React-Based Static Website Development for Decision Support System Using ROC and SAW: A Case Study on Hedonic Preferences of Chicken Meatballs

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Abstract – This study presents the development of Qbico (*Q-昆古*), a React-based static website decision support system (DSS) integrating the Rank Order Centroid (ROC) method for attribute weighting and the Simple Additive Weighting (SAW) method for alternative ranking. Unlike previous web-based DSS implementations that rely on server-side architectures, Qbico operates entirely on the client-side via React CDN, making it lightweight and freely deployable via GitHub Pages without a dedicated server. The system was evaluated using a case study involving hedonic preference data from four chicken meatball formulations assessed by 18 trained panelists across three attributes: taste, texture, and saltiness level. One-Way ANOVA confirmed statistically significant differences among formulations for all three attributes ($p \leq 0.05$). ROC weighting based on expert-determined priority order of taste > texture > saltiness level yielded weights of 0.611, 0.278, and 0.111, respectively. SAW computation produced a final ranking of YA > YB > XA > XB, with formulation YA identified as the best alternative, consistent with manual calculations in Microsoft Excel. Black-box testing across 17 test cases confirmed full functional correctness, and System Usability Scale (SUS) evaluation from 18 respondents yielded an average score of 90.4, corresponding to grade A+ "Best Imaginable," demonstrating excellent usability and user acceptance. Future development may extend Qbico to support additional MADM methods and incorporate data export functionality to broaden its applicability in agroindustrial decision-making.

Keywords: react, decision support system, rank order centroid, simple additive weighting, hedonic.

I. INTRODUCTION

Decision-making is a process carried out by individuals or groups (such as organizations, companies, or institutions) to determine the best choice from a number of available alternatives. Essentially, the decision-making process aims to resolve problems at hand while achieving the goals set by the individual or group. In practice, decision-making is performed by experts using various methods, ranging from simple to highly complex. In general, the stages of the decision-making process include: understanding the problem, formulating the problem, developing alternative solutions, gathering and tracing information related to those alternatives, selecting the alternative closest to the solution, making the decision, and implementing the chosen decision. Decision-making is a continuous activity that takes place as long as the individual or group exists. Therefore, the quality of decisions produced will greatly determine the direction and success of the individual or organization; correct decisions lead to better goal achievement, and vice versa [1][2].

Along with technological developments, the approach to decision-making has shifted from intuition- and experience-based approaches toward more rational and data-driven approaches, resulting in smarter, more accurate, and more effective decisions [3]. One such approach is the use of Multiple Attribute Decision-Making (MADM), which is an approach to decision-making by evaluating a limited number of alternatives based on attributes that are compared against each other and involve trade-off considerations in determining the best choice [4]. Within the MADM framework, there are various methods that can be used to support the decision-making process, each with different characteristics, advantages, and limitations. The choice of the appropriate method depends greatly on the complexity of the problem, the type of data used, and the objectives of the decision-making itself.

One of the earliest methods used to solve MADM problems is Simple Additive Weighting (SAW), which had been used by previous studies, including those conducted by the authors [5][6]. Other research by Mujiastuti et al. [7] used the SAW method in employee performance assessment decision-making. Hapid et al. [8] implemented the SAW method for decision-making in the selection of production material suppliers. Aziz and Purnomo [9] also applied SAW for determining rewards for partners of PT. Telkom Akses. The implementation of the SAW method across various studies is inseparable from its advantages: ease of implementation and flexibility in determining attributes and weights [10], with the ability to be easily explained to stakeholders when transparency in the recommendations is required.

In order to determine the weights in decision-making using the Simple Additive Weighting (SAW) method, it is necessary to determine the level of importance of each attribute used. These weights play a role in determining the extent to which each attribute influences the final decision outcome. One method that can be used to determine attribute weights is the Rank Order Centroid (ROC) method. Utami et al. [11] used the combination of ROC and SAW methods for decision-making in the selection of car leasing services. Saputra [12] applied the ROC and SAW combination to determine the location of bee hives (stup) at a Trigona honey-producing bee farm.

The application of the ROC and SAW method combination in decision-making for food products has also been conducted in previous studies. Sariati et al. [5] used the combination of ROC and SAW methods in hedonic decision-making for rosella-lemongrass-stevia herbal tea brewing results, while Pratama et al. [6] applied it to the determination of sensory (hedonic) preferences for green tea extract. However, the decision-making activity was still performed manually using Microsoft Excel, which limits its flexibility, scalability, and efficiency, particularly when dealing with multi-criteria evaluation, repeated assessments, and multiple users.

