SIMPLE ADDITIVE WEIGHTING METHOD IN CAKE SHOP SELECTION DECISION SUPPORT SYSTEM

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Abstract – *The process of selecting a cake shop for campus events can be challenging due to the variety of options available, each with differing prices, quality, and services. To address this issue, a Decision Support System (DSS) was developed using the Simple Additive Weighting (SAW) method, aimed at assisting event organizers in choosing the most suitable cake shop. This research applies SAW to evaluate five alternatives based on key criteria: service, taste, texture, price, and location. Data was collected through observations, expert interviews, and literature studies. Each criterion was weighted based on expert judgment, and a web-based application was built using PHP and MySQL to process and rank the alternatives. The results show that the system successfully identifies the best option, with "Chiquita" ranked as the top recommendation. This DSS model proves effective in supporting decision-making processes and offers an objective, user-friendly tool for optimizing event planning quality.*

Keywords: *Cake Shop, Decision Support System, Event Planning, Ranking, SAW*

I. INTRODUCTION

One of the most fundamental human activities in daily life is making decisions. In the business world, this process is very important for making decisions about things like choosing suppliers, controlling inventory, developing new products, and investments (Guritno et al., 2017). One of the things that are influenced is the process of making decisions, especially when it comes to choosing which items or services to offer. A Decision Support System is an information system that helps people in an organization make decisions by giving them interactive support at every step of the process. (Usanto et al., 2022).

In the campus environment, activities such as seminars, workshops, or other events often require the provision of refreshments as one of the important factors supporting the success of the event. One form of catering that is often provided is cake, which is not only served as a snack but also as a form of appreciation or symbolism of an event(Lupton, 1994). One aspect that cannot be overlooked in event planning is the selection of food providers, especially for events that involve cake consumption. Cake shops are one of the options frequently considered by campus event committees. Choosing the right cake shop is a crucial stage in planning an event that requires serious attention(Richards et al., 2022). Selecting the right cake shop is important because it relates to quality, variety, price, and the satisfaction of event participants.

In this context, the development of a Decision Support System (DSS) can be an effective solution. DSS can assist the event committee in selecting the bakery that best meets their event needs. Among the methods that have been used to select a bakery, the SMART Method has become one of the popular approaches used in DSS to facilitate decision-making by calculating the total score for each alternative based on predetermined criteria. The SMART Method is quite effective for selecting a bakery. **(Larasati et al., 2020).** In addition to the SMART method, previous researchers have extensively attempted to develop decision support systems (DSS) in the selection of cake shops or

restaurants, including the use of the Fuzzy AHP method (Nisa, 2022), MOORA (Hafizah et al., 2020), TOPSIS (Hutagalung et al., 2021b), and SAW (Savitri et al., 2022). This research uses the SAW method because the SAW method is the most popular and widely used method for multi-criteria MADM decision-making and is the best alternative (Tzeng & Huang, 2011). The SAW method as a simple weighting method or weighted sum in solving problems within a decision support system (Savitri et al., 2022).

This study aims to develop a web-based Decision Support System (DSS) that implements the Simple Additive Weighting (SAW) method to assist campus event organizers in selecting the most suitable cake shop. Unlike previous studies that focused solely on mathematical implementation, this research emphasizes both technical development and practical application. The system is designed to objectively assess multiple alternatives using expert-defined crisp values across five criteria: service, taste, texture, price, and location. The novelty of this study lies in combining expert weight judgment with a user-friendly web platform, ensuring that decision-making is transparent, systematic, and replicable in real-world event planning scenarios.

II. LITERATURE REVIEW

In recent years, decision support systems have become increasingly valuable in the food and bakery industry, especially for improving production planning, product quality, and helping consumers make better choices. Various studies have explored different methods to address these needs, ranging from fuzzy logic to multi-criteria decision-making (MCDM) techniques each offering practical benefits in real-world settings.

