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Revealing the Advantages of the Best Cooking Oil Brand: A Case Study of Weighted Aggregated Sum Assessment (WASPAS) Method in Decision Support System

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ABSTRACT

The purpose of this research is to implement the Weighted Aggregated Sum Product Assessment (WASPAS) method in determining the best cooking oil brand. The research method used is the Weighted Aggregated Sum Product Assessment (WASPAS) method with the stages of determining criteria, weights, and alternatives, creating a decision matrix, calculating the normalization value of the matrix and WASPAS weights in decision making Calculating the Qi value of normalization and weights makes ranking from the highest Qi value. From the research it is known that alternative A4 with the description Bimoli has the highest Qi value of 0.9162, so it is concluded that alternative A4 or Bimoli was chosen as the best cooking oil among the eight alternatives or other cooking oil brands. The result of this study is that the WASPAS method is able to recommend the selection of the best cooking oil for consumers.

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1. INTRODUCTION

Today, and especially in tropical countries, palm oil holds an important place among vegetable oils [1], [2]. From FAS-USDA (Foreign Agricultural Service - U.S Dapartement Of Agriculture) data for developing countries like Indonesia, it accounts for most of the world's palm oil production at 59%, with about 45.5 tons exported in the period 2022/2023.

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Palm oil can be used as a base material for making various products, such as making biolubricants or lubricants [3][4][5][6], biodiesel [7][8][9], transparent soap [10][11][12], and even its waste can be used for biogas energy generation [13][14][15]. In addition, palm kernel marks can also be used to make biofertilizers [16][17][18]. In this article, we will focus on cooking oil from palm oil.

Cooking oil is one of the staple ingredients in the cooking process that is very commonly used in various dishes. However, the many brands and varieties of cooking oil in the market may cause consumers to be confused in choosing the one that suits their needs and preferences. Choosing the right cooking oil is important considering the role of cooking oil in influencing flavor, nutritional quality, and health impacts [20][21].

For its various uses in cooking, cosmetics and soap factories, palm oil must be refined first [1]. In the cooking oil processing process consists of a refining process and a fractionation process. For the oil produced from the refining process consists of a liquid fraction and a solid fraction, in this frakctionation process, the solid fraction is separated from the liquid fraction [23], [24]. Some of the best-selling cooking oil brands on the market include Sari Murni, Bimoli, Sanco, and many others.

Due to the large number of cooking oil brands available, a decision support system (DSS) is needed to determine the best cooking oil [25], using criteria [26][27], such as color, taste, saturated fat, and price. In this article, the Weighted Aggregated Sum Assessment (WASPAS) method is used to provide accurate and useful recommendations for consumers [28][29] in choosing the best option for their daily cooking needs. In this article, eight brands of cooking oil will be used, including Sari Murni, Tawon, Fortune, Bimoli, Sanco, Rose Brand, Kuwali, and Tropical.

2. RESEARCH METHOD

Weighted Aggregated Sum Assessment (WASPAS) is one of the techniques that belong to the stream of multicriteria decision-making techniques [30]. It is based on the merger of two methods, namely the Weighted Sum Model (WSM) and the Weighted Product Model (WMP). The WASPAS method combines the advantages of both methods. For the WSM method, the advantage is the easy evaluation of alternatives using weighted sum. For the WMP method, the advantage is to prevent low-value solutions from being obtained. In 2016, the use of interval type-2 fuzzy sets in the WASPAS method was proposed [31].

Work steps of the WASPAS method [32][33].

a. Determining Criteria, Weights, and Alternatives
b. Create a decision matrix (1),

$$X = \begin{bmatrix} X1_1 & X1_2 & \dots & X1_n \\ X2_1 & X2_2 & \dots & X2_n \\ \dots & \dots & \dots & \dots \\ Xm_1 & Xm_2 & \dots & X3_n \end{bmatrix} \quad (1)$$

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c. Calculating the matrix normalization value and WASPAS weight in decision making. Where the formula used:

- Benefit Criteria (2)

$$X_{ij} = \frac{X_{ij}}{Max_{ij}X_{ij}} \quad (2)$$

- Cost Criteria (3)

$$X_{ij} = \frac{Min_{ij}X_{ij}}{X_{ij}} \quad (3)$$

d. Calculate the Qi value from normalization and weights, and also perform a ranking based on the highest Qi value using formula (4):

$$Q_i = 0{,}5\sum_{j=1}^{n} X_{ijw} + 0{,}5\prod_{j=1}^{n}(xij)^{wj} \quad (4)$$

e. The last step is to rank the highest Qi values.

3. RESULTS AND DISCUSSION

In this study, the type of cooking oil used is palm oil. Where the brand of cooking oil in this study is a brand that is often used, especially in the city of Padang. These brands include Sari Murni, Tawon, Fortune, Bimoli, Sanco, Rose Brand, Kuwali, and Tropical. The number of cooking oil brands on the market makes it difficult for people to determine the best brand. For price data adjusted at the time of the research, December 2022 and prices are seen from the selling prices at TransMart Padang and 2Mart minimarkets in Padang city.

