Culinary Places Recommendation System in Bekasi City Using the Simple Additive Weighting Method

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Abstract
Bekasi city, based on data from the Central Bureau of Statistics (BPS) in 2018, shows the average Economic Growth Rate (LPE) of 5.82% from 2013 to 2016. Based on this growth, Bekasi city has business opportunities, for example culinary business, that has already spread around Bekasi city. The number of culinary places can cause problems when visitors determine culinary places that fit their criteria. Many visitors usually rely on information from relatives in determine culinary places, so this allows a mismatch between the recommendations of relatives and the criteria they want. Based on the problem, one of the proposed solutions needs to be made a method to support decisions that can provide recommendations in determining culinary places for visitors. The method used in determining the recommendation of culinary places is Simple Additive Weighting (SAW). In the process of calculating the method there are alternatives and assessment criteria used, there are several assessment criteria, namely price, number of menus, rating, and distance.
result shows the recommended alternative culinary place is the eighth alternative (A8) since the alternative has the highest preference value of 0.85. Therefore, the proposed system can be integrated in the culinary website to support user in choosing the culinary place.

**Keywords:** culinary bekasi, culinary place selection, simple additive weighting

1. **Introduction**

Culinary is a cooked product in the form of side dishes, food and beverages. Every region has its own characteristic culinary taste, e.g. based on its sweet food taste, or spicy food. So that from the characteristic taste of each region has a different culinary tradition. Culinary is an inseparable lifestyle, this is because everyone needs to eat food they need every day from simple meals to fancy food (Astradanta et al., 2016).

Culinary diversity in Indonesia holds great potential to be developed as a supporting service in the development of culinary tourism. The food business contributes about 19.33% to tourism industry revenue (Astradanta et al., 2016). Bekasi city based on data from the Central Bureau of Statistics (BPS) in 2018 shows the average Economic Growth Rate (LPE) of 5.82% from 2013 to 2016. Based on this growth, the city of Bekasi has business opportunities, including culinary business, thus enabling many culinary places to be opened in the city of Bekasi (Mediaindonesia.com, 2019).

The large number of culinary places can cause problems in determining culinary places that fit their criteria. Many visitors usually rely on information from relatives in determine culinary places that invite a mismatch between the recommendations of relatives and their own criteria (Astradanta et al., 2016; Saksono et al., 2018; Yulianti & Juwita, 2016). In addition, the problem is also related to the problems experienced by the community in the city of Bekasi with the many alternative culinary places around them resulting in difficulty in determining culinary places that fit the criteria. Based on the problem, one of the proposed solutions needs to be made a method of supporting decisions that can provide recommendations in determining culinary places for visitors.
There are several methods in a decision support system, i.e. Simple Additive Weighting (SAW), the method that uses some alternative solutions in determining the recommendation of object. The working concept of simple additive weighting (SAW) is by looking for weighted summation of performance rating in each alternative. In the process of calculation saw method has the process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative values (Kusumadewi et al., 2006).

Based on the problems and alternative solutions, the purpose of this research is to help the visitors in determination of culinary places in Bekasi city. The method used in supporting the decision is Simple Additive Weighting.

Culinary is one part of a tourist destination. Culinary tourism itself becomes one of the alternatives in supporting tourism potential in Indonesia. In addition, it also related to local food from tourist destinations. Many factors are considered to influence the decision making of culinary tourism including price, location, company image and product quality. However, the results of the analysis that has been used using multiple regression analysis show that price and location factors have a positive and significant effect on purchasing decisions (Mangifera et al. 2018).

Decision support system is a system that is able to provide problem solving capabilities as well as communication capabilities for problems with semi-structured and unstructured conditions. This system is used to assist decision making in semi-structured and unstructured situations, where no one knows for sure the decision should have been made (Astradanta et al., 2016; Kusrini, 2007).

There have been several previous studies related to the process of finding culinary locations in several areas as references. The large number of restaurants located in the city of Kudus, makes it a problem for consumers or tourists who want to choose a restaurant. It can even take a lot of time because consumers are faced with a great selection of restaurants. Therefore, a decision support system is needed to assist consumers or tourists in choosing culinary places. In determining the selection of culinary places in the city of Kudus, a weighted product method was used to determine culinary places with several
criteria, namely, number of menus, average price, wifi, and charger place. Culinary location selection system with Weighted Product method was implemented in mobile-based system with the aim to make it easier for admins and users to choose culinary or restaurant (Wardhani & Lutfina, 2020).

Another study discusses the decision support system in choosing a culinary place with Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) method to help consumers or prospective customers of the restaurant in determining the restaurant that meets user criteria. This system is developed in two applications namely android applications and website applications. The android application of this system is intended for users or customers, while the website application is intended for restaurant managers and system administrators (Astradanta et al., 2016).

The number of restaurant providers in the city of Padang, making consumers or tourists who come to visit the city of Padang a little difficulty in choosing the desired restaurant. Therefore, a decision support system is needed to assist consumers or tourists in choosing a special culinary place for Padang cuisine. In determining the selection of culinary places in the city of Padang used Exponential Comparison Method (MPE) as a tool to determine culinary places with several criteria, namely physical, management, service and use of local products. This method provides restaurant recommendations based on the alternative values of subcriteria inputted by visitors (Yulianti & Juwita, 2016).

