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Research paper

Determining basic food quality using SAW

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Abstract

Basic food is an abbreviation of Nine Basic Ingredients, namely: rice/sago/corn, sugar, vegetables/fruits, beef/chicken/fish, milk, eggs, kerosene / LPG, cooking oil, and salt. To determine the quality of Basic food, many people still experience many obstacles, including the difficulty of distinguishing Basic food with good quality and Basic food with poor quality. So there is a need for artificial intelligence that can be used to determine the basic food quality that is suitable for consumption. With the existence of artificial intelligence, it is expected that ordinary people do not wrong to buy Basic food with good quality. This artificial intelligence was made by using the SAW method with the Visual Basic programming language.

Keywords: *Simple Additive Weighting; Basic Food; Quality; Artificial Intelligence.*

1. Introduction

1.1. Background

Basic food refers to the core point of view with an acronym for nine basic ingredients [1 - 3]. Basic foods are needed every day by the community, especially in Indonesia. Basic foods could be viewed into the number of items such as rice, sago, corn, sugar, vegetables, fruits, beef, chicken, fish, milk, eggs, kerosene, LPG, cooking oil, and salt [4 - 6]. However, in determining the quality of basic foods must be meticulous, because nowadays there are many criminals who fake basic foods, such as what happened recently such as plastic rice, fake oil (used oil that has been distilled then mixed with oil) [7 - 9]. To determine the quality of basic food is not easy, it is necessary to make an expert system to determine the quality of good food [10 - 12].

1.2. Problem formulation

From the above description, the following problem can be formulated:

1) How to design artificial intelligence to determine the quality of good food?
2) How to determine the quality of good food using artificial intelligence?

1.3. Research purpose

The purposes of this research were:

1) Make artificial intelligence to determine the quality of basic food.
2) Help ordinary people to determine the quality of basic food that is suitable for consumption.

2. Literature review

2.1. Artificial intelligence

Artificial Intelligence (AI) is the intelligence shown by an artificial entity. System like this is generally considered as computer [13- -15]. Intelligence is created and incorporated into a machine (computer) so that it can do the work that humans can do [16 - 18]. Some kinds of fields that use artificial intelligence include expert systems, computer games, fuzzy logic, artificial neural networks and robotics.

2.2. Quality

According to ISO-8402, Quality is the totality of facilities and characteristics of products or services that meet needs, explicitly or implicitly [19 - 21].
The definition could be viewed into the suitability for use in the sense that can be determined into emphasizing the customer expectations [22 - 24].
The particular concern of quality in tackling the issues of goal to achieve needs to understand the expectations of consumers with their demands and needs based on the current trends [25 - 27]. Every new standard could be enhanced through consuming the particular concern about the certain product referring to the current demand more in getting others [28 - 30]. With newer and

better standards, the point of view with quality refers to enhance the entire process in resulting the cognizance to improve the quality together with the sustainable continuity [31 - 33].

2.4. Basic food

Based on Ministerial Decree No.115 /mpp / kep / 2/1998 dated February 27, 1998, the nine basic foods are: Rice, Sago and Corn, Sugar, Vegetables and Fruits, Beef and Chicken and Fish, Oil and Margarine, Milk, Egg, Kerosene or LPG, Iodized Salt and Sodium salt. The nine basic foods include:

1) Rice, sago, and corn

In Latin, known as oriza, which comes from the Greek, oryza. In France, people call it ris, adopting from Italian riso, in English known as rice.

Indonesian Dictionary, in Bahasa: Kamus Besar Bahasa Indonesia (KBBI), defines the word rice as paddy that has been peeled off (which becomes rice after cooking); and seeds; granules (like corn, coffee).

Although in plant taxonomy, two types of species appear which both refer to rice plants; namely Oryza sativa and Oryza glaberrima [34 - 36]. Oryza Sativa is identified with Asian rice and Oryza Glaberrima is an African rice type such as the one replaced with wheat, or other cereals.

