The decision support system can be claimed to be a personal computer capable of running data into information so that when taking a semi-structured or problem-specific decision, A coffee shop is a place that prioritizes the sale of coffee with a variety of brewing methods, ranging from cold brew, percolator, Turkish coffee, automatic drip, moka pot, tubruk, Arabica, and many more. In this study, the authors used the PSI (preference selection index) method so that the selection of the best coffee shop was carried out by making a decision matrix, normalizing the decision matrix, calculating the mean value of normalized data, determining the variation of preferences, determining storage in preference values, determining the weight of the criteria, and calculating the PSI value so as to find the best alternative. The criteria used in the selection of coffee shops are five: food, drink, service, entertainment, and parking. Then the final result of the best alternative value is A6 as the best coffee shop in Tanjung Morawa, with a result of 3.702 using the PSI method.

**Keywords:** Decision Support System; Coffee Shop; The Best; PSI Method;

## 1. INTRODUCTION

The development of the times has brought various industries and advancements that compete to create innovation and creativity in order to enter the current market, whether it is coffee shops, restaurants, fast food businesses, and other shops. However, most teenagers tend to visit hangout places like coffee shops. A coffee shop is a place that prioritizes the sale of coffee with various brewing methods, such as Cold Brew, Percolator, Turkish Coffee, Automatic Drip, Moka Pot, Tubruk, Arabica, and many more[1]. Not only do they provide a variety of coffee menus, but many coffee shops also offer other supporting food and beverages. Various innovations, creativity, uniqueness, entertainment, food and coffee flavors, and the ambiance provided by each coffee shop aim to attract customers and provide a sense of relaxation.

As progress accelerates, more entrepreneurs open coffee shop businesses, leading to an increase in their number. This attracts visitors from all walks of life, whether old or young, upper or lower class, teenagers, or students, making them confused about choosing their ideal coffee shop. The design of cafes now has no limits and a variety of ambiances are offered[2]. They often have to go around searching for the most attractive place, which is considered inefficient nowadays. Therefore, a Decision Support System is needed to help determine the coffee shop that matches the visitors' criteria.

A Decision Support System is a system that can act in making a decision where an object has criteria that can be processed in a method[3]. A Decision Support System can be described as a personal computer capable of processing data into information so that a semi-structured or problem-specific decision can be made[1]. Decision Support Systems can also be described as personal computers that process data into information for making semi-structured problem-specific decisions. Methods found in decision support systems include SAW, WASPAS, TOPSIS, PSI, MAUT, and others [4]–[6]. In this research, the authors use the PSI (Preference Selection Index) method to select the best coffee shop by creating a decision matrix, normalizing the decision matrix, calculating the mean value of normalized data, calculating the preference variance, determining the storage in preference values, determining the weight of criteria, and calculating the PSI value to find the best alternative[7], [8].

Several related studies can be used as references for this research, such as the method used in the research conducted by Muhammad Nur Hendra Alvianto et al. in 2020, which discusses the Decision Support System for Cafe Selection in Yogyakarta using the Simple Additive Weighting (SAW) method, with the highest ranking value being alternative B with a final score of 9.4[9]. In the research conducted by Vika Haristianti et al. in 2021, which discusses the Analysis of Visitor Retention Factors in Coffee Shops Through the Evaluation of Interior Elements Performance, the main attraction of the café is the indoor area and comfort. Meanwhile, related research using the PSI method includes Rivalri Kristianto in 2020 with the title Decision Support System for Selecting the Best Animal Clinic Using the PSI (Preference Selection Index) Method, resulting in A8 with a score of 0.9179 [10]. Then, researchers Muhammad Rizki and Garuda Ginting in 2020, with the title Application of the Preference Selection Index Method in Selecting the Best Teller, resulted in Vindy as the best teller with a score of 0.75[11]. The research conducted by Sri Rezeki Nasution in 2020 with the title Decision Support System for Evaluating Employee Performance Using the Preference Selection Index (PSI) Method in the Primary Wood Processing Industry UD Maju Rezeki resulted in alternative A1 with the highest score of 0.7184[12]. Then, researchers Yusmar Ali et al. in 2019 with the title Application of the Preference

Selection Index (PSI) Method in Making Decisions on BOS Fund Distribution to Underprivileged Students resulted in the highest score, A4, with a result of 0.8311[13].

