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Decision Support System Classifying Soybean Quality with Simple Additive Weighting Method

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Abstract

Tempe A-Zaki Padang is one of the developing tempe industries in the city of Padang and wants to maintain the quality and safety of the products it produces. Problems that exist in the current system, such as separating intact soybeans, damaged soybeans, and wrinkled soybeans by sorting/separating them using the manual method will require quite a bit of time, in addition to using the manual method it will also require labor force is quite a lot and the costs incurred are relatively large. To overcome these problems, this study aims to build a decision support system (DSS) by applying the Simple Additive Weighting (SAW) method. The SAW method is a calculation method that is carried out by determining alternatives where each alternative will be assessed based on predetermined criteria and has been given a weight on each criterion assessment. The SAW method will help find the weighted sum of the performance ratings for each alternative on all attributes. This decision support system is web-based using the PHP programming language and MySQL database. The results of this study showed that green soybeans had the highest utility value, namely 0.8525, with these results making it easier for the Tempe A-zaki Padang House to classify quality soybeans.

Keywords : Soybean, Decision Support System, Simple Additive Weighting, Performance Rating, Criteria .

1. Introduction

Soybeans are legumes that have a high protein content . In addition, soybeans are also widely used by the community as a raw material for tofu , tempeh, processed food and other beverages. Soybeans also contain a lot of nutrients, including carbohydrates, calcium, phosphorus, iron, vitamin A, vitamin B1 and vitamin C [1].

Tempe A-Zaki Padang is one of the developing tempe industries in the city of Padang and wants to maintain the quality and safety of the products it produces. Problems that exist in the current system, such as separating intact soybeans, damaged soybeans, and wrinkled soybeans by sorting/separating them using the manual method will require quite a bit of time, in addition to using the manual method it will also require labor force is quite a lot and the costs incurred are relatively large. The same is true for the tempe craftsmen that the author uses as a research site, which as a whole still uses manual methods, such as in the process of selecting quality soybeans.

From these problems, in this study the authors created a decision support system. A decision support system is a system created to solve a problem, because many problems cannot be solved without using certain assistance such as structured and unstructured problems.

The goal of a decision support system that must be achieved is to help managers make decisions, support the manager's judgment rather than try to replace it, increase the effectiveness of manager decision making rather than efficiency [2]. Appropriate decision-making should also be balanced with the speed and accuracy of data collection, data processing and finally at the decision-making stage. Decision support systems specifically focus on features that make them easy for non-computer-savvy people to use in an interactive mode [3].

Decision Support System (SPK) is an information system aimed at being semi-structured in decision making [4]. A decision support system is a system that can interactively make decisions through data users and decision models to solve semi-structured and unstructured problems [5]. A Decision Support System (DSS) is needed to facilitate the assessor's work in deciding on exemplary health workers in an objective, professional and transparent manner. The TOPSIS method gives output results in the form of the ideal solution distance from the criterion [6].

Decision support systems (DSS) are part of a computer-based information system including knowledge-based systems or knowledge management that are used to support decision making in an organization or company. It can also be said to be a computer system that processes data into information to make decisions on specific semi-structured problems [7].

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This decision support system uses the Simple Additive Weighting (SAW) method. The basic concept of the SAW method is to find the weighted sum of the performance ratings for each alternative on all attributes. The SAW method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings [8]. The SAW method is a calculation method that is carried out by determining alternatives where each alternative will be assessed based on predetermined criteria and has been given a weight on each assessment criterion [9].

Previous research on determining the best employees at AMIK Mahaputra Riau was obtained by applying the SAW method with test results using manual calculations and decision support application systems obtained the same results for the same test data. So it was concluded that this system can be used as a helper application for the best employee recommendations, which can rank employees from the highest to the lowest and at the same time print reports on the best employee results [10]

Research conducted by Erikson Marbun and Seng Hansun on decision support systems for selecting study programs using the SAW and AHP methods, in which the research that has been done can be concluded that the 'FTI Recommendation' decision support system has been successfully designed and built using the AHP and SAW methods. This system can be used to carry out the process of recommending study programs at the Faculty of Engineering and Informatics by using eight criteria consisting of three criteria and five sub criteria. The system has been tested by comparing manual calculations with calculations performed by the system with the same results. This study also tested user satisfaction by distributing USE Questionnaires to 35 respondents. Based on the results of the evaluation carried out, the percentage of user satisfaction levels reached 77.22 % , which means it is good [11].

