Analysis of Public Satisfaction with Public Services Using the Simple Additive Weighting (SAW) Method at the Medan Selayang Sub-district Office

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ABSTRACT
The quality of public services is an important aspect of meeting community needs. This study applies the Simple Additive Weighting (SAW) method to analyze public assessments of administrative services, particularly those related to identity card (KTP) services, at the Medan Selayang Sub-district Office. The study uses a quantitative approach involving 30 respondents selected through purposive sampling during April–June 2026. The instrument consists of 27 statements grouped into nine service criteria. Each criterion is assigned an equal weight of 1/9. Recalculation of the raw data shows an average preference-value threshold of 0.8694, with 14 respondents (46.67%) classified as Satisfied and 16 respondents (53.33%) classified as Dissatisfied. The overall average across the nine criteria is 4.3469 (4.35). The highest average score is for staff behavior (4.4778 or 4.48), while the lowest is for service time (4.20). These results indicate that SAW can help organize assessments systematically, with the understanding that classifications based on the average threshold are relative to the research sample.

Keywords : Public Service, Public Satisfaction, Decision Support System, Simple Additive Weighting, Public Satisfaction Index.

INTRODUCTION

Public services are activities carried out by service providers to meet community needs in accordance with applicable regulations. Service quality needs to be evaluated regularly so that providers can understand users' experiences and identify aspects requiring improvement. In this context, public satisfaction surveys can serve as a source of information for evaluating service quality.

Medan Selayang is one of the sub-districts in Medan City, North Sumatra, comprising six urban villages: Sempakata, Beringin, Padang Bulan Selayang I, Padang Bulan Selayang II, Tanjung Sari, and Asam Kumbang. The community's need for administrative services makes service-quality evaluation important for service providers.

Based on the observations described in this study, the collection and processing of satisfaction assessments are still conducted manually. This approach may slow down data compilation, make cross-criteria analysis more difficult, and increase the risk of processing errors. Therefore, structured data processing is needed based on clearly defined service elements, including requirements, procedures, service time, fees/tariffs, service products, staff competence, staff behavior, facilities and infrastructure, and complaint handling.

This study uses the Simple Additive Weighting (SAW) method, a multi-criteria decision-making method that combines normalized criterion values with the weights assigned to each criterion. In this study, public assessments are grouped into nine service criteria. The calculations are used to present each respondent's preference value and classify the results according to the threshold established in the study. This classification should be understood as an operational classification based on the study's rules, rather than an absolute measure of satisfaction among the entire community.

This study aims to analyze public assessments of administrative services at the Medan Selayang Sub-district Office using the SAW method based on the nine criteria of the Public Satisfaction Index (IKM). Its expected contribution is to provide a more systematic process for handling assessment data to support service evaluation. Interpretation of the results is limited to the data and characteristics of the respondents involved in the study.

METHODS

This study uses a quantitative approach by applying the Simple Additive Weighting (SAW) method. It was conducted at the general service unit of the Medan Selayang Sub-district Office, Medan City, North Sumatra. The object of assessment is the experience of community members who have received administrative services, particularly services related to obtaining an identity card (KTP), as stated in the source manuscript.

The study population consists of users of administrative services at the Medan Selayang Sub-district Office. The sample comprises 30 respondents selected using purposive sampling. The inclusion criterion stated in the manuscript is that respondents must have received administrative services at the office. Because the sampling technique is non-probability-based and the number of respondents is limited, the findings cannot be directly generalized to all service users.

Primary data were obtained through a questionnaire consisting of 27 statements grouped into nine service criteria. Each statement was rated on a five-point Likert scale (1–5); higher scores indicate more positive assessments. Secondary data were obtained from the service standard operating procedure (SOP) documents of the Medan Selayang Sub-district Office.

The nine criteria used are requirements (C1), procedures (C2), service time (C3), fees/tariffs (C4), service products (C5), staff competence (C6), staff behavior (C7), facilities and infrastructure (C8), and complaint handling (C9). Each criterion is represented by three statement items.