This limitation indicates the need for a more efficient implementation through a web-based Decision Support System (DSS). It is designed as a general-purpose system to support decision-making in various contexts. In this study, the DSS is specifically applied as a case study in food technology research, where it is used to support structured decision-making processes within that domain. A DSS enables the integration of structured decision-making methods such as ROC and SAW into a centralized and interactive platform, allowing users to perform the entire decision-making process—from inputting evaluation data, generating attribute weights, to producing final rankings—directly through a web browser. Compared to spreadsheet-based approaches, a web-based DSS improves accessibility, reduces manual processing errors, supports real-time interaction, and provides a more consistent decision workflow. Therefore, this study aims to develop a web-based decision support system (DSS) by integrating the ROC and SAW methods, so that users (decision-makers in agro-industry and general public) can carry out the entire process of decision-making.

Web-based decision support systems (DSS) have previously been developed by Dharma et al. [13] using the PHP programming language and the CodeIgniter framework with a MySQL database using the MARCOS method. Aldi W. [14] used the PHP programming language and a MySQL database to build a web-based DSS with the AHP method. Ermawati [15] built a web-based decision support system with the SAW method using PHP, the Laravel framework, and a MySQL database. All three systems are built on PHP-based server-side rendering architectures that require active server infrastructure and a database to operate, making their deployment and maintenance relatively more complex and dependent on server availability. Moreover, each user request generally triggers a full page reload, which can reduce interface responsiveness. Therefore, this study develops the decision support system as a React-based static web application that runs entirely on the client-side without requiring a back-end server or database, making it easier and free to deploy via GitHub Pages, lighter to access, and capable of delivering a more interactive and responsive interface experience for users. To assess the performance of the system built, this study uses a case study involving hedonic data from an agricultural processed product in the form of chicken meatballs.

II. LITERATURE REVIEW

The ROC method assigns weight values to each attribute based on its order of importance. The ranking is determined according to the priorities set by the decision-maker — for example, the first attribute is considered more important than the second, the second more important than the third, and so on up to the n-th attribute. This priority order is then used as the basis for calculating the weight of each attribute. The combination of ROC and SAW methods has been applied in many previous studies. The mathematical equation for the ROC calculation is as follows:

$$Wn = \frac{1}{k}\sum_{\mathrm{i=n}}^{k}\left(\frac{1}{i}\right) \tag{1}$$

where W_n denotes the weight of the attribute at priority rank n, k represents the total number of attributes, and i indicates the priority level of each attribute as previously ordered.

Simple Additive Weighting (SAW), which is also known as Weighted Sum Model or Weighted Averaging Operator, was first used to formally study MADM problems in 1957 [4]. The basic concept of SAW is to calculate the weighted sum of the performance rating of each alternative against all attributes. The alternative with the highest weighted sum is considered the best choice [5][6]. The SAW calculation steps are as follows:

1. Define the attributes (C*j*) and alternatives (A*i*) involved in the decision-making process, where *i* denotes the number of rows (i = 1, 2, ..., n) and j denotes the number of columns (j = 1, 2, ..., m).
2. Establish the performance rating of each alternative with respect to each attribute. In this study, the performance rating is derived from the hedonic test results for taste, texture, and saltiness level.
3. Assign the weight (W) to each attribute, where the weight values are obtained from the preceding Rank Order Centroid (ROC) calculation.
4. Construct the decision matrix (X) comprising the performance rating of each alternative across all attributes, arranged in the following matrix configuration:

$$X = \begin{bmatrix} \mathrm{x}_{11} & \cdots & \mathrm{x}_{1\mathrm{j}} \\ \vdots & \ddots & \vdots \\ \mathrm{x}_{\mathrm{i}1} & \cdots & \mathrm{x}_{\mathrm{ij}} \end{bmatrix} \tag{2}$$

5. Normalize the decision matrix to yield the normalized performance rating (r_{ij}) for each alternative based on the attribute type (*benefit* or *cost*). Each attribute (j) is classified as *benefit* when a higher value is preferable, and as *cost* when a lower value is preferable. The normalization equation applied according to attribute type is as follows:

$$\mathrm{r_{ij}} = \begin{cases} \dfrac{\mathrm{X_{ij}}}{\mathrm{max_{x_{ij}}}} & \text{if } j \text{ is } benefit \\ \dfrac{\mathrm{min_{x_{ij}}}}{\mathrm{X_{ij}}} & \text{if } j \text{ is } cost \end{cases} \tag{3}$$

6. Compute the weighted sum for each alternative to derive the final preference score (V*i*) using the following equation:

$$\mathrm{Vi} = \sum_{\mathrm{j=1}}^{\mathrm{n}} \mathrm{W_j\, r_{ij}} \tag{4}$$

The alternative yielding the highest preference score (V*i*) is selected as the final outcome of the decision-making process.

III. SYSTEM ANALYSIS AND DESIGN

A. *Data Collection Method*

In this study, the data were collected through direct experimental activities involving chicken meatball preparation, sensory (hedonic) testing, interviews conducted by the author for attribute weighting, and manual decision-making calculations by ROC-SAW method.

1. *Equipment and Materials*

The hardware used for developing the static Decision Support System (DSS) website was an Asus ExpertBook B1 laptop equipped with an Intel Core i7-1355U processor and 16 GB RAM. The software utilized included Visual Studio Code (VSCode) as the code editor, Node.js as the runtime environment and package manager, React.js as the frontend development framework, and Google Chrome for system testing and validation.