Previous research on After calculating using the SAW and WP method approaches, then measuring and comparing the real data of the questionnaire respondents using the hamming distance technique, in the first experiment showed the same results between SAW and WP, namely 80%. However, in the second experiment where after adding the data of 1 new respondent, the hamming distance measurement results showed slightly different figures, namely 78% for SAW and 80% for WP. From the two events mentioned above, it can be concluded that at the same time it can be interpreted that in general these two methods are relatively equally relevant to be implemented in cases of this type. However, in certain special cases, the SAW method approach is considered relatively more relevant to be implemented in a decision support system for this type of case compared to using the WP method [12]

PHP is an interpreter language that is almost similar to the C language which has simplicity in commands. PHP has become a common scripting language that is widely used among web developers. Having many advantages is the main reason why PHP is preferred as a general basis for creating a web [13]. MySQL is a software / SQL data-based management system software or DBMS which has multi-threaded properties with around six million installations worldwide. In addition, MySQL is also a database access program that is networked so that it can be used for multiuser applications [14].

2. Research methodology

Research methodology is a science that studies ways to make observations with the right thoughts in an integrated way through scientifically arranged stages to search, compile and analyze and conclude data, so that it can be used to find, develop and test the truth of a knowledge, which can be seen in Figure 1 as follows:

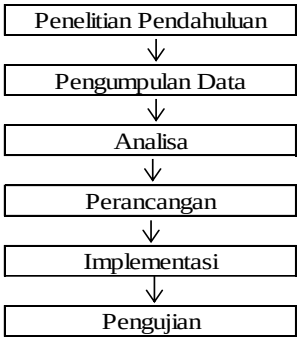

Figure 1. Research Framework

Based on the research framework that has been described previously, it can be described the discussion of each stage in the research as follows:

2.1 Preliminary Research

The research stage is a sequence of processes or steps that will be carried out in completing this research. The stages of this research are as follows:

1. Field Research (Field Research)
   The author conducted field research through interviews with the leadership of Rumah Tempe A-Zaki Padang to classify the quality of soybeans.
2. Library Research (Library Research)
   Library research was conducted to obtain information contained in books, journals, and other literature that was used to support the research being conducted.
3. Laboratory Research (Laboratory Research)
   The research was conducted using a computer device to process the data obtained, processed and created using an existing programming language to produce information in accordance with the existing problems.

2.2 Data collection

In collecting data, the author obtained sales data by conducting field research, namely direct interviews with the leadership of Rumah Tempe A-Zaki Padang. The author obtained some important information related to the research being carried out.

2.3 Analysis

This sub will explain the analysis carried out in this study. The analysis is in the form of:

1. Data Analysis, the data analysis stage is the analysis stage of all data relating to the problems faced.
2. Process Analysis, this analysis is carried out to find out how to solve the problem so that it can produce solutions with the right method. The method used in this study is the SAW method which is a method for obtaining precise and accurate decision results.
3. System analysis, carried out to find out the system design that will be made in the research. System analysis needs to be done so that the system to be created can facilitate users and work quickly, precisely, and effectively. The system will be designed using the PHP programming language and MySQL database .

2.4 Design

The design will use UML as a design model so that it is organized and structured with the design. Some diagrams focus on the robustness of object-oriented theory and some focus on design and construction details. All are intended as a means of communication between the team of programmers and with users.

2.5 Implementation

System implementation is the stage of laying the system so that it is ready to operate. Implementation aims to confirm the design modules, so that users can provide input to information technology management.

2.6 Testing

This stage will test applications created using the PHP programming language and MySql database. This is done in order to find out whether the application can run according to the design that is done.