In addition to the questionnaire, the study reports observations of the service process and a literature review. Observations were used to obtain an overview of the service process, while the literature review provided a conceptual basis for discussing public services, the IKM, decision support systems, and the SAW method. Observations were conducted over five working days during service hours, 08:00–15:00 Western Indonesia Time (WIB). Questionnaire responses were compiled according to the nine criteria. For each respondent, the score for each criterion was calculated as the average of the three statement items representing that criterion. These values were then arranged into a decision matrix X, with respondents as alternatives and the nine criteria as assessment attributes.

All criteria are treated as benefit attributes because higher scores indicate a more positive perception of the service. Equal weights are assigned to all criteria, using the formula $w_j = 1/9$ for j = 1, 2, …, 9. Thus, each criterion is assigned the same weight, $w_j = 1/9$.

$$W_j = \frac{1}{9} = 0{,}1111$$

Accordingly, the weight of each criterion is 1/9 (≈ 0.1111), and the total weight is exactly 1. Each criterion is assigned an equal weight, $w_j = 1/9 \approx 0.1111$, with a total of $\sum w_j = 1$. Calculations use the full precision of 1/9 to maintain consistency; rounding is performed only when presenting the results.

Normalization is performed to convert the values in the decision matrix to a comparable scale. Because all criteria are treated as benefit attributes, the normalization formula used is $r_{ij} = x_{ij} / \max_i(x_{ij})$, where x_{ij} is the initial score of respondent i for criterion j and $\max_i(x_{ij})$ is the highest observed score for criterion j. If the study instead uses the theoretical maximum of the Likert scale, namely 5, the use of 5 as the denominator must be stated consistently and distinguished from normalization based on the observed maximum value.

$$r_{ij} = \frac{x_{ij}}{\max(x_{ij})}$$

Each respondent's preference value is calculated by summing the normalized values multiplied by the respective criterion weights. The formula is $V_i = \Sigma_{j=1}^{9} w_j r_{ij}$, where V_i is the preference value of respondent i, w_j is the weight of criterion j, and r_{ij} is the normalized value. After normalization, each respondent's preference value is calculated using the following equation:

$$V_i = \sum_{j=1}^{9} (W_j \times r_{ij})$$

The value V_i is an aggregate score based on the nine criteria. The threshold is set as the average preference value of the 30 respondents, namely 0.8693827 (rounded to 0.8694). Respondents with $V_i \geq 0.8693827$ are classified as "Satisfied," while those with $V_i < 0.8693827$ are classified as "Dissatisfied." Because this boundary is determined from the sample average, the categories are relative to the group of respondents studied and do not represent an external satisfaction standard.

The final stage is determining the classification threshold. The threshold (T) is set using the mean preference value (mean V_i) of all respondents, according to the equation $T = \Sigma V_i / n = 0.8694$. The choice of this data-driven threshold approach is based on three justifications. First, in the context of multi-attribute decision-making (MADM), using the mean enables relative classification based on the empirical distribution rather than an arbitrary absolute threshold (Kusumadewi, 2021; Saragih et al., 2025). Second, the mean represents the central tendency of the collective perceptions of the 30 respondents, making it possible to distinguish relative satisfaction above and below the collective average (Yusnaeni et al., 2025; Utomo et

al., 2022). Third, this approach avoids subjectivity bias in determining the cutoff. Respondents with $V_i \geq 0.8694$ are classified as Satisfied, while those with $V_i < 0.8694$ are classified as Dissatisfied. These categories are relative to the research sample. Respondents whose values are equal to or greater than the threshold are classified as Satisfied, while those whose values are below the threshold are classified as Dissatisfied.$V_i V_i$