This study employed four chicken meatball formulations as decision alternatives. These formulations differed based on the combination of seasoning and tapioca starch concentrations used in each recipe.

2. *Chicken Meatball Formulation Alternatives*

This study used four chicken meatball formulations as decision alternatives in the DSS evaluation process. The alternatives were differentiated based on seasoning and tapioca starch concentrations. The first treatment (XA) consisted of 15 g of seasoning and 50 g of tapioca starch, while the second treatment (XB) used 15 g of seasoning with an increased starch concentration of 150 g. The third treatment (YA) contained 20 g of seasoning combined with 50 g of tapioca starch, and the fourth treatment (YB) applied the highest levels of both components, using 20 g of seasoning and 150 g of tapioca starch.

In all formulations, the proportions of the remaining ingredients, including ground chicken meat, egg white, shallots, garlic, mushroom broth powder, garlic powder, and ground pepper, were kept constant to ensure that only the seasoning and tapioca starch concentrations affected the evaluation results.

3. *Sensory (Hedonic) Testing*

The hedonic test followed the previous procedure by Pratama et al. [6] and Sariati et al. [5] with a slight modification, and was conducted on chicken meatball samples by observing three attributes: taste, texture, and saltiness level. A total of 18 trained panelists were involved in the testing of chicken meatballs, which took place in the sensory laboratory of the D-IV Integrated Plantation Product Processing Study Program, Pontianak State Polytechnic. The panelists assessed each sample using a five-point hedonic scale as follows: 1 – Strongly dislike, 2 – Dislike, 3 – Slightly like, 4 – Like, and 5 – Strongly like. The results were subsequently analyzed using Minitab software to determine the mean, standard deviation, as well as one-way analysis of variance (ANOVA) to determine whether statistically significant differences existed among the panelists' assessments for each attribute.

4. *Decision-Making Using ROC and SAW*

The ROC and SAW combination employed in this study followed the decision-making procedure established in prior work by Pratama et al. [6] and Sariati et al. [5]. The decision-making activity begins with determining the weight of each attributes used (taste, texture, and saltiness level) using the Rank Order Centroid (ROC) method. The priority order of the attributes applied in this study was established by an expert in agroindustrial engineering. Subsequently, decision-making based on hedonic data was carried out using the Simple Additive Weighting (SAW) method. The calculations were conducted manually using Microsoft Excel.

B. *System Architecture and Development Methods*

The developed Decision Support System (DSS), Qbico, is implemented as a client-side web application with a static architecture. The system does not utilize a backend server or database; instead, all computational processes are executed directly within the user's browser. This architecture is enabled through the use of React loaded via CDN, where the React library is loaded directly through <script> tags without requiring any installation process or build tools such as NPM, allowing the application to run entirely using HTML, CSS, and JavaScript without requiring a build process or server-side runtime.

The system architecture consists of three main layers. The first layer is the presentation layer, which handles the user interface for inputting criteria, alternatives, and displaying results. The second layer is the processing layer, which contains the implementation of the ROC and SAW algorithms executed in the browser. The third layer is the data layer, which is temporarily stored in the browser's memory during runtime.

The development of the static decision support system (DSS) website was carried out using the waterfall model [16][17][18], which consists of five sequential phases:

1. Requirements Analysis

Requirements analysis is the process of gathering and defining the system's services, constraints, and goals through user consultation, resulting in a detailed system specification. In this study, the functional requirements of the system were identified, including the ability to input hedonic assessment data, perform and display ROC-based attribute weighting, execute SAW-based decision-making calculations, and present the final preference ranking of alternatives.

2. System and Software Design

System and software design involves establishing the overall system architecture and describing the fundamental components of the system — such as the data input module, ROC weight calculation module, SAW computation module, and results display — along with how these components interact with one another, where data flows from the input stage through the calculation processes and ultimately to the output.

In this study, the overall architecture and user interface layout of the ReactJS-based static web application were designed, along with a Use Case Diagram to illustrate how the user interacts with each functional feature of the system. The system was designed to operate entirely on the client-side without requiring a back-end server or database, with all computations handled locally within the browser. The system is designed in Figure 1.

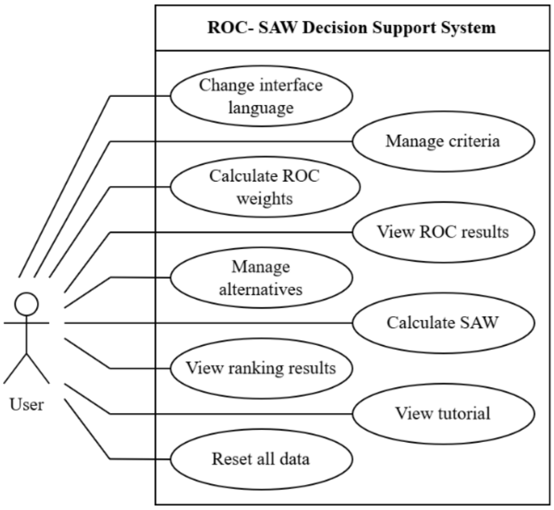


Fig. 1. Use Case Diagram of System

3. Implementation

Implementation is the phase in which the software design is translated into actual programs or program units. In this study, the system was developed using ReactJS as the primary front-end framework. The source code was written and managed using VSCode as the code editor, with NodeJS serving as the runtime environment and dependency manager throughout the development process.