3. Results and Discussion

Simple Additive Weighting (SAW) method is often also known as the weighted sum method. The basic concept of the SAW method is to find the weighted sum of the performance ratings for each alternative on all attributes

$$benefit \qquad r_{ij} = \frac{X_{ij}}{Max_i X_{ij}} \qquad (1)$$

$$cost \qquad r_{ij} = \frac{Min_i X_{ij}}{X_{ij}} \qquad (2)$$

Where

r_{ij} = normalized performance rating value
$Max_i X_{ij}$= maximum value of row and column
$Min_i X_{ij}$= minimum value of row and column
X_{ij} = standard criterion value in the i-th row, j-th column
Benefit = if the greatest value is the best
Cost = if the smallest value is the best

The preference value for each alternative (V_i) is given as:

$$Vi = \sum_{j=1}^{n} W_j \, r_{ij} \qquad (3)$$

Where:
V_i = final value of the alternative
W_j = predetermined weight
r_{ij} = matrix normalization
n = number of alternatives

larger V_i value indicates that alternative A_i is more selected.

The steps in the process of the SAW method are as follows:

1. Define criteria

The initial step of the Simple Additive Weighting method is to assign a weight value to each criterion for selecting the quality of soybeans. To obtain the criteria for assessing the quality of soybeans, an interview was conducted with the tempe business owner A-Zaki. The criteria are as follows.

Table 1. Criteria Provisions

No	Criteria Weight	Code
1.	Color	C1
2.	Texture	C2
3.	Cost	C3
4.	Aroma	C4
5.	Taste Image	C5

From the table above, it can be seen that this study used 5 criteria that had been determined by the leadership of Tempe A-Zaki. The criteria obtained include color, taste, texture, aroma, and cost

2. Determines the alternative match rating

The values of each criterion are as follows:

a. Color (C1)
The color criteria match rating can be seen in Table 2.

Table 2. Color Table (C1)

No.	Color (C1)	Mark
1.	Very good	100
2.	Good	80
3.	Pretty good	60
4.	Not good	40
5.	Not good	20

b. Texture (C2)
The texture criterion match rating can be seen in Table 3.

Table 3. Texture Table (C2)

No.	Texture (C2)	Mark
1.	Very good	100
2.	Good	80
3.	Pretty good	60
4.	Not good	40
5.	Not good	20

c. Cost (C3)
The cost criteria suitability rating can be seen in Table 4.

Table 4. Cost Table (C3)

No.	Cost (C3)	Mark
1.	Very good	100
2.	Good	80
3.	Pretty good	60
4.	Not good	40
5.	Not good	20

d. Fragrance (C4)
The aroma criteria suitability rating can be seen in Table 5.

Table 5. Aroma Table (C4)

No.	Fragrance (C3)	Mark
1.	Very good	100
2.	Good	80
3.	Pretty good	60
4.	Not good	40
5.	Not good	20

e. Taste Image (C5)
The taste image criteria suitability rating can be seen in Table 6.

Table 6. Taste Image Table (C5)

No.	Taste Image (C5)	Mark
1.	Very good	100
2.	Good	80
3.	Pretty good	60
4.	Not good	40
5.	Not good	20

3. Determine the normalized values and attribute weights
Next determine the weight of each criterion.

Table 7. Table of Normalized Weights

No	Criteria Weight	Weight (Wh)	Normalization
1.	Color	30	0.30
2.	Texture	20	0.20
3.	Cost	10	0.10
4.	Aroma	15	0.15
5.	Taste Image	25	0.25
Total		100	1.00

4. Determine the value of each alternative
Determine the value of each alternative based on the suitability rating of the previous data.

Table 8. Table of Values for Each Alternative

No.	Alternative	CRITERIA				
		C1	C2	C3	C4	C5
1.	Soya bean Yellow	Pretty good	Good	Not good	Good	Not good
2.	Soya bean Black	Good	Not good	Good	Pretty good	Not good
3.	Soya bean Green	Very good	Pretty good	Very good	Pretty good	Good
4.	Soya bean Chocolate	Pretty good	Not good	Pretty good	Good	Not enough Good

5. Determine the decision matrix
The decision matrix is obtained from the value of each alternative that has been matched with the match rating value. The table of the decision matrix can be seen in Table 9.