Guritno (Guritno et al., 2017) focused on how to better manage bakery production by using the Fuzzy Mamdani method. The study developed a prediction system for the total number of bakery and cake products to be made, helping businesses avoid under- or over-production. What makes this approach stand out is its ability to deal with uncertainty in customer demand something that's very common in food production. By making sense of vague or fluctuating data, this fuzzy system helps bakery owners make smarter inventory decisions. Moving on to quality control, (Hafizah et al., 2020) introduced the MOORA method in the context of flight catering services. They aimed to find the best quality cakes by evaluating multiple factors at once. The MOORA approach helped them rank different cake options more objectively, which is crucial in a competitive industry where maintaining high quality can directly impact customer satisfaction.

(Savitri et al., 2022) took a slightly different path by developing a decision support system using the Simple Additive Weighting (SAW) algorithm. Their system was designed to assist bakeries in selecting the highest-quality bread products. By assigning weights to different criteria like texture and taste, the system could highlight which bread options were the best. This makes it easier for bakery owners to maintain consistent quality and for customers to get a better product.

Finally, in a broader context, (Hutagalung et al., 2021) applied the TOPSIS method to help people choose the best restaurant in Bandung. Rather than focusing only on food, this study included various aspects such as service, location, and ambiance. The strength of TOPSIS lies in its ability to compare multiple options and rank them based on how close they are to an "ideal" choice. This is particularly helpful in urban settings where consumers are faced with too many dining options.

In summary, all these studies show how powerful and versatile decision-making methods can be when applied thoughtfully in the culinary world. Whether it's predicting how much cake to bake, identifying the tastiest bread, or helping people find the best place to eat, each approach brings its own value. Together, they demonstrate how technology can support better decision-making for both businesses and consumers in the food industry.

III. METHODS

This research uses the research and development (R&D) method. The stages in this method will serve as a reference in the implementation of the research. These stages include system design, system development, implementation of the methods used into the system, until the system can be used as a

good decision support system (Sufaidah & Alfirdaus, 2024). Data collection was carried out to obtain information and data related to this research. The data collection method involved observation and direct interviews with experts and the event committee handling campus activity consumption.

1. Research Steps

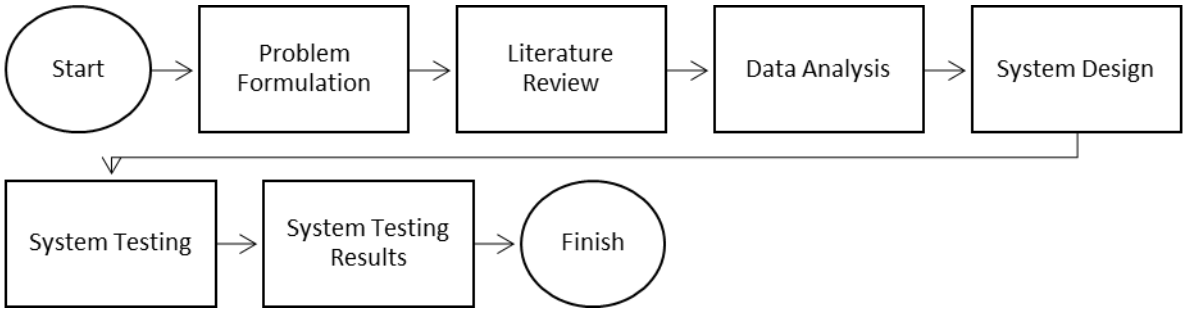

Figure 1. Research Steps

Formulation is the most important stage in research, serving as the cause for the research activities to exist and be carried out, as well as determining the type and sample to be studied. Library research was conducted by studying, investigating, and reading journals, books, internet information, and theses related to the research problem, which discusses the decision support system using the SAW method. Conducted to analyze whether the data used is in accordance with the data needed by the author to conduct the research. After the data is analyzed and suitable data is obtained, the data is then processed to obtain more accurate data that is closer to the research topic. Conducted to design a web-based system to run the program to be created, namely a web-based Decision Support System. In conducting tests on the system that has been created to prove the accuracy of the developed system. To determine the results of the vendor selection decision system for the bakery. To see if the trials conducted can run to meet the solution created by the author. Can the system assist the relevant parties in making decisions accurate?

The data analysis technique used is the quantitative analysis technique. The quantitative data analysis technique is used to conduct research related to numerical data. This type of method requires a large amount of numerical data and can be calculated using statistical formulas (Sugiyono, 2021). This technique is used to determine the values needed in the SAW method.