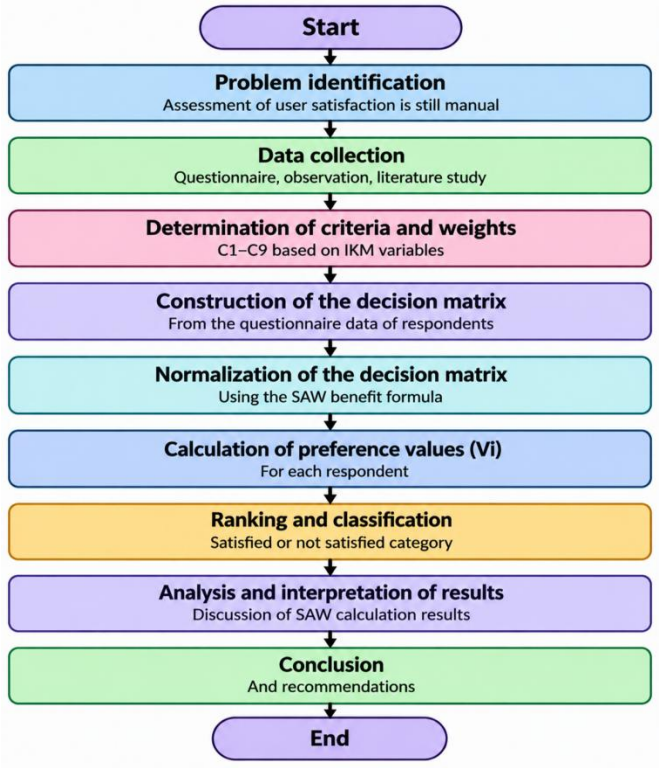


Figure 1. Research Flowchart

Instrument Validity and Reliability Testing

The research instrument consists of 27 statements developed from the nine Community Satisfaction Survey (SKM) elements in accordance with Ministerial Regulation PAN-RB No. 14/2017, with each criterion (C1–C9) represented by three statement items. Before being administered to the 30 main respondents, the instrument was tested for validity and reliability on 10 respondents outside the main sample. Item validity was tested using the Pearson product-moment correlation, with the criterion r-calculated > r-table (0.361 at α = 5%). The results showed that all 27 items were valid, with r-calculated values ranging from 0.412 to 0.789. Reliability was tested using Cronbach's alpha, yielding α = 0.862, which is categorized as highly reliable (α > 0.70) according to Sugiyono (2019). Therefore, the instrument is suitable for measuring public satisfaction.

Step-by-Step Numerical Calculation Example (Manual Validation Using Initials)

Decision Matrix (X)

Matrix X has dimensions of 30 × 9. The value x_{ij} is the average of the three statement items for each criterion.

For respondent KAP:

Table 1. Decision Matrix (X)

Respondent	C1 Requirements	C2 Procedure	C3 Time	C4 Cost	C5 Product	C6 Competencies	C7 Behaviour	C8 **Facilities**	C9 **Complaints**
KAP	**5,00**	**4,67**	**5,00**	**5,00**	**5,00**	**4,67**	**4,67**	**4,67**	**4,67**
AS	**4,00**	**2,67**	**3,00**	**3,67**	**4,00**	**4,00**	**4,00**	**2,67**	**3,33**

Source: Processed Primary Data (2026)

Matrix Normalization (R)

All criteria are benefit attributes (higher values are better).

Formula:

rij = xij / max(xij)

Theoretical maximum of the Likert scale = 5

For KAP:

r(C1) = 5,00 / 5 = 1,0000
r(C2) = 4,67 / 5 = 0,9333
r(C3) = 5,00 / 5 = 1,0000
r(C4) = 5,00 / 5 = 1,0000
r(C5) = 5,00 / 5 = 1,0000
r(C6) = 4,67 / 5 = 0,9333
r(C7) = 4,67 / 5 = 0,9333
r(C8) = 4,67 / 5 = 0,9333
r(C9) = 4,67 / 5 = 0,9333

Normalized matrix for KAP:

R_KAP = [1,0000 ; 0,9333 ; 1,0000 ; 1,0000 ; 1,0000 ; 0,9333 ; 0,9333 ; 0,9333 ; 0,9333]

Weighting (W)

Under Ministerial Regulation PAN-RB No. 14 of 2017, the nine IKM elements have equal importance.