4. System Testing

System testing involves verifying that the overall software requirements have been met prior to delivery. In this study, the system was evaluated using the black-box testing method, which focuses on verifying the functional behavior of the application without examining its internal code structure. Each feature — including data input, ROC weight calculation, SAW computation, and results display — was tested to ensure that the system produced outputs consistent with the expected results.

Following deployment, the user experience of the system was assessed using the System Usability Scale (SUS). The evaluation involved several users (students) who interacted directly with the system to measure its usability, effectiveness, efficiency, and overall user satisfaction [19][20]. The results of the SUS assessment were then analyzed to determine the level of system acceptance and identify areas requiring further improvement.

5. *Operation and Maintenance*

Operation and maintenance refers to the phase in which the system is deployed for practical use, with ongoing efforts to correct errors, improve existing components, and enhance services as new requirements emerge. In this study, the static files — consisting of HTML, CSS, and JavaScript — were uploaded to GitHub Pages, a free static site hosting service provided by GitHub, making the application publicly accessible via a web browser without the need for a dedicated server.

IV. RESULTS, IMPLEMENTATION, AND DISCUSSION

A. *The Results of Sensory (Hedonic) Testing*

We tested the same program (with a different purpose) in a Community Service Program at SMK/SMTI Pontianak (17/06/2026). There were more than 200 participants, and each participant accessed the same GitHub Pages link (including the one used in the presentation). No issues were reported by the participants.

The testing was carried out in a real-use scenario where participants accessed the system simultaneously using their personal devices. The observed outcome indicated that the DSS could be accessed and operated normally across different devices without any reported access failures or system errors.

It should be noted that this activity was not a controlled experimental study with formal data collection or performance benchmarking. Therefore, no detailed measurement data (such as processing time, bandwidth usage, or device-specific performance metrics) were recorded. The evaluation is based on direct observation during system deployment and user feedback, which indicated that the system functioned properly across heterogeneous devices in a concurrent usage environment. The results of hedonic testing conducted to evaluate the sensory acceptability of four chicken meatball formulations based on three attributes: taste, texture, and saltiness level are presented in Table 1. The One-Way ANOVA revealed a significant effect of formulation on the taste attribute ($p \leq 0.05$). Among the four treatments, YA received the highest mean score (4.000 ± 0.594) of taste hedonic score, indicating that panelists rated it as "like," while XB obtained the lowest score (2.000 ± 0.840), corresponding to "dislike." Treatments XA (3.333 ± 0.485) and YB (3.611 ± 0.916) fell within the "slightly like" to "like" range. The notably low score of XB suggests that the combination of low seasoning (15 g) and high tapioca starch (150 g) negatively affected taste perception, likely due to the dilution effect of excess starch on the overall flavor intensity of the meatball.

TABLE 1
THE RESULTS OF HEDONIC TESTING

Formulation (F)	**Attribute**		
	Taste	**Texture**	**Saltiness Level**
XA	3.333 ± 0.485	3.611 ± 0.698	3.111 ± 0.963
YA	4.000 ± 0.594	3.888 ± 0.676	3.722 ± 0.826
XB	2.000 ± 0.840	2.833 ± 0.985	1.444 ± 0.784
YB	3.611 ± 0.916	3.555 ± 0.984	3.277 ± 0.958

Formulation also had a significant effect on texture ($p \leq 0.05$), although the F-value was comparatively lower than those of the other two attributes, indicating a relatively smaller magnitude of difference among treatments. YA yielded the highest texture hedonic score (3.888 ± 0.676), followed by XA (3.611 ± 0.698) and YB (3.555 ± 0.984), all of which were rated as "slightly like" to "like." XB again received the lowest score (2.833 ± 0.985), suggesting that the higher starch concentration without adequate seasoning produced a texture that was less preferred by panelists, possibly due to an overly dense or rubbery mouthfeel resulting from excess tapioca starch.

The saltiness attribute showed the most pronounced variation across treatments, with a significant ANOVA result ($p \leq 0.05$). YA recorded the highest saltiness level hedonic score (3.722 ± 0.826), while XB received the lowest score (1.444 ± 0.784), which approached "strongly dislike." This finding is consistent with the formulation composition, as XB contained the lowest seasoning level (15 g) combined with the highest starch proportion (150 g), which likely diluted the perceived saltiness considerably. XA (3.111 ± 0.963) and YB (3.277 ± 0.958) showed moderate scores within an acceptable range.