Sago comes from German, Sago and French, Sagou. Sago is a type of food in the form of flour produced from sago tree. Taxonomy, sago trees come from the class of Liliopsida, from the order of Arecales, the family of Arecaceae and the genus of Metroxylon. Sago is indeed a plant that is commonly found in the Asian region. Sago is used as a substitute for rice because it has a high carbohydrate content. In Indonesia, sago is common in Maluku and in the Papua region [37 - 40].

Corn contains Calories, Proteins, Fats, Carbohydrates, Calcium, Phosphorus, Iron, Vitamins and Water; experts generally think that corn comes from Central America or South America.

However, in some regions, various notes reveal that corn has its own history. In the Asian region, for example, corn is said to originate from the Himalayas. In America, corn is thought to originate from the Andean mountains, especially in Ecuador, Peru and Bolivia. There are also those who believe in general, that corn in the world comes from Central America (Mexico region).

2) Sugar

Sugar is a food ingredient produced from sugar cane. Sugar originated in India, which was first discovered in India, which was marked first by the discovery of sugar cane planted by Polynesians and spread to India. Sugar cane plants that produce sugar then spread everywhere after the Arabs attacked Persia in 642 AD. At that time, besides finding sugar cane, they also discovered how sugar was made [41 - 43].

3) Vegetable and fruit

Vegetables are leaves (such as mustard greens), plants (such as bean sprouts), legumes or seeds (eg peas, beans), which can be cooked. Then, vegetables can also be interpreted as a soupy dish (like curry, soup).

4) Beef, chicken, and fish

Beef, chicken and fish have been included as one of 9 basic foods which are daily human needs. In general, meat contains substances needed by the body, including fat, cholesterol, sodium, potassium, carbohydrates, proteins and vitamins.

5) Oil and margarine

Oil is a member of the lipid group, which is a neutral lipid. Oil is a triglyceride which is composed of three units of fatty acids, is liquid at room temperature (25°C) and contains more unsaturated fatty acids so that it is easily oxidized. Cooking oil in a broader sense is oil derived from natural ingredients, both animals and plants used for frying dishes [44 - 46].

From plants, cooking oil is usually produced from coconut, palm oil, corn, soybeans, sunflower seeds and olives and some other plants. While from animal sources, cooking oil is usually processed from sardine fish and whales.

6) Milk

Milk, in derived from the German language, Milch which is a derivative of the Latin mulgere which means to blush or squeeze. Historically, milk has been known since 10000 BC. In Ancient Egypt, milk was only served to the king and his family, religious leaders, and people who were considered rich [47][48]. At that time, milk was produced from sheep and cattle. From the 5th to 14th centuries, milk began to be known in Europe. Some of the nutrients contained in milk include; vitamins, protein, calcium, magnesium, phosphorus, and zinc, fats and minerals.

7) Egg

According to the KBBI, various definitions related to eggs, among others; cell (found in women) who will become a child, if fertilized by sperm, shelled objects that contain the substance of life of future children produced by poultry (chickens, ducks, birds, etc.), are usually eaten (boiled, plucked, omelette, etc.), small objects with shells, (usually in groups) containing prospective children, produced by animals (lizards, crocodiles, turtles, mosquitoes, fleas, etc.), various objects whose shapes (apparently, their nature, etc.) resemble eggs [49 - 50].

8) Kerosene and LPG

Kerosene and LPG both function as fuel. Fuel, is a word derived from Latin Focalia and French foaille. Simply put, fuel can be defined as a certain material used to produce fire. Examples of fuels include oil and coal. Kerosene and LPG are included in that category. Kerosene is one of the fuels used by most Indonesians, especially before 2004.

9) Iodized salt and sodium salt

Salt is used by most of the world's population as a food flavoring; so that food will be more delicious. Salt, tastes salty. A sufficient amount of salt into a dish will make the dish more delicious. Salt contains substances that are useful for the human body. Various kinds of salt include:

a) Iodized salt

Iodine is an essential nutrient for the body because it is a component of thyroxin hormone. Iodized salt is very important to be consumed to prevent goiter. Goiter is a swollen disease of the front neck because of an enlarged gland. Iodized salt consumption helps us to prevent goiter.

b) Sodium salt

Sodium salt (sodium chloride) is also called kitchen salt. Since ancient times, salt is very trusted to preserve food, especially meat or fish. Consuming kitchen salt is also good for our health. However, it is recommended that we keep maintaining the amount of salt intake. Because, if we consume too much, we will have hypertension.