2. SAW Methods

Churchman and Ackoff were the first to apply the SAW method to portfolio selection issues (1954). The SAW approach has emerged as the most well-liked and extensively utilized technique for MADM decision-making because of its ease of use. Furthermore, SAW is the best substitute and has emerged as the most widely used approach for MADM problems (Tzeng & Huang, 2011). To apply the SAW method, each qualitative criterion—such as "Good" or "Very Cheap"—was converted into a numerical crisp value between 25 and 100 based on expert input. Two domain experts evaluated the importance of each criterion, and their weights were combined using an averaging method to ensure fairness and reduce bias. The criteria were classified into benefit attributes (service, taste, texture) and cost attributes (price, location). A decision matrix was created from the alternatives, followed by normalization using maximum values for benefit criteria and minimum values for cost criteria. The final score for each alternative was computed by multiplying the normalized values with the respective criterion weights and summing the results to determine the ranking. The formula for performing the normalization is as follows:

$$rij = \begin{cases} \frac{X_{ij}}{Max_{X_{ij}}} & \text{If J is the profit (cost) attribute} \\ \frac{Min_{X_{ij}}}{X_{ij}} & \text{If J is the cost attribute} \end{cases} \quad (1)$$

Explanation:
Rij = normalized performance rating value
Xij = attribute value possessed from each criterion
MaxXij = highest value from each criterion
MinXij = lowest value from each criterion

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

$$V_i = \sum_{j=1}^{n} W_j R_{ij} \quad (2)$$

Explanation:
Vi = ranking for each alternative
Wj = weight value of each criterion
Rij = normalized performance rating value
A larger Vi value indicates that alternative Ai is more preferred.
The steps in using the Simple Additive Weighting method are as follows:

1. Determine the criteria to be used as a reference in decision-making, namely Ci.
2. Assign weight values to each criterion as W.
3. Provide suitability rating values for each alternative on each criterion.
4. Create a decision matrix based on the criteria (Ci), then normalize the matrix based on equations adjusted to the type of attribute (benefit attribute or cost attribute) to obtain the normalized matrix R.

IV. RESULTS AND DISCUSSION

In the Simple Additive Weighting (SAW) method, the criteria used refer to (Normah et al., 2022). The evaluation criteria are divided into two categories: benefit and cost. Benefit criteria are those for which higher values indicate better evaluation results. Examples of benefit criteria in selecting a bakery include service, taste, and texture, as higher values in these criteria indicate better quality. Conversely, cost criteria are those for which lower values indicate better evaluation results. Examples of cost criteria in selecting a bakery include price and possibly location if distance or travel costs are a negative consideration. The lower the value in the cost criteria, the better the evaluation results. Overall, the benefit and cost criteria are in opposite directions. In the evaluation system using the SAW method, the goal is to maximize the value on the benefit criteria and minimize the value on the cost criteria. Thus, the system can provide the best decision that meets consumer needs.

Table 1. Criteria

No	Code	Criteria	Attribute
1.	C1	Service	Benefit
2.	C2	Taste	Benefit
3.	C3	Texture	Benefit
4.	C4	Price	Cost
5.	C5	Location	Cost

Alternatives are objects or lists that will be selected and evaluated. In the selection of bakery vendors, the alternatives consist of various bakeries available for consumers to consider. Each bakery will be evaluated based on predetermined criteria, where each bakery alternative will be scored according to

these criteria. These scores will then be accumulated to determine the bakery that best meets the needs and preferences of consumers.

Table 2. Alternative

No	Code	Alternative
1.	A01	Le Gourmet
2.	A02	Chiquita
3.	A03	Bu Henny Snack
4.	A04	Amanda
5.	A05	Holland Bakery

At Table 3 presents the qualitative criteria values used in evaluating cake shops through the SAW (Simple Additive Weighting) method. It lists five main criteria, coded as C1 through C5, each associated with descriptive rating levels and corresponding numerical weights. Criterion C1 represents taste quality, with levels ranging from "Bad" (25) to "Very Good" (100). Criterion C2 refers to the deliciousness of the cake, evaluated from "Not Delicious" (25) to "Very Delicious" (100). Criterion C3 assesses softness, with weights assigned from "Not Soft" (25) to "Very Soft" (100). Criterion C4 evaluates pricing, where "Very Cheap" receives the highest weight (100), and "Expensive" the lowest (25). Lastly, Criterion C5 measures the distance of the cake shop, where "Very Close" is most preferred (100), and "Far" the least (25). These weighted values serve as the foundation for calculating total scores, which are used to rank the cake shop alternatives.