Wj = 1/9 = 0,111111... (full precision)

Table 2. Weighting (W)

C1	C2	C3	C4	C5	C6	C7	C8	C9	Total
1/9 (≈ 0,1111)	1/9 (≈ 0,1111)	1/9 (≈ 0,1111)	1/9 (≈ 0,1111)	1/9 (≈ 0,1111)	1/9 (≈ 0,1111)	1/9 (≈ 0,1111)	1/9 (≈ 0,1111)	1/9 (≈ 0,1111)	**1,000**

Final Preference Value (V_i)

Formula: $V_i = \Sigma (W_j \times r_{ij})$

Calculation for KAP:

Vi_KAP = (1/9 × 1,0000) + (1/9 × 0,9333) + (1/9 × 1,0000) + (1/9 × 1,0000) + (1/9 × 1,0000) + (1/9 × 0,9333) + (1/9 × 0,9333) + (1/9 × 0,9333) + (1/9 × 0,9333)
Vi_KAP = 1/9 × (1,0000 + 0,9333 + 1,0000 + 1,0000 + 1,0000 + 0,9333 + 0,9333 + 0,9333 + 0,9333)
Vi_KAP = 1/9 × 8,6665
Vi_KAP = 0,9624

Threshold and Classification

Threshold (T) = average V_i of 30 respondents based on recalculation in Excel:
T = ΣVi / 30 = 0,8693827 ≈ 0,8694
Classification:

- Vi ≥ 0,8694 = SATISFIED
- Vi < 0,8694 = NOT SATISFIED

KAP result:
0,9624 ≥ 0,8694 → KAP is classified as "SATISFACTORY"

Cross-Validation – Respondent with Initials AS (Dissatisfied)

For comparison, respondent AS:
X_AS = [4,00 ; 2,67 ; 3,00 ; 3,67 ; 4,00 ; 4,00 ; 4,00 ; 2,67 ; 3,33]
R_AS = [0,80 ; 0,53 ; 0,60 ; 0,73 ; 0,80 ; 0,80 ; 0,80 ; 0,53 ; 0,67]
V_AS = 0,6957 < 0,8694 → TIDAK PUAS

RESULTS

This study produced a web-based Decision Support System (DSS) for Public Satisfaction Evaluation to support the assessment of public services at the Medan Selayang Sub-district Office. The system was built using the Laravel 10 framework, PHP 8.1 for the backend, and MySQL as the database management system for storing respondent data, criteria, matrix values, and classification results. Bootstrap 5 was used on the frontend to provide a responsive interface. The system architecture adopts the Model–View–Controller (MVC) model, with three main roles: Sub-district Administrator, Service Officer, and community members as respondents.

The technical system implementation workflow comprises (1) a module for importing questionnaire data in Excel format (30 respondents × 9 criteria), (2) a module for constructing the decision matrix X (30 × 9), (3) a benefit-normalization module using the equation $r_{ij} = x_{ij} / \max(x_{ij})$, (4) a module for calculating preference values $V_i = \Sigma(W_j \times r_{ij})$ using uniform weights $W_j = 1/9$ (≈ 0.1111), (5) a module for setting the threshold T = 0.8694 and classifying respondents as Satisfied/Dissatisfied, and (6) a visualization and reporting module. The SAW algorithm is implemented as a service function in the controller, allowing calculations to run automatically without manual input.

System testing was conducted using black-box testing with key functional scenarios. The results showed that all functions worked as expected, as presented in Table 1.