Depok city area is a growing city in the south of Jakarta. One of the growing areas is the culinary tourism sector. Many places sell different types of food, from street vendors to modern places. The number of culinary destinations in depok city becomes a problem for tourist in determining the appropriate location. Therefore, a decision-making system that can help determine it was proposed using Simple Additive Weighting as a method with some criteria, i.e. location, price, transportation, distance, facilities, parking, menu variations, and operational time (Sunarti, 2020).
Culinary Places Recommendation System in Bekasi City Using the Simple Additive Weighting Method

2. Research Methods

2.1. Data

Data collection in this study used systematic literature review from material books, scientific works and research documentation that is used as a reference in finding information and supporting theories related to supporting decisions in the selection of culinary places using the Simple Additive Weighting method. For culinary place data obtained from the gojek application in which there is information about the price range, the number of menus, ratings and distance of restaurants.

2.2. Simple Additive Weighting

The stages used in obtaining the results of the decision are: the search stage, the design stage, the selection stage and the implementation stage (Figure 1). The search stage is done by identifying information on the problem. The design stage is done by formulating the assessment criteria used in determining the best alternative, the assessment criteria used in the selection of culinary places, namely price, number of menus, rating and distance. The selection stage uses the Simple Additive Weighting method as a solution used in determining culinary places. In the implementation stage, the decision maker performs the selected solving action at the election stage. Successful implementation is characterized by the answering of the problem and from this stage obtained a report on the implementation of the solution and the result is obtained a recommended culinary place based on the results of the calculation of the SAW method (Kusrini, 2007).

Source: (Kusrini, 2007)

Figure 1. Decision Steps
The working concept of simple additive weighting (SAW) is by looking for weighted summation of performance rating in each alternative. In the process of calculation SAW method has the process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative values (Kusumadewi et al., 2006).

The phases of the SAW method include 1) determining alternatives, 2) determining the assessment criteria, 3) determining the weight of each criterion, 4) making matrix normalization, 5) making the matrix normalized, 6) determining the quality of each alternative until finally obtained the result of the decision.

There are two possible formulas for determining normalization. This can be done by first determine the type of attribute contained in the assessment criteria used. Possible types of attributes include benefits and costs. Formula (1) is a formula used in determining the normalization of the matrix if the valuation criteria used are types of profit attributes, while the formula (2) is used if the assessment criteria used are types of cost attributes.

\[
    r_{ij} = \frac{x_{ij}}{\text{Max} \ x_{ij}} \quad (1)
\]

\[
    r_{ij} = \frac{\text{Min} \ x_{ij}}{x_{ij}} \quad (2)
\]

Where the normalization of the matrix \((rij)\) for the type of profit attribute is obtained by the proportion between the values of the alternatives in each criteria attribute with the maximum value of all the alternatives in each criterion. While in determining the normalization of the matrix for the type of cost attribute is done by dividing between the minimum value of each alternative in each criterion with the value of the alternative on each attribute criteria. After normalizing the matrix, a normalized matrix is formed.

Ranking of alternatives can be calculated through equation (3).

\[
    Vi = \sum_{j=1}^{n} w_j \ r_{ij} \quad (3)
\]
Where the variable \( \text{Vi} \) represents the final value of the alternative, \( \text{wij} \) is the weight of the predetermined criteria and the \( \text{rij} \) is the value of matrix normalization. The final result is obtained from the perankingan process by summing the multiplication result between the normalized matrix and the weight vector. The best alternatives are obtained based on the final value of the preference that has the highest value.

### 3. Results and Discussion

Alternatives used in this study are based on several lists of culinary places in Bekasi where the locations are around Universitas Bhayangkara, Jakarta Raya. The assessment criteria used include price, number of menu variants, rating and distance. Table 1 shows data on the assessment criteria used, the weight of each criterion and the type of attributes of each criterion.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Name</th>
<th>Weight</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Price</td>
<td>40%</td>
<td>Price</td>
</tr>
<tr>
<td>C2</td>
<td>Number of Menu</td>
<td>10%</td>
<td>Revenue</td>
</tr>
<tr>
<td>C3</td>
<td>Rating</td>
<td>30%</td>
<td>Revenue</td>
</tr>
<tr>
<td>C4</td>
<td>Distance</td>
<td>20%</td>
<td>Revenue</td>
</tr>
</tbody>
</table>

Source: Research Result (2021)

Table 2 shows alternative data and assessment criteria. There are 10 alternatives used in this study.

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Price</th>
<th>Number of Menu</th>
<th>Rating</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>A2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>A3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>A4</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>A5</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>A6</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>A7</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>A8</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>A9</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>A10</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Research Result (2021)
Based on the assessment criteria data and alternatives that have been determined, the next stage of calculating normalization by paying attention to the type of attribute of each criterion is a criterion of profit or cost.