2.5. SAW

It is stated as the weighted addition method [51 - 52]. The basic concept of the SAW method is to find the weighted sum of the performance branches in each alternative on all criteria [53 - 55]. The SAW method requires the decision matrix normalization process (X) to a scale that can be compared with all available alternative branches. The SAW method recognizes two attributes, namely the criteria of benefits and criteria [56 - 58]. The fundamental difference between these two criteria is in the selection of criteria when making a decision.

The following is the formula for the simple additive weighting method (SAW):

$$\mathrm{Rij} = \frac{Xij}{maxi\ (xij)}$$

$$= \frac{Min\ i\ xij}{Xij}$$

If j is the attribute of profit, if j is the attribute of cost

Remarks:

Rij = the value of the normalized performance

Xij = the attribute value that is owned by each criterion

Maxi (xij) = the biggest value of each criterion

Min i xij = the smallest value of each criterion
Benefit = if the biggest value is the best
Cost = if the smallest value is the best

$V_t = \sum W_j R_{ij}$
Remarks:
Vi = ranking for each alternative
Wj = the weight value of each criterion
Ri = normalized performance rating value
The completion steps are:

1) Determine alternative, namely Ci.
2) Determine matching branch of every alternative on every criterion.
3) Give the value of the matching branch of each alternative on each criterion.
4) Determine the weight of preference or level of interest (W) for each criterion. W = [W1, W2, W3, Wj].
5) Make a matching branch table from each alternative on each criterion. Make a decision matrix (X) formed from the matching branch table of each alternative on each criterion. The value of X for each alternative (Ai) for each criterion (Cj) that has been determined, where, i = 1, 2 ... m and j = 1, 2

2.5.1. Advantage of SAW model

The advantage of the Simple Additive Weighting (SAW) model compared to other decision-making models lies in its ability to make judgments more precisely because it is based on the specified criteria and weighting preferences, besides that SAW can also select the best alternative from a number of alternatives, because of the ranking process after determining the weight value for each attribute.

2.5.2. Disadvantage of SAW model

- Must determine the weight of each attribute.
- Must make decision matrix.

2.6. Visual basic 6.0

Visual Basic is a program to make Microsoft windows based applications quickly and easily. Visual Basic provides a tool for creating simple applications for complex applications for personal use or for companies or agencies with larger systems.
Microsoft Visual Basic 6.0 is a very popular Windows-based programming language that is fully supported by other Microsoft programs that make this one programming language.

3. Research method

3.1. System analysis

System analysis in this study would be carried out in several stages, namely manual system analysis, problem analysis and Artificial Intelligence analysis. The following will be explained by each of these analyzes.

3.2. Data flow diagram (DFD)

In the data flow diagram level 1, the user process is used to explain the activity of data flow in diagnostics, the user enters without having to log in or enter the password first. The user immediately selects the user level and press the level button, DFD diagram level 2 diagnostic process consists of 3 processes consisting of users, diagnoses and diagnosis results.

3.3. SAW method calculation

3.3.1. Criteria determination and weighting

In SAW method calculation there are steps that should be performed:

a) Determine each criteria as shown in table 1.

Table 1: Criteria information

Criteria		Information
C1	Price	Basic food price
C2	Brand	Basic food brand
C3	Amount of basic food per package	Amount of basic food per

Furthermore, from each of these criteria the weight will be determined. This weight consists of five SAW numbers, which are very cheap, cheap, sufficient, expensive, very expensive. Table 2 shows Weight of criteria determination.

Table 2: Weight of Criteria Determination

Criteria code	Weight
C1	50%
C2	30%
C3	20%

3.4. Best basic food calculation and selection

Table 3 shows best basic food selection.