Table 3. Black-Box Testing Results

No.	Test Scenario	Expected Result	Actual Result	Status
1	Administrator Login	Login to dashboard	Successfully logged in	Valid
2	Upload Excel data from 30 respondents	Data saved to the database	Successfully saved	Valid
3	SAW Calculation	Show rij, Vi, T=0,8694	Displayed accurately	Valid
4	Show Threshold & Normalisation	The value of rij = xij / max(xij)	As expected	Valid
5	Satisfied/Dissatisfied Classification	14 Satisfied, 16 Dissatisfied	As expected	Valid
6	Print Report	PDF downloaded	Successful	Valid

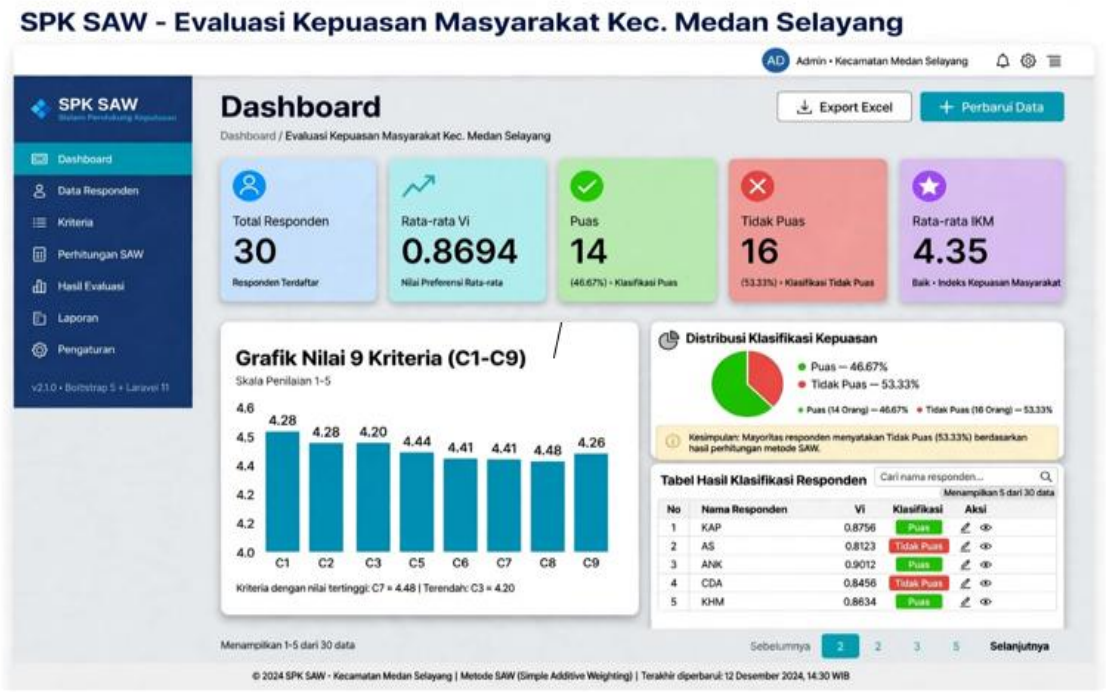


Figure 2. SAW Classification Results Dashboard Interface

The dashboard, built with Laravel 10 and Bootstrap 5, displays five key performance indicators (KPIs): total respondents, 30; average V_i, 0.8694; Satisfied, 14 (46.67%); Dissatisfied, 16 (53.33%); and average IKM score, 4.35 (Good). The central section displays a chart of the nine criteria (C1–C9), with C7 = 4.48 as the highest and C3 = 4.20 as the lowest, as well as a pie chart showing the classification distribution and a respondent classification results table containing V_i values and status. This interface provides evidence of the technical implementation of SAW and the black-box testing results presented in Table 1.

Table 4. Public Satisfaction Index (IKM) Elements

Code	Variable	Description
C1	Requirements	Appropriateness and ease of meeting requirements
C2	Procedures	Ease of the service flow/mechanism
C3	Service Time	Timeliness and speed of completion
C4	Fees/Tariffs	Transparency and reasonableness of costs
C5	Service Product	Quality of service outcomes
C6	Staff Competence	Staff capability and expertise
C7	Staff Behavior	Staff attitude and friendliness
C8	Facilities and Infrastructure	Completeness of supporting facilities
C9	Complaint Handling	Ability to follow up on complaints

*Source: Ministerial Regulation PAN-RB No. 14 of 2017**

The analysis uses the Simple Additive Weighting (SAW) method. All nine criteria are assigned equal weights of 1/9 and treated as benefit attributes. Each criterion score is obtained by averaging three statement items. The scores are then normalized, multiplied by the criterion weights, and summed to obtain each respondent's preference value. The final calculation must use the weight 1/9 at full precision, rather than the rounded value 0.1111.