The first criterion is the type of cost and in calculating the normalization of the matrix, the equation (2) was used. The first step determines the minimum value of the overall alternative to the price criteria, and the minimum value obtained for the price criteria is 1. Next, here’s the calculation process for the first and second alternatives to the price criteria.

\[
r_{ij} = \frac{\text{Min } x_{ij}}{x_{ij}}
\]

\[
r_{11} = \frac{1}{3} = 0.33 \quad r_{21} = \frac{1}{4} = 0.25
\]

Number of menu criteria, rating, and distance are types of profit attributes, thus, the first step is to determine the maximum value of the alternative for each criterion. The maximum value of menu, rating, and distance criteria are 5, 5, and 4, respectively. Calculation of matrix normalization for the criteria of the number of menus on the first and second alternatives are illustrated as follows:

\[
r_{ij} = \frac{x_{ij}}{\text{Max } x_{ij}}
\]

\[
r_{21} = \frac{5}{5} = 1 \quad r_{22} = \frac{3}{5} = 0.6
\]

Normalization calculation for rating criteria of first and second alternatives are:

\[
r_{ij} = \frac{x_{ij}}{\text{Max } x_{ij}}
\]

\[
r_{31} = \frac{5}{5} = 1 \quad r_{32} = \frac{4}{5} = 0.8
\]

Normalization calculation for distance criteria of first and second alternatives are:
Culinary Places Recommendation System in Bekasi City Using the Simple Additive Weighting Method

\[
    r_{ij} = \frac{x_{ij}}{\text{Max } x_{ij}}
\]

\[
    r_{41} = \frac{4}{4} = 1 \quad r_{42} = \frac{3}{4} = 0.75
\]

Table 3 shows normalized rating criteria (rij) that create normalized matrix (R).

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Price</th>
<th>Number of Menu</th>
<th>Rating</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0.33</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A2</td>
<td>0.25</td>
<td>0.6</td>
<td>0.8</td>
<td>0.75</td>
</tr>
<tr>
<td>A3</td>
<td>0.25</td>
<td>1</td>
<td>0.8</td>
<td>0.75</td>
</tr>
<tr>
<td>A4</td>
<td>1</td>
<td>0.6</td>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>A5</td>
<td>0.5</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>A6</td>
<td>0.33</td>
<td>0.4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A7</td>
<td>0.5</td>
<td>0.4</td>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>A8</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>A9</td>
<td>0.333333</td>
<td>0.4</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>A10</td>
<td>0.5</td>
<td>0.4</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Source: Research Result (2021)

The final stage determines the preference value for each alternative by using an equation (3). Here’s an example of a calculation in determining the preference value for the first alternative.

\[
    V_i = \sum_{j=1}^{n} w_j r_{ij}
\]

\[
    V1 = (0.33 \times 0.4) + (1 \times 0.1) + (1 \times 0.3) + (1 \times 0.2) = 0.73
\]

Table 3 shows calculation result of preference value for all alternatives using equation (3). It ranges from 0.57 to 0.85.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0.73</td>
</tr>
<tr>
<td>A2</td>
<td>0.55</td>
</tr>
<tr>
<td>A3</td>
<td>0.59</td>
</tr>
<tr>
<td>A4</td>
<td>0.81</td>
</tr>
<tr>
<td>A5</td>
<td>0.70</td>
</tr>
</tbody>
</table>
Based on the results of preference values obtained from alternative data and assessment criteria used shows that the results of processing simple additive weighting method shows that alternative 8 (A8) is an alternative culinary place recommended because it has the highest preference value of 0.85 and then continued with alternative 4 (A4) with the result of spread preference value of 0.81. Table 5 shows the order in which the SAW method preference values are returned from highest to lowest.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>A6</td>
<td>0.67</td>
</tr>
<tr>
<td>A7</td>
<td>0.59</td>
</tr>
<tr>
<td>A8</td>
<td>0.85</td>
</tr>
<tr>
<td>A9</td>
<td>0.57</td>
</tr>
<tr>
<td>A10</td>
<td>0.64</td>
</tr>
</tbody>
</table>

Source: Research Result (2021)

4. Conclusion

The research conducted shows the Simple Additive Weighting method can provide recommendations in determine the culinary place based on the highest value of the results of an alternative. In obtaining the results of decisions SAW uses several steps, including determining alternatives, assessment criteria, making normalization of matrices, forming normalized matrices, greed of each alternative and lastly can be known decision results.
based on the value of preference of an alternative the highest. Based on the results of the alternative calculation that has the highest preference value is the alternative A8 with a value of 0.85. Thus, it can be concluded that the alternative A8 is a recommended culinary place to choose based on the results of the calculation of saw method. The proposed system appropriate to integrate in a culinary information system.

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Author Contributions
Fata Nidaul Khasanah the topic; Fata Nidaul Khasanah and Herlawati conceived models and designed the experiments; Fata Nidaul Khasanah and Herlawati the algorithms; Fata Nidaul Khasanah and Herlawati analysed the result.

Conflicts of Interest
The author declare no conflict of interest.

References