B. Decision-Making on Hedonic Data Using ROC and SAW

The priority order of the attributes established by the expert was determined as follows: taste was ranked as the most important attribute, followed by texture as the second priority, and saltiness level as the least prioritized attribute, resulting in the order of taste > texture > saltiness level. Based on this priority order, the weight calculations for each attribute using ROC are presented in Table 2.

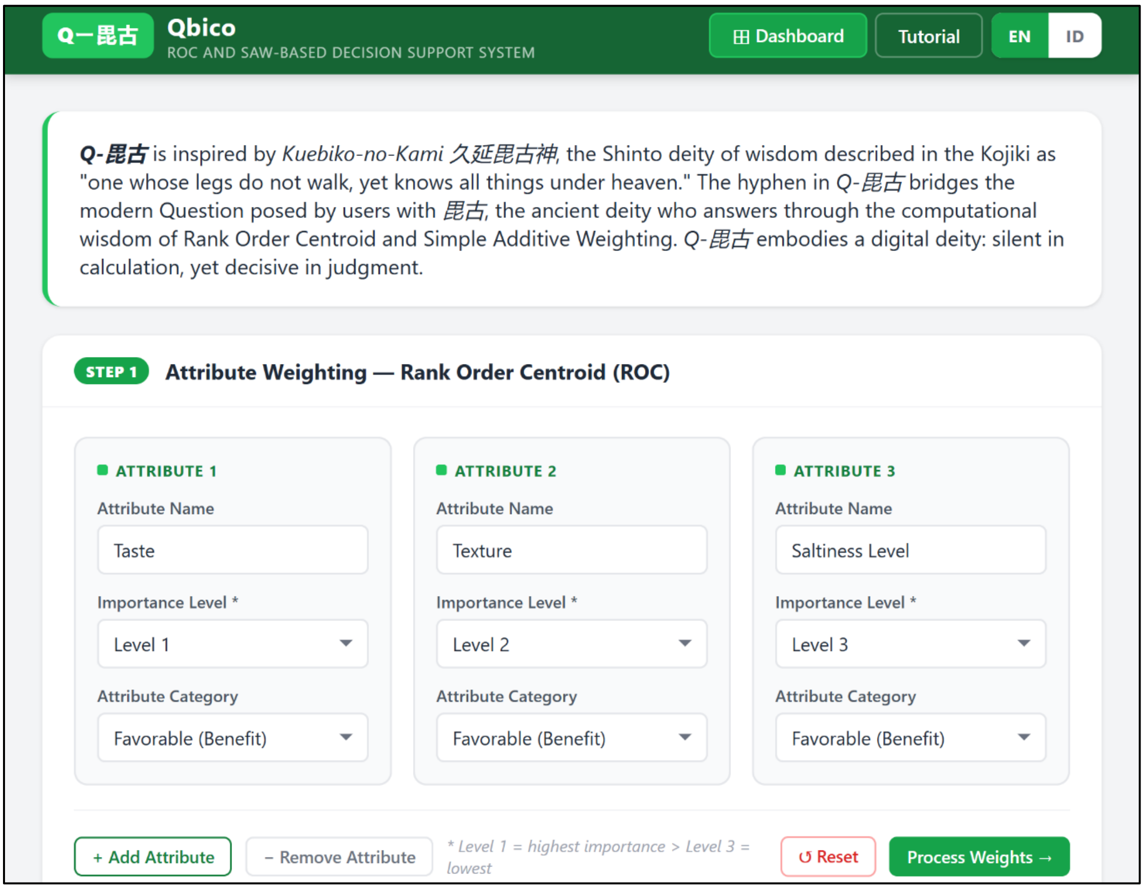
TABLE 2
ROC WEIGHTS FOR EACH ATTRIBUTE

Attribute	ROC Weight
Taste	$\frac{1}{3}\left(\frac{1}{1}+\frac{1}{2}+\frac{1}{3}\right) = 0.611$
Texture	$\frac{1}{3}\left(\frac{0}{1}+\frac{1}{2}+\frac{1}{3}\right) = 0.278$
Saltiness Level	$\frac{1}{3}\left(\frac{0}{1}+\frac{0}{2}+\frac{1}{3}\right) = 0.111$

TABLE 3
NORMALIZED DECISION MATRIX AND FINAL SAW PREFERENCE SCORE

F	Attribute (ROC Weight)			Vi
	Taste (0.611)	Texture (0.278)	Saltiness Level (0.111)	
XA	0.833	0.929	0.836	0.860
YA	1.000	1.000	1.000	1.000
XB	0.500	0.729	0.388	0.551
YB	0.903	0.914	0.880	0.903

Taste, as the highest-ranked attribute, received a weight of 0.611, followed by texture with a weight of 0.278, and saltiness level with the lowest weight of 0.111, with the total weight summing to 1.000. These weights were subsequently applied in the SAW calculation. Prior to the SAW preference scoring, a normalized decision matrix was constructed by dividing the score of hedonic data (mean) from each alternative by the maximum value within the respective attribute column, as all attributes were treated as benefit (equation 3).