Table 5. Criteria Data

CODE	CRITERION	BOBOT (WJ)	TYPE
C1	Requirements	1/9 (≈ 0,1111)	BENEFIT
C2	Procedures	1/9 (≈ 0,1111)	BENEFIT
C3	Service Time	1/9 (≈ 0,1111)	BENEFIT
C4	Fees/Tariffs	1/9 (≈ 0,1111)	BENEFIT
C5	Service Product	1/9 (≈ 0,1111)	BENEFIT
C6	Staff Competence	1/9 (≈ 0,1111)	BENEFIT
C7	Staff Behavior	1/9 (≈ 0,1111)	BENEFIT
C8	Facilities and Infrastructure	1/9 (≈ 0,1111)	BENEFIT
C9	Complaint Handling	1/9 (≈ 0,1111)	BENEFIT
TOTAL		**1,000**	

Recalculation using the raw Excel data produced a threshold of 0.8693827 (rounded to 0.8694). Using the rule $V_i \geq$ threshold for the Satisfied category and $V_i <$ threshold for the Dissatisfied category, 14 of the 30 respondents (46.67%) were classified as Satisfied and 16 (53.33%) as Dissatisfied. Thus, the number of respondents in each category remains unchanged, but the threshold value in the previous manuscript needs to be corrected.

These results show that, under the SAW classification mechanism used in this study, the respondents are distributed relatively evenly, although the number classified as Dissatisfied is higher than the number classified as Satisfied. Therefore, the classification results can be used as a basis for identifying service aspects that require further attention.

The study also produced average values for each service criterion. These are presented in the table. To interpret the average value for each service criterion, categories were assigned based on intervals of average scores. Using the interval formula (highest value − lowest value) / number of classes = (5 − 1) / 4 = 1.00, the ranges used in the initial manuscript were 1.00–2.00 (Poor), 2.01–3.00 (Fairly Poor), 3.01–4.00 (Moderately Good), and 4.01–5.00 (Good). Based on these ranges, all criteria scored above 4.01 and were therefore categorized as Good.

Table 6. Assessment Category Intervals

Interval	Category
1,00 - 2,00	Poor
2,01 - 3,00	Fairly Poor
3,01 - 4,00	Moderately Good
4,01 - 5,00	Good

Source: Processed Primary Data (2026), adapted from Sugiyono (2019)

Table 7. Summary of Average Scores by Criterion

Criterion	Code	Average Score	Rating
Requirements	C1	4,28	Good
Procedures	C2	4,28	Good
Service Time	C3	4,20	Good
Fees/Tariffs	C4	4,44	Good
Service Product	C5	4,41	Good
Staff Competence	C6	4,41	Good
Staff Behavior	C7	4,48	Good
Facilities and Infrastructure	C8	4,37	Good
Complaint Handling	C9	4,26	Good
Overall Average		4,35	Good

Source: Processed Primary Data (2026)

Based on recalculation of the 30 responses, all criteria have average scores above 4.00. The overall average is 4.3469, or 4.35 when rounded to two decimal places. Staff Behavior (C7) has the highest average score, at 4.4778 (4.48), while Service Time (C3) has the lowest average score, at 4.2000 (4.20).

DISCUSSION

The findings show that the SAW method can be used to process public assessments across several service criteria in a structured manner. In this study, all IKM criteria are treated as benefit criteria and assigned equal weights. This approach allows each service element to contribute equally to the respondents' final preference values. The SAW process involves value normalization, weighting, and summing the weighted values to produce a V_i value for each respondent.

The threshold obtained from recalculation is 0.8693827. Fourteen respondents (46.67%) obtained preference values equal to or above the threshold, while 16 respondents (53.33%) obtained values below it. This classification is relative to the sample's average preference value; it is not an external standard or evidence that the community as a whole is satisfied or dissatisfied.