In this research, the authors are interested in using PSI (Preference Selection Index) because this method does not determine alternatives between attributes. Weighting is done according to the specifications of each alternative and does not have requirements for attribute weighting in decision-making problems. This method is very useful for resolving conflicts in determining the relative importance between attributes. It starts with creating a decision matrix, then normalizing the decision matrix, calculating the mean value of normalized data, calculating preference variation values, determining storage in preference values, and determining the weight of criteria.

## 2. RESEARCH METHODOLOGY

### 2.1 Decision Support System (DSS)

A Decision Support System (DSS) is a system that provides information for data processing and modeling. This system can help in making decisions with both exposed and unexposed events in the DSS. The purpose of the DSS is to enable users to obtain more efficient decisions, and it is designed to be run using interactive software to facilitate decision-making with the existing data[14]–[17]. The components of a Decision Support System include a Model Base, Database Management, and User Interface[18].

### 2.2 Coffee Shop

A coffee shop is an ideal place that is very comfortable with various ambiances provided, such as facilities like free WiFi, air conditioning, indoor and outdoor designs that bring tranquility to every visitor, and accompanied by jazz or classical music[19].

### 2.3 PSI Method

The PSI method is a Multi-Criteria Decision Making (MCDM) method. This method does not determine alternatives between attributes. Weighting is done according to the specifications of each alternative. The following are the steps in the PSI method[20]–[22]:

1. Creating a decision matrix

$$X_{ij} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (1)$$

2. Normalizing the decision matrix

If the attribute is a benefit (advantage), it can be normalized as follows:

$$R_{ij} = \frac{x_{ij}}{x_{jmax}} \quad (2)$$

If the attribute is a cost (disadvantage), it can be normalized as follows:

$$R_{ij} = \frac{x_{jmin}}{x_{ij}} \quad (3)$$

Where  $X_{ij}$  is the attribute measure ( $i=1,2,\dots,N$  dan  $j=1,2,\dots,M$ ).

3. Calculating the mean value of the normalized data

Each attribute is calculated using the following equation:

$$N_j = \frac{1}{N} \sum_{i=1}^m R_{ij} \quad (4)$$

4. Calculating the preference variation value

A preference value between the values of each attribute is calculated using the equation:

$$\phi_j = \sum_{i=1}^m (R_{ij} - N_j) \quad (5)$$

5. Determining the storage in preference values

$$\rho_j = 1 - \phi_j \quad (6)$$

6. Determining the weights of the criteria

$$W_j = \frac{\rho_j}{\sum_{j=1}^n \rho_j} \quad (7)$$

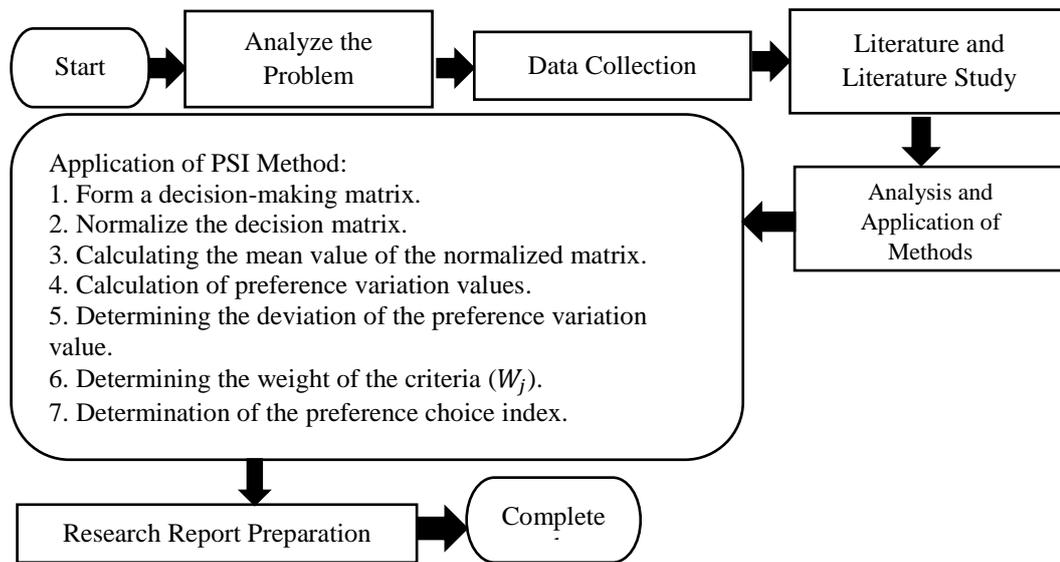
7. Calculating the PSI value

$$\mathcal{O} = \sum_{i=1}^m (R_{ij} - W_j) \tag{8}$$

**2.4 Research Stages**

In conducting this research, there are several stages that the author undertakes, which are explained in the following discussion:

1. Problem Identification  
This stage is carried out to identify the problems that will be faced in this research.
2. Data Collection (Literature Review)  
In this stage, data collection is done to find material related to the case from various sources on the internet.
3. Application of the PSI Method  
In this stage, the problems faced with a set of data are resolved through the application of the PSI Method.
4. Research Report Preparation  
In this stage, the research report is created with the aim of clearly presenting the final results of the resolved problems.



**Figure 1.** Research Framework

**3. RESULTS AND DISCUSSION**

The PSI method is a multi-criteria decision-making (MCDM) solution method and does not require assigning relative importance between attributes, and does not require weights. This method obtains results with minimal and simple calculations.

**3.1 Determination of Alternative Data**

In the Application of Alternatives plays a role for Determining the Best Coffee Shop. The following alternative data determines the coffee shop in the following table:

**Table 1.** Alternative Data

Alternativ	Coffee Shop Name
A1	Good Fella
A2	Bi.el Coffee
A3	Abah Awak
A4	Doa Mamak
A5	Kopi Lawas
A6	D'Raja Coffee
A7	Lalu Coffee

**3.2 Application of Criteria**

In determining the Best Coffee Shop, there are criteria that must be met by each coffee shop as shown in the table below:

**Table 2.** Criteria

Criteria	Description	Criteria Type
C1	Food	Benefit
C2	Drinks	Benefit
C3	Service	Benefit
C4	Service	Benefit
C5	Service	Benefit

Description of Criteria in Table 2:

- Food : Heavy or light meals provided
- Beverages : Drinks and coffee provided, either hot or cold
- Service : Interaction activities between workers and customers
- Entertainment : Availability of live music or karaoke
- Parking : Space for parking two-wheeled and four-wheeled vehicles

The following are the alternative coffee shop data used in this research to determine the best coffee shop.

**Table 3.** Coffee Shop Alternative Data

Alternative	Food	Drinks	Service	Service	Service
A1	Tasty	Delicious	Not Friendly	Available	Narrow
A2	Tasty	Delicious	Friendly	Available	Spacious
A3	Tasty	Delicious	Friendly	Available	Narrow
A4	Not Good	Delicious	Friendly	Available	Narrow
A5	Very Good	Delicious	Very Friendly	Available	Narrow
A6	Very Good	Delicious	Friendly	None	Spacious
A7	Tasty	Delicious	Friendly	None	Spacious

In table 3 above, there is still data that is of the linguistic type, therefore it requires weighting in order to get a value. The following are the weighting tables needed in this research can be seen below.

**Table 4.** Weight of Food and Coffee/Beverage

Fuzzy Number	Value
Not Good	4
Tasty	8
Very Good	9

**Table 5.** Service Weight

Fuzzy Number	Value
Not Friendly	5
Friendly	7
Very Friendly	9

**Table 6.** Entertainment Weight

Fuzzy Number	Value
None	0
Available	5

**Table 7.** Parking Weight

Fuzzy Number	Value
Narrow	3
Spacious	7

Then the weighting data for the criteria shown in tables 4,5,6 and 7 after weighting is as follows:

**Table 8.** Criteria Alternative Data

Alternative	C1	C2	C3	C4	C5
A1	8	8	5	5	3
A2	8	8	7	5	7
A3	8	8	7	5	3
A4	4	8	7	5	3
A5	9	8	9	5	3
A6	9	8	7	0	7
A7	8	8	7	0	7

### 3.3 Application of PSI Method

1. Creating a decision matrix

$$X_{ij} = \begin{pmatrix} 8 & 8 & 5 & 5 & 3 \\ 8 & 8 & 7 & 5 & 7 \\ 8 & 8 & 7 & 5 & 3 \\ 4 & 8 & 7 & 5 & 3 \\ 9 & 8 & 9 & 5 & 3 \\ 9 & 8 & 7 & 0 & 7 \\ 8 & 8 & 7 & 0 & 7 \end{pmatrix}$$

2. Normalize the decision matrix

In normalizing the decision matrix in this study only uses equation 2 because all criteria are of the benefit type, it will produce the following normalization table.