3.1. Criteria, Data Weights, dan Alternatives

The series of matches for the criteria of Color, Taste, Saturated Fat, and Price are: Point 3 = Very Good, Point 2 = Good, and Point 1 = Fair

Table 1. Criteria and Weight Data

Criteria	Description	Weight	Attributes Criteria
C1	Color	20%	Benefit
C2	Flavor	20%	Benefit
C3	Saturated Fat	25%	Cost
C4	Price	35%	Cost

The following is Table 2. for the weighting of the color criteria.

Table 2. Weighting of color Criteria

Color	Weight
Transparent	3
Clear	2
Thick	1

And Table 3. for the weighting of the flavor criteria

Table 3. The Weighting of Color Criteria

Flavor	Weight
Bland	3
Mild	2
Bitter	1

Furthermore, there are eight alternatives used

Table 4. Alternatif

Alternative	Description
A1	Sari Murni
A2	Tawon
A3	Fortune
A4	Bimoli
A5	Sanco
A6	Rose Brand
A7	Kuwali
A8	Tropical

3.2. Creating a Decision Matrix

After the weights of the Color and Taste criteria are determined, then proceed with making the Alternative and Criteria match table.

Table 5. Suitability of Alternatives and Criteria

Alternatif	Kriteria			
	C1	C2	C3	C4
A1	Transparent	Mild	3,5 g	IDR 17,800
A2	Transparent	Mild	3,7 g	IDR 17,500
A3	Transparent	Mild	4 g	IDR 20,000
A4	Clear	Bland	4 g	IDR 19,000
A5	Clear	Bland	4 g	IDR 20,000
A6	Transparent	Mild	4 g	IDR 18,000
A7	Transparent	Mild	4 g	IDR 17,000
A8	Transparent	Mild	3,5 g	IDR 19,000

Table 6. Alternative and Criteria Suitability Rating

Alternatif	Kriteria			
	C1	C2	C3	C4
A1	2	2	3,5	17,800
A2	2	2	3,7	17,500
A3	2	2	4	20,000
A4	3	3	4	19,000
A5	3	3	4	20,000
A6	2	2	4	18,000
A7	2	2	4	17,000
A8	2	2	3,5	19,000

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3.3 Calculating the Normalization Matrix and Weight Value

Then calculate the matrix normalization value for each criterion. The following Table 7 is a step to calculate normalization based on the Benefit and Cost criteria attribute formula.

Table 7. Calculating Nomalization Value

R_{11} = 2/3 = 0,67	R_{21} = 2/3 = 0,67	R_{31} = 3,5/3,5 = 1,00	R_{41} = 17.000/17.800= 0,96
R_{12} = 2/3 = 0,67	R_{22} = 2/3 = 0,67	R_{32} = 3,5/3,7 = 0,95	R_{42} = 17.000/17.500 = 0,97
R_{13} = 2/3 = 0,67	R_{23} = 2/3 = 0,67	R_{33} = 3,5/4 = 0,88	R_{43} = 17.000/20.000 = 0,85
R_{14} = 3/3 = 1,00	R_{24} = 3/3 = 1,0	R_{34} = 3,5/4 = 0,88	R_{44} =17.000/19.000 = 0,89
R_{15} = 3/3 = 1,00	R_{25} = 3/3 = 1,0	R_{35} = 3,5/4 = 0,88	R_{45} = 17.000/20.000 = 0,85
R_{16} = 2/3 = 0,67	R_{26} = 2/3 = 0,67	R_{36} = 3,5/4 = 0,88	R_{46} = 17.000/18.000 = 0,94
R_{17} = 2/3 = 0,67	R_{27} = 2/3 = 0,67	R_{37} = 3,5/4 = 0,88	R_{47} = 17.000/17.000 = 1,00
R_{18} = 2/3 = 0,67	R_{28} = 2/3 = 0,67	R_{38} = 3,5/3,5 = 1,00	R_{48} = 17.000/19.000 = 0,89

From the results of the normalization above, a matrix will be made. The following matrix is the result of the normalization calculation (5);

$$X = \begin{bmatrix} 0{,}67 & 0{,}67 & 1.00 & 0{,}96 \\ 0{,}67 & 0{,}67 & 0{,}95 & 0{,}97 \\ 0{,}67 & 0{,}67 & 0{,}88 & 0.85 \\ 1 & 1 & 0{,}88 & 0{,}89 \\ 1 & 1 & 0{,}88 & 0{,}85 \\ 0{,}67 & 0{,}67 & 0{,}88 & 0{,}94 \\ 0{,}67 & 0{,}67 & 0{,}88 & 1 \\ 0{,}67 & 0{,}67 & 1 & 0{,}89 \end{bmatrix}$$