Q-昆古 is inspired by *Kuebiko-no-Kami 久延毘古神*, the Shinto deity of wisdom described in the Kojiki as "one whose legs do not walk, yet knows all things under heaven." The hyphen in *Q-昆古* bridges the modern Question posed by users with *昆古*, the ancient deity who answers through the computational wisdom of Rank Order Centroid and Simple Additive Weighting. *Q-昆古* embodies a digital deity: silent in calculation, yet decisive in judgment.

STEP 1 **Attribute Weighting — Rank Order Centroid (ROC)**

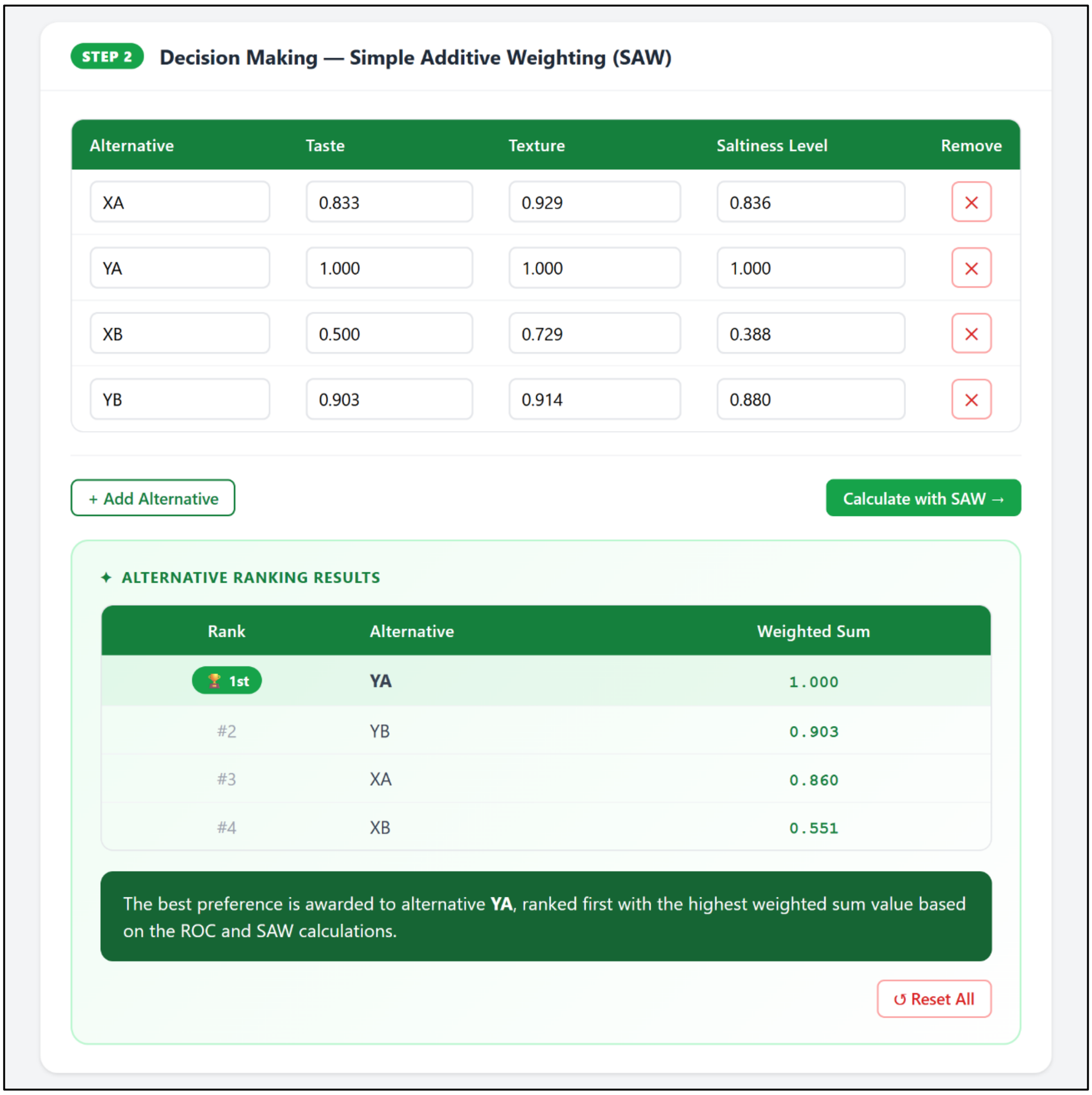
ATTRIBUTE 1
Attribute Name: Taste
Importance Level *: Level 1
Attribute Category: Favorable (Benefit)

ATTRIBUTE 2
Attribute Name: Texture
Importance Level *: Level 2
Attribute Category: Favorable (Benefit)