Table 3. Crips Value

No	Criteria Code	Nama Nilai Crips	Weight
1	C1	Bad	25
2	C1	Quite Good	50
3	C1	Good	75
4	C1	Very Good	100
5	C2	Not Delicious	25
6	C2	Quite Delicious	50
7	C2	Delicious	75
8	C2	Very Delicious	100
9	C3	Not Soft	25
10	C3	Quite Soft	50
11	C3	Soft	75
12	C3	Very Soft	100
13	C4	Expensive	25
14	C4	Quite Cheap	50
15	C4	Cheap	75
16	C4	Very Cheap	100
17	C5	Far	25
18	C5	Medium Distance	50
19	C5	Near	75
20	C5	Very Close	100

The alternative values record the value of each alternative based on all the predetermined criteria data. The alternative values reflect how each bakery meets each criterion. Each alternative value is calculated by weighting each criterion, which is then summed to obtain a total score for each alternative. This total score is used to determine the order or ranking of the cake shops. Can see at Table 4.

Table 4. Alternative Value

Code	Alternative	Service	Taste	Texture	Price	Location
A01	Le Gourmet	Good	Delicious	Soft	Expensive	Medium Distance
A02	Chiquita	Good	Delicious	Soft	Expensive	Far
A03	Bu Henny Snack	Very Good	Very Delicious	Soft	Expensive	Very Close

A04	Amanda	Good	Delicious	Soft	Quite Cheap	Medium Distance
A05	Holland Bakery	Good	Delicious	Soft	Quite Cheap	Medium Distance

Next, an analysis of the types of criteria is conducted to determine the weight value for each criterion (Wi), with the total weight amounting to 1 (∑Wi = 1), ensuring that each criterion has a proportional contribution to the final assessment it show at Table 5. The following is an explanation of the criteria weighting table from two experts and the combined criteria weighting table.

Table 5. Alternative Value from Experts

Weight	Service	Taste	Texture	Price	Location	Total
Expert 1 (Mr. Riza)	15	50	5	15	15	100
Expert 2 (Mrs. Mulya)	10	50	15	20	5	100
Bobot Gabungan	12.5	50	10	17.5	10	100

Then, the alternative values at Table 4 were adjusted according to the weights on the predetermined crisp data.

Table 6. Determination of Alternative Values with Crisp Values

Code	Alternative	Service	Taste	Texture	Price	Location
A01	Le Gourmet	75	75	75	25	50
A02	Chiquita	75	75	75	25	25
A03	Bu Henny Snack	100	100	75	75	100
A04	Amanda	75	75	75	75	50
A05	Holland Bakery	75	75	75	50	50

After each alternative is evaluated, it is followed by the calculation stage using the SAW method formula. Continued with the normalization calculation. The normalization stage is the process of dividing the criteria; if the criterion type is a benefit, it is divided by the largest attribute value, and if the criterion type is a cost, it is divided by the smallest attribute value. The purpose of the normalization stage in the Simple Additive Weighting (SAW) method is to convert the criterion values into a form that can be directly compared.

Table 7. Normalization Stage Results

Code	Alternative	Service	Taste	Texture	Price	Location
A01	Le Gourmet	0.75	0.75	1	1	1
A02	Chiquita	0.75	0.75	1	1	0.5
A03	Bu Henny Snack	1	1	1	0.3	0.25
A04	Amanda	0.75	0.75	1	0.3	0.5
A05	Holland Bakery	0.75	0.75	1	0.5	0.5

The final stage of the ranking process in the Simple Additive Weighting (SAW) method is to calculate the total value (V) for each alternative. The data that has been normalized in table 6 is then multiplied by the corresponding criterion weights, and the results are summed up. This is done for each criterion on each alternative. The final result of this calculation is the total value for each alternative, which reflects the value held by that alternative based on the predetermined criterion weights.