Then perform weight normalization (table 8)

Table 8. Weight Normalization

Criteria Code	Description	Weight	Normalize
C1	Color	20%	0,2
C2	Flavor	20%	0,2
C3	Saturated Fat	25%	0,25
C4	Price	35%	0,35

3.4 Calculating Qi from Normalization and Weights

The next step is to calculate the Qi value to determine the highest value. the following is the summation of Qi :

$$Q_1 = 0{,}5\left((0{,}2 \times 0{,}67) + (0{,}2 \times 0{,}67) + (0{,}25 \times 1{,}00) + (0{,}35 \times 0{,}96)\right) + 0{,}5(0{,}67^{0{,}2} \times 0{,}67^{0{,}2} \times 1{,}00^{0{,}25} \times 0{,}96^{0{,}35}) = \mathbf{0{,}8469}$$

$$Q_2 = 0{,}5\left((0{,}2 \times 0{,}67) + (0{,}2 \times 0{,}67) + (0{,}25 \times 0{,}95) + (0{,}35 \times 0{,}97)\right) + 0{,}5(0{,}67^{0{,}2} \times 0{,}67^{0{,}2} \times 0{,}95^{0{,}25} \times 0{,}97^{0{,}35}) = \mathbf{0{,}8360}$$

$$Q_3 = 0{,}5\left((0{,}2 \times 0{,}67) + (0{,}2 \times 0{,}67) + (0{,}25 \times 0{,}88) + (0{,}35 \times 0{,}85)\right) + 0{,}5(0{,}67^{0{,}2} \times 0{,}67^{0{,}2} \times 0{,}88^{0{,}25} \times 0{,}85^{0{,}35}) = \mathbf{0{,}7825}$$

$$Q_4 = 0{,}5\left((0{,}2 \times 1{,}00) + (0{,}2 \times 1{,}00) + (0{,}25 \times 0{,}88) + (0{,}35 \times 0{,}89)\right) + 0{,}5(1{,}00^{0{,}2} \times 1{,}00^{0{,}2} \times 0{,}88^{0{,}25} \times 0{,}89^{0{,}35}) = \mathbf{0{,}9236}$$

$$Q_5 = 0{,}5\left((0{,}2 \times 1{,}00) + (0{,}2 \times 1{,}00) + (0{,}25 \times 0{,}88) + (0{,}35 \times 0{,}85)\right) + 0{,}5(1{,}00^{0{,}2} \times 1{,}00^{0{,}2} \times 0{,}88^{0{,}25} \times 0{,}85^{0{,}35}) = \mathbf{0{,}9162}$$

$$Q_6 = 0{,}5\left((0{,}2 \times 0{,}67) + (0{,}2 \times 0{,}67) + (0{,}25 \times 0{,}88) + (0{,}35 \times 0{,}94)\right) + 0{,}5(0{,}67^{0{,}2} \times 0{,}67^{0{,}2} \times 0{,}88^{0{,}25} \times 0{,}94^{0{,}35}) = \mathbf{0{,}8122}$$

$$Q_7 = 0{,}5\left((0{,}2 \times 0{,}67) + (0{,}2 \times 0{,}67) + (0{,}25 \times 0{,}88) + (0{,}35 \times 1{,}00)\right) + 0{,}5(0{,}67^{0{,}2} \times 0{,}67^{0{,}2} \times 0{,}88^{0{,}25} \times 1{,}00^{0{,}35}) = \mathbf{0{,}8315}$$

$$Q_8 = 0{,}5\left((0{,}2 \times 0{,}67) + (0{,}2 \times 0{,}67) + (0{,}25 \times 1{,}00) + (0{,}35 \times 0{,}89)\right) + 0{,}5(0{,}67^{0{,}2} \times 0{,}67^{0{,}2} \times 1{,}00^{0{,}25} \times 0{,}89^{0{,}35}) = \mathbf{0{,}8237}$$

3.5 Ranking of the Highest Qi Value

The last step is to perform ranking based on the highest Qi value.

Table 9. Ranking

Alternative	Description	Qi	Rangking
A1	Sari Murni	0,8469	3
A2	Tawon	0,8386	4
A3	Fortune	0,7825	8
A4	Bimoli	0,9236	1
A5	Sanco	0,9162	2
A6	Rose Brand	0,8122	7
A7	Kuwali	0,8315	5
A8	Tropical	0,8237	6

From table 10 above, it can be seen that alternative A4 with the description Bimoli has the highest Qi value of 0.9162, so it is concluded that alternative A4 or Bimoli was chosen as the best cooking oil among the eight alternatives or other cooking oil brands.

4. CONCLUSION

Based on the results obtained, the following conclusions can be drawn: (1) The decision support system can determine the best cooking oil quickly and easily, (2) The results obtained become more objective so that it is more accurate in determining the best cooking oil, (3) Determination of the weight of the criteria used greatly affects the calculation results of the WASPAS method.

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