Table 9. Decision Matrix Table

No.	Alternative	CRITERIA				
		C1	C2	C3	C4	C5
1.	Yellow Soybean	60	80	40	80	40
2.	Black Soybean	80	40	80	60	40
3.	Green Soybeans	100	60	100	60	80
4.	Brown Soybean	60	20	60	80	40
	Min/Max value	100	80	40	80	80

6. Determine the normalized matrix values
The table of the normalized matrix can be seen in Table 10.

Table 10. Normalized Matrix Table

No	Alternative	CRITERIA				
		C1	C2	C3©	C4	C5
1.	Yellow Soybean	$\frac{60}{100} = 0.6$	$\frac{80}{80} = 1$	$\frac{40}{40} = 1$	$\frac{80}{80} = 1$	$\frac{40}{80} = 0.5$
2.	Black Soybean	$\frac{80}{100} = 0.8$	$\frac{\frac{40}{80}}{} = 0.5$	$\frac{40}{80} = 0.5$	$\frac{\frac{60}{80}}{} = 0.75$	$\frac{40}{80} = 0.5$
3.	Soya bean Green	$\frac{100}{100} = 1$	$\frac{\frac{60}{80}}{} = 0.75$	$\frac{\frac{40}{100}}{} = 0.4$	$\frac{\frac{60}{80}}{} = 0.75$	$\frac{80}{80} = 1$
4.	Brown Soybean	$\frac{60}{100} = 0.6$	$\frac{\frac{20}{80}}{} = 0.25$	$\frac{\frac{40}{60}}{} = 0.67$	$\frac{80}{80} = 1$	$\frac{40}{80} = 0.5$

7. Calculating the matrix by adding up the criteria matrix for each alternative.

The table of the normalized matrix can be seen in Table 11.

Normalization:
W1=0.30, W2=0.20, W3=0.10, W4=0.15, W5=0.25

Table 11. Matrix

CRITERIA					Results
C1	C2	C3	C4	C5	
0.6	1	1	1	0.5	C1 = (0.30 × 0.6) + (0.20 × 1) + (0.10 × 1) + (0.15 × 1) + (0.25 × 0.5) =0.755
0.8	0.5	0.5	0.75	0.5	C2 = (0.30 × 0.8) + (0.20 × 0.5) + (0.10 × 0.5) + (0.15 × 0.75) + (0.25 × 0.5) =0.6275
1	0.75	0.4	0.75	1	C3 = (0.30 × 1) + (0.20 × 0.75) + (0.10 × 0.4) + (0.15 × 0.75) + (0.25 × 1) =0.8525
0.6	0.25	0.67	1	0.5	C4 = (0.30 × 0.6) + (0.20 × 0.25) + (0.10 × 0.67) + (0.15 × 1) + (0.25 × 0.5) =0.572

8. Ranking Results

Based on the case above, namely in classifying the quality of soybeans that have the highest overall *utility value* , namely Green Soybeans . Can be seen in Table 12.

Table 12. Ranking Results

Alternative	The final result
Green Soybeans	0.8525
Yellow Soybean	0.755
Black Soybean	0.6275
Brown Soybean	0.572

From Table 12 above it can be seen that the one with the highest utility value is Green Soybean with a value of 0.8525. So it can be concluded that green soybeans are the best quality soybeans for making Tempe A-Zaki Padang.

In conclusion

In the discussion that has been described, the authors put forward several conclusions in response to the problem. With the existence of a classification information system in classifying the quality of soybeans, it can provide convenience to the Tempe A-Zaki House in the process of evaluating it in an efficient time, can minimize errors and can increase profits at the Tempe A-Zaki Padang House. Using the SAW method in making applications can help in determining what criteria are needed and so that it can be used as a reference in the selection process and with a system with the SAW method it can be processed quickly and accurately, and decision data can be stored properly and safely .

References

[1] Prawiro, JHH (2019). Application of the TOPSIS (Technique For Others Reference By Similarity To Ideal Solution) Method in the Soybean Selection System at the Research Institute for Various Nuts and Tubers (BALITKABI). JATI (Journal of Informatics Engineering Students), 3(1), 136-143.