ATTRIBUTE 3
Attribute Name: Saltiness Level
Importance Level *: Level 3
Attribute Category: Favorable (Benefit)

** Level 1 = highest importance > Level 3 = lowest*

Fig. 2. ROC Weight Calculation Results of Qbico



Decision Making — Simple Additive Weighting (SAW)

Alternative	Taste	Texture	Saltiness Level	Remove
XA	0.833	0.929	0.836	✕
YA	1.000	1.000	1.000	✕
XB	0.500	0.729	0.388	✕
YB	0.903	0.914	0.880	✕

✦ ALTERNATIVE RANKING RESULTS

Rank	Alternative	Weighted Sum
🏆 1st	**YA**	1.000
#2	YB	0.903
#3	XA	0.860
#4	XB	0.551

The best preference is awarded to alternative **YA**, ranked first with the highest weighted sum value based on the ROC and SAW calculations.

Fig. 3. SAW-Based Alternative Ranking Results of Qbico

The resulting normalized matrix (Table 3) was then used as the basis for the SAW score calculation. Based on the results in Table 3, formulation YA obtained the highest SAW preference score (Vi) of 1.000, followed by YB with a score of 0.903, XA with a score of 0.860, and XB with the lowest score of 0.551. Based on these results, the ranking of formulations from most to least preferred was established as YA > YB > XA > XB.

Therefore, formulation YA, consisting of 20 g of seasoning and 50 g of tapioca starch, was identified as the best formulation among the four treatments, as it consistently achieved the highest scores across all three sensory attributes and yielded the highest overall SAW score.

C. Implementation of ROC and SAW-based Decision Support System in Static Website Using React

The decision support system developed in this study was implemented as a static website using React via CDN, named Qbico (*Q-昆古*). Qbico takes its name from *Kuebiko-no-Kami* (*久延昆古神*), a Shinto deity of wisdom. The hyphen symbolizes the bridge between the user's question and the ancient deity's wisdom, here expressed through the computational logic of ROC and SAW.

TABLE 4
FUNCTIONAL TESTING RESULTS OF QBICO USING BLACK-BOX METHOD

Test Scenario	Test Steps	Expected Result	Status
Attribute name validation	Leave all attribute name fields empty, then click “Process Weights”	Alert: all attribute name fields must be filled in	PASS
Importance level and category validation	Fill in all attribute names, leave Importance Level or Attribute Category unselected, then click “Process Weights”	Alert: all Importance Levels and Attribute Categories must be filled in	PASS
Duplicate importance level validation	Select the same Importance Level for two different attributes	Alert: importance level already selected; selection is prevented	PASS
Minimum attribute limit	Set attribute count to 3, then click “Remove Attribute”	Modal appears: minimum number of attributes is 3	PASS
Maximum attribute limit	Add attributes until count reaches 8, then click “Add Attribute”	Modal appears: maximum number of attributes is 8	PASS
ROC weight calculation accuracy	Enter 3 attributes, set priority as Taste (Level 1), Texture (Level 2), and Saltiness Level (Level 3), set all categories to Benefit, then click “Process Weights”	ROC weights displayed: Taste = 0.6111, Texture = 0.2778, Saltiness Level = 0.1111	PASS
Step 2 availability before ROC	Open the system without completing Step 1	Step 2 displays info banner; SAW input is not accessible	PASS
Empty alternative validation	Complete Step 1, then click “Calculate with SAW” without adding any alternative	Alert: please add at least one alternative before calculating	PASS
Empty alternative name validation	Complete Step 1, add an alternative, leave the alternative name empty, then click “Calculate with SAW”	Alert: the Alternative column must not be empty	PASS
Empty cell validation	Complete Step 1, add an alternative with name filled, leave one or more attribute value cells empty, then click “Calculate with SAW”	Alert: table has empty cells; all cells must be filled before calculating	PASS
SAW normalization — Benefit	Complete Step 1 with all attributes set to Benefit, enter performance values for all alternatives, then click “Calculate with SAW”	Normalized values computed as x/max(x); weighted sum (Vi) is correctly calculated	PASS
SAW normalization — Cost	Complete Step 1 with at least one attribute set to Cost, enter performance values, then click “Calculate with SAW”	Normalized values for Cost attributes computed as min(x)/x; weighted sum (Vi) is correctly calculated	PASS
SAW ranking accuracy	Complete Steps 1 and 2 with four alternatives (XA, YA, XB, YB), enter hedonic data, then click “Calculate with SAW”	Ranking displayed as YA (1st) > YB (2nd) > XA (3rd) > XB (4th); Vi scores match manual calculation	PASS
Winner modal display	Complete Steps 1 and 2, then click “Calculate with SAW”	Modal appears displaying the name of the best alternative (rank 1)	PASS
Reset Step 1	Fill in all Step 1 fields, click “Process Weights”, then click “Reset”	All attribute inputs, ROC weights, and Step 2 data are cleared; system returns to initial state	PASS
Reset All	Complete all steps until SAW results are displayed, then click “Reset All”	All data including attributes, alternatives, ROC weights, and SAW results are fully cleared	PASS
Language switch — EN to ID and otherwise	Set language to EN, then click “ID” and otherwise	All interface text switches to Indonesian and otherwise; previously entered data is retained	PASS