**Table 9.** Normalization on the Decision Matrix

Alternative	C1	C2	C3	C4	C5
A1	0.8	1	0.5	1	0.428
A2	0.8	1	0.7	1	1
A3	0.8	1	0.7	1	0.428
A4	0.4	1	0.7	1	0.428
A5	1	1	1	1	0.428
A6	1	1	0.7	0	1
A7	0.8	1	0.7	0	1
TOTAL	5.6	7	5	5	4,712

3. Calculating the Mean Value of normalized data

$$N_{j1} = \frac{1}{7} * 5.6 = 0.8$$

$$N_{j2} = \frac{1}{7} * 7 = 1$$

$$N_{j3} = \frac{1}{7} * 5 = 0.714$$

$$N_{j4} = \frac{1}{7} * 5 = 0.714$$

$$N_{j5} = \frac{1}{7} * 4.712 = 0.673$$

4. Calculating the Preference Variation Value

In calculating the preference variation value in this study using equation 5, it will produce the following preference variation value table.

**Table 10.** Preference Variation Value

Alternative	C1	C2	C3	C4	C5
A1	0	0	0.045	0.081	0.060
A2	0	0	0	0.081	0.106
A3	0.	0	0	0.081	0.060
A4	0.16	0	0	0.081	0.060
A5	0.04	0	0.081	0.081	0.060

Alternative	C1	C2	C3	C4	C5
A6	0.04	0	0	0.509	0.106
A7	0	0	0	0.509	0.106
TOTAL	0.24	0	0.126	1.423	0.558

5. Determining storage in preference values

$$\rho_{j1} = 1 - 0.24 = 0.76$$

$$\rho_{j2} = 1 - 0 = 1$$

$$\rho_{j3} = 1 - 0.126 = 0.874$$

$$\rho_{j4} = 1 - 1.423 = -0.423$$

$$\rho_{j5} = 1 - 0.558 = 0.442$$

$$\text{Total } \rho_j = 2.653$$

6. Determine the weight of the criteria

$$W_{j1} = 0.76 / 2.653 = 0.286$$

$$W_{j2} = 1 / 2.653 = 0.376$$

$$W_{j3} = 0.874 / 2.653 = 0.329$$

$$W_{j4} = -0.423 / 2.653 = -0.159$$

$$W_{j5} = 0.442 / 2.653 = 0.166$$

7. Calculating the PSI Value

In calculating the PSI value in this study using equation 8, it will produce the following PSI value table.

**Table 11.** PSI values

Alternative	C1	C2	C3	C4	C5	Total	Rank
A1	0.514	0.624	0.171	1.159	0.262	2.73	6
A2	0.514	0.624	0.371	1.159	0.834	3.502	2
A3	0.514	0.624	0.371	1.159	0.262	2.93	5
A4	0.114	0.624	0.371	1.159	0.262	2.53	7
A5	0.714	0.624	0.671	1.159	0.262	3.43	4
A6	0.714	0.624	0.371	1.159	0.834	3.702	1
A7	0.514	0.624	0.371	1.159	0.834	3.502	3

Based on the results of the application of the PSI method, the ranking results were obtained, after which the researchers arranged the alternatives according to the ranking obtained, which can be seen in table 12 below.

**Table 12.** Alternatives Arranged In Order

Alternative	Total	Rank
A6	3.702	1
A2	3.502	2
A7	3.502	3
A5	3.43	4
A3	2.93	5
A1	2.73	6
A4	2.53	7

It can be stated from the table above that Alternative A6 is the best alternative with a total of 3,702 as the best coffee shop.

## 4. CONCLUSION

It can be concluded that it can be reviewed in the research above that it has been produced that in determining the best coffee shop using the PSI (preference selection index) method has 7 alternative samples and 5 criteria as a result of getting the best alternative is A6 with a value of 3.702. The criteria used in the selection of coffee shops are 5 criteria, namely Food, Drink, Service, Entertainment, and Parking. The PSI method does not require determining the weight of each criterion, so it can make it easier to receive maximum decisions. This method is very useful for a conflict in determining the relative importance between attributes.

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