Table 3: Best Basic Food Selection

Basic food name	Type/brand	Price (IDR)	Quantity
Rice	Medium Rice	11,000	1 kg
	Pera Rice	13,000	1 kg
	Premium Rice	12,000	1 kg
Cooking Oil	Bimoli	25,000	2 kg
	Fortune	20,000	2 kg
	Sania	19,000	2 kg
Meat	Beef	105,000	1 kg
	Chicken	20,000	1 kg
Egg	Chicken	19,000	1 kg
	Duck	25,000	1 kg
Milk	Bendera Milk	41,000	0.4 kg
	Dancow Milk	44,000	0.4 kg

Give value of each alternative (Ai) on predetermined criteria (Cj).

b) Price value

Table 4: Price Value

Price	Fuzzy Number	Value
8,000 – 11,000	Very cheap	1
12,000 – 19,000	Cheap	0.8
20,000 – 25,000	Sufficient	0.6
26,000 – 41,000	Expensive	0.4
42,000 – 50,000	Very Expensive	0.2

c) Type/brand

In the type/brand value variable consists of five fuzzy numbers, namely famous, medium, not famous as shown in table 5.

Table 5: Type/Brand Value

Fuzzy numbers	Value
Famous	0.6
Medium	0.3
Not famous	0.1

d) Quantity value

In the quantity value variable consists of five fuzzy numbers, namely Very Low, Low, Medium, High, Very High as shown in Table 6.

Table 6: Quantity Value

Quantity	Fuzzy numbers	Value
Price= 0.3-0.5 kg	Very low	1
Price= 1 – 1.5 kg	Low	0.8
Price = 2 – 2.5 kg	Medium	0.6
Price = 3000 - 5,000	High	0.4
Price = 10,000 – > 20,000	Very high	0.2

Medium	Medium	0.6
Many	High	1

Table 7 shows matching rate.

Table 7: Matching Rate

Basic food name	Type/brand	Price (IDR)	Quantity
Rice	0.3	1	0.8
	0.1	0.8	0.8
	0.6	0.8	0.8
Cooking Oil	0.6	0.6	0.6
	0.3	0.6	0.6
	0.1	0.8	0.6
Meat	0.6	0.2	0.8
	0.3	0.6	0.8
Egg	0.6	0.8	0.8
	0.3	0.6	0.8
Milk	0.3	0.4	1
	0.6	0.2	1

From table 8 is changed into the X decision matrix with data:

e) Rice

$$X=\begin{pmatrix} 0.3 & 1 & 0.8 \\ 0.1 & 0.8 & 0.8 \\ 0.6 & 0.8 & 0.8 \end{pmatrix}$$

$$r11 = \frac{0.3}{Max(0.3,0.1,0.6)} = \frac{0.3}{0.6} = 0.5$$
$$r12 = \frac{1}{Max(1,0.8,0.8)} = \frac{1}{1} = 1$$
$$r13 = \frac{0.8}{Max(0.8,0.8,0.8)} = \frac{0.8}{0.8} = 1$$

$$r21 = \frac{0.1}{Max(0.3,0.1,0.6)} = \frac{0.1}{0.6} = 0.16$$
$$r22 = \frac{0.8}{Max(1,0.8,0.8)} = \frac{0.8}{1} = 0.8$$
$$r23 = \frac{0.8}{Max(0.8,0.8,0.8)} = \frac{0.8}{0.8} = 1$$
$$r31 = \frac{0.6}{Max(0.3,0.1,0.6)} = \frac{0.3}{0.6} = 0.5$$
$$r32 = \frac{0.8}{Max(1,0.8,0.8)} = \frac{0.8}{1} = 0.8$$
$$r33 = \frac{0.8}{Max(0.8,0.8,0.8)} = \frac{0.8}{0.8} = 1$$

From the calculation above obtained normalization matrix as follows:

$$R=\begin{pmatrix} 0.5 & 0.16 & 0.5 \\ 1 & 0.8 & 0.8 \\ 1 & 1 & 1 \end{pmatrix}$$

Give values for each of the following criteria:

W1= 50%, W2=30%, W3=20%, W= [0.5, 0.3, 0.2]

Then the results obtained are as follows:

$V_1 = (0.5)(0.8) + (0.3)(0.16) + (0.2)(0.5) = 0.548$

$V_2 = (0.5)(1) + (0.3)(0.8) + (0.2)(0.8) = 0.9$

$V_3 = (0.5)(1) + (0.3)(1) + (0.2)(1) = 1$

From the results above, the V3 value is greater; this indicates that premium rice is of a quality compared to the type of medium rice and pera rice.

f) Cooking oil

$$X=\begin{pmatrix} 0.6 & 0.6 & 0.6 \\ 0.3 & 0.6 & 0.6 \\ 0.1 & 0.8 & 0.6 \end{pmatrix}$$

$$r11 = \frac{0.6}{Max(0.6,0.3,0.1)} = \frac{0.6}{0.6} = 1$$
$$r12 = \frac{0.6}{Max(0.6,0.6,0.8)} = \frac{0.6}{0.8} = 0.75$$
$$r13 = \frac{0.6}{Max(0.6,0.6,0.6)} = \frac{0.6}{0.6} = 1$$
$$r21 = \frac{0.3}{Max(0.6,0.3,0.1)} = \frac{0.3}{0.6} = 0.5$$
$$r22 = \frac{0.6}{Max(0.6,0.6,0.8)} = \frac{0.6}{0.8} = 0.75$$
$$r23 = \frac{0.6}{Max(0.6,0.6,0.6)} = \frac{0.6}{0.6} = 1$$
$$r31 = \frac{0.6}{Max(0.6,0.3,0.1)} = \frac{0.6}{0.6} = 1$$

$$r32 = \frac{0.8}{Max(0.6,0.6,0.8)} = \frac{0.8}{0.8} = 1$$
$$r33 = \frac{0.6}{Max(0.6,0.6,0.6)} = \frac{0.6}{0.6} = 1$$

From the calculation above obtained normalization matrix as follows:

$$R=\begin{pmatrix} 1 & 0.5 & 1 \\ 0.75 & 0.75 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

Give values for each of the following criteria:

W1= 50%, W2=30%, W3=20%, W= [0.5, 0.3, 0.2]

Then the results obtained are as follows:

$V_1 = (0.5)(1) + (0.3)(0.5) + (0.2)(1) = 0.8$

$V_2 = (0.5)(0,75) + (0.3)(0.75) + (0.2)(1) = 0.8$

$V_3 = (0.5)(1) + (0.3)(1) + (0.2)(1) = 1$

From the results above, the V3 value is greater, this indicates that the Sania Oil is of high quality compared to the type of Bimoli oil and Fortune oil.

g) Meat

$$X=\begin{pmatrix} 0.6 & 0.2 & 0.8 \\ 0.3 & 0.6 & 0.8 \end{pmatrix}$$

$$r11 = \frac{0.6}{Max(0.6,0.3)} = \frac{0.6}{0.6} = 1$$
$$r12 = \frac{0.2}{Max(0.2,0.6)} = \frac{0.2}{0.6} = 0.33$$
$$r13 = \frac{0.8}{Max(0.8,0.8)} = \frac{0.2}{0.8} = 0.25$$
$$r21 = \frac{0.3}{Max(0.6,0.3)} = \frac{0.3}{0.6} = 0.5$$
$$r22 = \frac{0.6}{Max(0.2,0.6)} = \frac{0.6}{0.6} = 1$$
$$r23 = \frac{0.8}{Max(0.8,0.8)} = \frac{0.8}{0.8} = 1$$

From the calculation above obtained normalization matrix as follows:

$$R = \begin{pmatrix} 1 & 0.5 \\ 0.33 & 1 \\ 0.25 & 1 \end{pmatrix}$$

Give values for each of the following criteria:

W1=50%, W2=30%, W3=20%,

W= [0.5, 0.3, 0.2]

Then the results obtained are as follows:

$V_1 = (0.5)(1) + (0.3)(0.5) = 0.65$

$V_2 = (0.5)(0.33) + (0.3)(1) = 0.465$

From the results above, it is obtained that the value of V2 is greater, this indicates that beef has better quality than chicken meat.