[2] Andreswari, D., Winanda, H., & Utama, FP (2021). Decision Support System for Student Creativity Program Proposal Selection Using the Web-Based Topsis Method (Case Study: Bengkulu University). Pseudocode, 8(2), 153-160. https://doi.org/10.33369/pseudocode.8.2.153-160

[3] Putra, A., Achmadi, S., & Mahmudi, A. (2022). Decision Support System Using the Simple Additive Weighting (SAW) Method in Selecting Web-Based State-Owned Enterprises (BUMN) Shares. JATI (Journal of Informatics Engineering Students), 6(1), 301-308. https://doi.org/10.36040/jati.v6i1.4609

[4] Ikhlas, M., & Jafnihirda, L. (2021). Decision Support System, MFEP, UMKM, UML. 7(2), 240–253. https://doi.org/http://dx.doi.org/10.31154/cogito.v7i2.318.240-253 .

[5] Nengsih, NSW, Sari, DP, & Ramadhanu, A. (2019). EMPLOYEE PERFORMANCE ANALYSIS BASED ON COMMUNICATION, WORK STRESS, WORK CONFLICT PT. WEST Sumatra ANDALAS KENCANA POM MUARA TIMPEH, DHARMASRAYA DISTRICT. 2(1), 10–21. https://doi.org/https://doi.org/10.47233/jteksis.v1i1.24 .

[6] Pratiwi, M., & Marta, W. (2018). Application of the Customer Relationship Management Concept in Building Catering Branding in Padang City. KOMIK (National Conference on Computer and Information Technology), 2(1), 78–86. https://doi.org/10.30865/komik.v2i1.912

[7] Fauzan, R., Indrasary, Y., & Muthia, N. (2017). Decision Support System for Admission of Bidik Misi Scholarships at POLIBAN with the Web-Based SAW Method. Informatics Online Journal, 2(2), 79-83. https://doi.org/10.15575/join.v2i2.101

[8] Widyassari, AP (2022). Comparison of the SAW and TOPSIS Methods in the Selection of Fast Food Restaurant Locations in Cepu. JIIFKOM (Scientific Journal of Informatics and Computers), 1(1), 22-29.

[9] Rusliyawati, R., Damayanti, D., & Prawira, SN (2020). Implementation of the Saw Method in the Decision Support System for the Selection of the Social Customer Relationship Management Model. Edutic Scientific Journal: Education and Informatics, 7(1), 12-19. https://doi.org/10.21107/edutic.v7i1.8571

[10] Simatupang, J. (2018). The decision support system for determining the best employees uses the Amik Mahaputra Riau case study method. Journal of Intra Tech, 2(1), 73-82. https://doi.org/10.37030/jit.v2i1.27

[11] Marbun, E., & Hansun, S. (2019). Decision Support System for Selection of Study Programs Using the Saw and Ahp Methods. ILKOM Scientific Journal, 11(3), 175-183. https://doi.org/10.33096/ilkom.v11i3.432.175-183

[12] Kusumantara, PM, Kustyani, M., & Ayu, T. (2019). Comparative Analysis of SAW and WP Methods in Decision Support Systems for Choosing Wedding Organizers in Surabaya. Teknika: Engineering and Science Journal, 3(1), 19-24. http://dx.doi.org/10.51804/tesj.v3i1.396.19-24

[13] Mardison, SD Rizki, LN Rani, A. Ramadhanu, and R. Witri, "(Implementation of the Electre (Elimination Et Choix Traduisan La Realite) Method in a Healthy Food Menu Decision Support System for Toddlers in the Sasak Area Health Center Pasisie Using the Php And Database Mysql Programming Language)," J. KomtekInfo, vol. 7, no. 1, pp. 15–21, 2020, https://doi.org/10.35134/komtekinfo.v7i1.61 .

[14] J. Janitra, S. Information, A. Prasetyo, L. Suvi, MI Ramadhan, and C. Mei, "Web-Based Sales Information System at Mazidah Collection Web-Based Sales Information System at Mazidah Collection," vol. 2, no. 1, pp. 43–52, 2022, https://doi.org/10.25008/janitra.v2i1.146 .