Table 8. Ranking Results

Alternative	Result	Rank
Chiquita	0.84375	1
Bu Henny Snack	0.80250	2
Le Gourmet	0.79375	3
Holland Bakery	0.70625	4
Amanda	0.67125	5

Based on the ranking calculation results using the formula, Chiquita Bakery received the highest score of 0.84375 and can be the first choice if you want to buy cakes for the Perbanas Institute Student Event. Meanwhile, Amanda received the lowest score of 0.67125. The next stage involves the design of the Decision Support System (DSS). The system being built can be seen in the use case diagram. This diagram divides the system into two main actors, namely the admin and the user. Each actor has different access capabilities to the pages within the system.

The final stage is testing or program testing. In this testing, the Black Box Testing method is used. Black box testing, also known as Behavioral Testing, is a testing method conducted to observe the input and output results of the software without knowing the software's code structure. This testing is carried out at the end of the software development process to determine whether the software functions properly. Testing with this method can be done by anyone. Here are the test results on the decision support system in determining the Bakery Vendor.

Table 9. Black-Box Testing Results

Input	Output	Testing Results	Conclusion
Click Select Cake Shop Vendor	Go to the main page	Successfully went to the main page of the application	Success
Click Alternative Value	Go to alternative values page	Successfully navigated to the alternative values page	Success
Click Change Alternative Value	Fill in the alternative weight values	Successfully fill the criteria for each alternative with the specified crisp value.	Success
Click Calculation	Go to the calculation page	Successfully navigated to the calculation page and displayed the calculation results along with ranking based on criteria, crisp value, and existing alternatives.	Success
Click on the cake shop	Go to the cake shop information page	Successfully accessed the Cake Shop information page to get the cake shop information needed when you want to fill in the alternative weight value.	Success
Click the Print Button	Go to print page preview	Successfully navigated to the preview of the data you want to print.	Success

Based on the test results that have been conducted, the application runs well and successfully performs the calculations using the Simple Additive Weighting (SAW) method based on the criteria, crisp values, and existing alternatives, along with the ranking results. Based on the test results that have been conducted, the application runs well and successfully performs calculations using the Simple Additive Weighting (SAW) method based on the criteria, crisp values, and existing alternatives, along with the ranking results. The SAW-based evaluation revealed that Chiquita scored highest among all alternatives, supported by strong performance in taste, service, and proximity. Although Bu Henny Snack outperformed others in texture and location, its higher price lowered its overall score. This indicates how SAW effectively balances multiple attributes and reflects real-world trade-offs in decision-making. Furthermore, the use of crisp values simplifies qualitative assessments while preserving expert reasoning. However, a limitation of this approach is the subjectivity involved in determining weight and value scales. These results demonstrate that a properly designed DSS can significantly enhance decision quality and reduce bias in vendor selection for event planning.

V. CONCLUSION

The Simple Additive Weighting (SAW) method has proven effective in helping the campus event committee select a suitable bakery based on established criteria such as service, taste, texture, price, and location. Decision Support System (DSS) provides optimal and efficient solutions for selecting a bakery, reducing subjectivity and increasing objectivity in the decision-making process. This research emphasizes the importance of selecting the right criteria in Decision Support Systems (DSS) to achieve the desired outcomes in choosing a bakery. The use of technology and databases in DSS enhances the ease and speed of decision-making. Location and price play a significant role in the final decision, highlighting the importance of considering cost and accessibility aspects in the selection of a bakery.

The implementation of the SAW method within a web-based Decision Support System (DSS) has proven to be effective in assisting event committees in selecting suitable cake shop vendors based on well-defined criteria. By incorporating expert-weighted crisp values, the system supports objective, consistent, and efficient decision-making. The results show that Chiquita is the top-ranked alternative, emphasizing the method's ability to balance quality and cost attributes. Despite its effectiveness, the study acknowledges limitations such as expert subjectivity and a limited number of alternatives. Future research should consider expanding the range of criteria, integrating user preferences dynamically, and applying hybrid MCDM methods to enhance accuracy and adaptability in broader contexts.

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