h) Egg

$$X = \begin{pmatrix} 0.6 & 0.8 & 0.8 \\ 0.3 & 0.6 & 0.8 \end{pmatrix}$$

$$r11 = \frac{0.6}{Max(0.6,0.3)} = \frac{0.6}{0.6} = 1$$
$$r12 = \frac{0.8}{Max(0.8,0.6)} = \frac{0.8}{0.8} = 1$$
$$r13 = \frac{0.8}{Max(0.8,0.8)} = \frac{0.6}{0.8} = 0.75$$
$$r21 = \frac{0.3}{Max(0.6,0.3)} = \frac{0.3}{0.6} = 0.5$$
$$r22 = \frac{0.6}{Max(0.8,0.6)} = \frac{0.6}{0.8} = 0.75$$
$$r23 = \frac{0.8}{Max(0.8,0.8)} = \frac{0.8}{0.8} = 1$$

From the calculation above obtained normalization matrix as follows:

$$R = \begin{matrix} 1 \\ 1 \\ 0.75 \end{matrix} \begin{pmatrix} 0.5 \\ 0.75 \\ 1 \end{pmatrix}$$

Give values for each of the following criteria:

W1= 50%, W2=30%, W3=20%,

W= [0.5, 0.3, 0.2]

Then the results obtained are as follows:

$V_1 = (0.5)(1) + (0.3)(0.5) = 0.65$

$V_2 = (0.5)(1) + (0.3)(0.75) = 0.725$

From the results above it is obtained that the value of V2 is greater this indicates that duck eggs have better quality than broiler eggs.

i) Milk

$$X = \begin{pmatrix} 0.3 & 0.4 & 1 \\ 0.6 & 0.2 & 1 \end{pmatrix}$$

$$r11 = \frac{0.3}{Max(0.3,0.6)} = \frac{0.3}{0.6} = 0.5$$
$$r12 = \frac{0.4}{Max(0.4,0.2)} = \frac{0.4}{0.4} = 1$$
$$r13 = \frac{1}{Max(1,1)} = \frac{1}{1} = 1$$
$$r21 = \frac{0.6}{Max(0.6,0.3)} = \frac{0.6}{0.6} = 1$$
$$r22 = \frac{0.2}{Max(0.4,0.2)} = \frac{0.2}{0.4} = 0.5$$
$$r23 = \frac{1}{Max(1,1)} = \frac{1}{1} = 1$$

From the calculation above obtained normalization matrix as follows:

$$R = \begin{pmatrix} 0.5 & 1 \\ 1 & 0.5 \\ 1 & 1 \end{pmatrix}$$

Give values for each of the following criteria:

W1= 50%, W2=30%, W3=20%,

W= [0.5, 0.3, 0.2]

Then the results obtained are as follows:

$V_1 = (0.5)(1) + (0.3)(1) + (0.2)(1) = 1$

$V_2 = (0.5)(1) + (0.3)(0,5) + (0.2)(1) = 0.85$

From the results above it is obtained that the value of V1 is greater this indicates that the quality of Bendera milk is better than Dancow milk.

4. Implementation

4.1. System main page

Figure 1 shows system main page.

Fig. 1: System Main Page.

4.2. Admin login page

Figure 2 shows admin login page.

Fig. 2: Admin Login Page.

4.3. Basic food quality determination page

Figure 3 shows basic food quality determination page

Fig. 3: Basic Food Quality Determination Page.

5. Conclusion

From the above description can be concluded as follows: 1) Artificial intelligence was made by using the SAW method with the Visual Basic programming language. 2) With the artificial intelligence to determine the quality of Basic food obtained results: Premium rice with a value of 1, Sania oil with a value of 1, beef with the results of 0.65, duck eggs with a value of 0.725 and Bendera powdered milk with a value of 1.

Because in the process of making / planning this artificial intelligence system there are still shortcomings and are still far from perfect. The suggestions for the next development include: 1) always monitor and update data at any time because the price of Basic food is subject to change at any time. 2) In system maintenance, it should be carried out by people who are experts in the information technology field.

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