TABLE 5
SYSTEM USABILITY SCALE (SUS) EVALUATION RESULTS

Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total	Final Score
A	5	1	4	2	5	1	5	1	5	1	38	95.0
B	4	1	5	2	4	1	5	1	4	1	36	90.0
C	5	1	5	1	4	1	4	1	4	2	36	90.0
D	5	1	5	1	4	1	4	1	4	2	36	90.0
E	5	2	4	1	5	1	4	1	4	1	36	90.0
F	5	1	5	1	4	1	4	1	4	2	36	90.0
G	5	1	4	2	5	1	4	1	4	1	36	90.0
H	5	1	5	2	4	1	4	1	4	1	36	90.0
I	5	2	4	1	5	1	4	1	4	1	36	90.0
J	5	2	5	1	4	1	4	1	4	1	36	90.0
K	5	1	5	1	4	1	4	2	4	1	36	90.0
L	5	1	5	2	4	1	4	1	4	1	36	90.0
M	5	1	5	1	4	1	4	1	4	2	36	90.0
N	4	1	5	1	4	1	5	1	4	2	36	90.0
O	4	1	5	1	5	1	4	1	5	2	37	92.5
P	5	2	5	1	4	1	4	1	4	1	36	90.0
Q	4	2	4	1	4	1	5	1	5	1	36	90.0
R	4	1	4	1	4	1	5	2	5	1	36	90.0
Average SUS Score												**90.4**

The ROC weight calculation results and the SAW-based alternative ranking produced by Qbico are presented in Fig. 3 and Fig. 4, respectively. The results were consistent with those obtained through manual calculation using Microsoft Excel, confirming the computational accuracy of the implemented system. The system was also designed to provide an intuitive user interface that allows users to input criteria and alternatives without requiring technical expertise. In addition, the implementation ensures that all calculations are executed client-side, enabling fast response times and reducing dependency on server infrastructure.

V. TESTING

Black-box testing was conducted to evaluate the functional correctness of Qbico without consideration of its internal code structure. A total of 17 test cases were designed to cover all major functionalities of the system. The test scenarios and their expected outcomes are presented in the Table 4. All 17 test cases yielded a PASS result, indicating that the system functioned as expected across all tested scenarios.

The validation tests confirmed that the system correctly handles erroneous or incomplete inputs by triggering appropriate alert messages, ensuring that no calculation proceeds with missing or invalid data. These include validation for empty attribute names, unselected importance levels or categories, duplicate importance level selection, and empty alternative names or cell value.

The attribute limit tests verified that the system correctly restricts the number of attributes to a minimum of 3 and a maximum of 8, with corresponding modal warnings displayed upon violation. The computation tests confirmed that the ROC weighting and SAW scoring functions produce accurate results consistent with manual calculations, with correct normalization applied for both Benefit and Cost attribute categories, and that the winner modal is correctly displayed upon completion of the SAW calculation. The reset function tests ensured that both the partial reset and full reset functions properly clear all relevant data and return the system to its initial state. Finally, the language toggle test verified that switching between English and Indonesian correctly updates all interface text in both directions without any loss of previously entered data.

The usability evaluation results (Table 5) indicate that the developed website achieved an average System Usability Scale (SUS) score of 90.4 from 18 respondents. Based on the SUS interpretation scale, this score falls within the range of 84.1–100, which corresponds to grade A+ with the interpretation of “Best Imaginable” [20]. This result demonstrates that the system has an excellent level of usability.

VI. CONCLUSION

This study successfully developed Qbico (*Q-昆古*), a React-based static website decision support system that integrates the ROC and SAW methods for attribute weighting and alternative ranking.The system operates entirely on the client-side without requiring a back-end server or database, making it more lightweight and easier to deploy compared to conventional server-side DSS implementations. The case study on chicken meatball hedonic preferences demonstrated that Qbico correctly computed ROC weights and SAW preference scores consistent with manual calculations in Microsoft Excel, confirming the computational accuracy of the system. One-Way ANOVA results indicated significant differences among the four formulations across all three sensory attributes, and the ROC-SAW decision-making process identified formulation YA — comprising 20 g of seasoning and 50 g of tapioca starch — as the best formulation with the highest SAW preference score of 1.000.

Black-box testing confirmed that all 17 functional test cases passed, verifying the system's reliability in handling both valid inputs and erroneous conditions. Furthermore, the SUS evaluation yielded an average score of 90.4, classified as grade A+ "Best Imaginable," indicating that the system is highly usable and well-accepted by users. For future development, Qbico may be extended to support a wider range of MADM methods, accommodate larger numbers of attributes and alternatives, and incorporate data export functionality to further enhance its applicability in agroindustrial and broader decision-making contexts.

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