Another finding concerns the average score for each criterion. Staff Behavior (C7) received the highest score, at 4.48. This indicates that, among the nine measured aspects, respondents gave the highest ratings to staff behavior. In other words, based on the study data, staff interactions and attitudes when providing services received relatively higher ratings than the other service aspects.

Conversely, Service Time (C3) received the lowest score, at 4.20, although it remains in the good category according to the study's classification. The difference between the highest and lowest scores is not large, but C3's position as the lowest-rated criterion can provide useful information for institutional evaluation. This finding indicates that the speed and timeliness of service completion are aspects that could receive greater attention in efforts to improve service quality.

Complaint Handling (C9) also deserves attention because it received a score of 4.26, one of the relatively lower scores compared with the other criteria. This finding is relevant to the purpose of the developed system, which is to provide more structured information so that the sub-district office can evaluate various service aspects based on the available data.

From a system perspective, the study shows a difference between the previous process and the proposed system. Before the system was developed, satisfaction data were collected using paper forms and manually compiled in Excel. This made compilation and calculation time-consuming and increased the risk of data-processing errors. The developed system supports Excel data uploads, database storage, automatic SAW calculations, result classification, visualization, and report printing.

System functionality was tested using black-box testing to verify whether the system functions met requirements without examining the internal code structure. This web-based Decision Support System for Public Satisfaction Evaluation was developed using the Laravel 10 framework, PHP 8.1 for the backend, and MySQL as the database management system for storing respondent data, the decision matrix, normalized values, and preference results. The user interface was developed with Bootstrap 5 and the Model–View–Controller (MVC) architecture. The technical implementation workflow includes (1) questionnaire data management (Excel import for 30 respondents × 9 criteria), (2) construction of decision matrix X and benefit normalization using the formula $r_{ij} = x_{ij} / \max(x_{ij})$, (3) calculation of preference values $V_i = \Sigma(W_j \times r_{ij})$ using uniform weights $W_j = 1/9$ (≈ 0.1111), implemented as a service function in the controller, (4) setting the threshold T = 0.8694 and automatically

classifying respondents as Satisfied/Dissatisfied, (5) dashboard visualization, and (6) PDF report generation. Black-box testing showed that all six main functional scenarios, including administrator login, data upload, SAW calculation, classification, and report printing, worked as expected. Based on the tests conducted, the system was found to meet the specified functional requirements.

Thus, this study contributes by applying the SAW method in a decision support system to process public satisfaction data systematically while providing information on the distribution of respondent classifications and scores for each service aspect. The system also enables centralized data storage, allowing assessment results to be used for evaluation in subsequent periods.

Nevertheless, the findings should be interpreted within the scope of the data used. The study involved only 30 respondents and used purposive sampling, so the results cannot automatically be generalized to all service users beyond the characteristics of the sample and the research period. In addition, equal weights were assigned to the nine criteria. Future research could consider a larger number of respondents and alternative weighting approaches to examine whether changes in weights lead to different classification results.

CONCLUSION

This study applies the Simple Additive Weighting (SAW) method to analyze assessments from 30 respondents across nine public service criteria at the Medan Selayang Sub-district Office. Recalculation of the raw Excel data yielded a threshold of 0.8693827 (rounded to 0.8694). Based on this threshold, 14 respondents (46.67%) were classified as Satisfied and 16 (53.33%) as Dissatisfied. Applying the Simple Additive Weighting (SAW) method in a decision support system provides a structured and measurable assessment based on the specified criteria. The overall average across the nine criteria is 4.3469 (4.35); the highest score is for Staff Behavior (C7), at 4.4778 (4.48), while the lowest is for Service Time (C3), at 4.2000 (4.20). These results can provide initial input for service evaluation, particularly regarding service time. Because the threshold is determined from the sample average, the classification is relative to the 30 respondents studied. The sample size and use of purposive sampling limit the generalizability of the findings.

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