Bulletin of Network Engineer and Informatics
E-ISSN 2986-8017 | P-ISSN 2987-4858
https://bufnets.tech

Vol. 3 No 2 – October 2025
DOI: 10.59688/bufnets.v3i2.1

WEB-BASED DECISION SUPPORT SYSTEM FOR KPPS MEMBER SELECTION USING SMART METHOD

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Received : 20 October 2025	Accepted : 03 November 2025	Published : 26 November 2025

Abstract

General elections constitute a fundamental pillar of democracy, necessitating objective and transparent administration mechanisms, particularly through the Voting Organizing Group (KPPS). This research develops a web-based decision support system (DSS) to facilitate the Voting Committee (PPS) in selecting KPPS members utilizing the Simple Multi-Attribute Rating Technique (SMART) method. The system was designed employing the Waterfall development model with web-based architecture implemented through the PHP programming language and MySQL database management system. The findings indicate that the system significantly enhances objectivity and transparency in the KPPS member selection process. The system proves to be effective, readily adaptable, and substantially improves organizational accountability.

Keywords: *SPK, KPPS, Pemilu, SMART method, KPU*

1. INTRODUCTION

Elections in Indonesia are conducted periodically and constitute a fundamental pillar of the Indonesian democratic system[1]. Through elections, citizens have the opportunity to directly elect their representatives[2]. The success of an election is inseparable from the active participation of citizens, both as voters, participants, and organizers, which are formed by relevant institutions such as the General Elections Commission (Komisi Pemilihan Umum, KPU)[3].

To ensure the implementation of fair and honest elections, reliable election administrators are required at the grassroots level, particularly the Voting Organizing Group (Kelompok Penyelenggara Pemungutan Suara, KPPS). KPPS serves as one of the ad-hoc bodies of the KPU that directly interacts with voters at polling stations (Tempat Pemungutan Suara, TPS)[4].

As the front line of democracy, KPPS members are expected to demonstrate high integrity, professionalism[5], neutrality, and adherence to democratic values throughout every stage of their duties. However, in practice, various issues are often encountered regarding KPPS performance, ranging from allegations of partiality to a lack of integrity and professionalism. These issues frequently attract the attention of election participants. To address such problems, a transparent, fair, and measurable selection system is required in the recruitment process of KPPS members.

A Decision Support System (DSS) is an interactive system that assists in decision-making for semi-structured problems[6]. A DSS is highly relevant for supporting a fair, objective, and measurable selection process[7]. The method applied in this study is the Simple Multi Attribute Rating Technique (SMART) method. SMART is a weighted multi-criteria selection model that is easy to implement and effective in producing accurate decision outcomes[8].

Several related studies include: [9] for scholarship recipient selection, [10] for business feasibility assessment, and [11] for blood donor candidate selection. The system development process employs the Waterfall model. A DSS based on the SMART method offers numerous advantages, including efficiency and adaptability to multiple criteria

and selection subjects. Furthermore, implementing a web-based selection system can enhance efficiency and transparency in the recruitment of KPPS members[12].

Based on the identified problem, a study is intended to be conducted on a web-based Decision Support System for the selection of KPPS members using the SMART method, with the objective of ensuring a more effective and transparent selection process.

2. RESEARCH METHODOLOGY

2.1 Type of Research

This study adopts a Research and Development (R&D) approach that combines research phases with product development. The research focuses on developing a web-based decision support system utilizing the SMART method for decision calculations and the Waterfall methodology for system implementation. The effectiveness of the developed application is evaluated through output validation and system performance testing[13].

This research develops a web-based decision support system that utilizes the Simple Multi-Attribute Rating Technique (SMART) method to facilitate the selection process of Voting Organizing Group (KPPS) members in Anjani Village, East Lombok District.

2.2 Research Location

This study was implemented at the Voting Committee (Panitia Pemungutan Suara/PPS) secretariat located in Anjani Village, Suralaga District, East Lombok Regency, West Nusa Tenggara Province, Indonesia. The research methodology encompassed sequential stages commencing with requirements analysis and concluding with system testing and validation

2.3 Research Subjects and Objects

The research subjects encompass members of the Voting Committee (PPS) in Anjani Village, Suralaga District, consisting of 3 primary members and 3 administrative staff from the village government. Additionally, the research subjects include prospective Voting Organizing Group (KPPS) members from the previous election cycle selected for data analysis, as well as PPS leadership who provided criterion weights, parameter values, and performance thresholds through in-depth interviews.

The research objects focus on the KPPS member selection process encompassing candidate registration announcements, administrative verification, public consultation, and official appointment procedures. This research analyzes six evaluation criteria determined based on consultation with PPS leadership: Education (30%), Health Status (20%), Age (10%), Experience (25%), Interview Performance (5%), and Test Score (10%). The research objectives also include a candidate pool of 10 participants (A1-A10) representing KPPS member candidates from the previous election cycle distributed across 3 polling stations (TPS) in Anjani Village. Furthermore, the research objectives encompass KPPS member eligibility requirements including Indonesian citizenship, age range of 17-55 years, moral integrity, non-partisan status, local residency, physical and mental fitness, and a clean criminal record.

The research population consists of prospective KPPS members in Anjani Village, East Lombok Regency. The research sample comprises 10 candidates (A1-A10) representing participants from the previous election cycle, selected through purposive sampling to demonstrate system functionality across various qualification levels. The analyzed data includes educational backgrounds, health verification results, age classifications, prior election experience levels, interview scores, and written examination results. This data was subsequently processed through the SMART methodology to generate objective, criterion-based rankings for KPPS member selection.

2.4 System Development Methodology

This research comprises multiple fundamental stages structured sequentially as outlined below:

2.4.1 Requirements Analysis Phase

The requirements analysis phase involves comprehensive data and information collection pertaining to the KPPS member selection procedures and processes. This phase utilizes multiple data collection methods including semi-structured interviews with key stakeholders, direct observation of selection procedures, documentation analysis, and structured questionnaires to gather comprehensive system specifications.

Data collected through semi-structured interviews were subjected to analysis and computation using the Simple Multi-Attribute Rating Technique (SMART) methodology.

The critical data elements required for this research encompass: evaluation criteria specifications, weighted criterion values, parameter values for each criterion, and performance passing thresholds for candidate qualification.

a. Evaluation Criteria and Weightings

The identification and determination of evaluation criteria and their corresponding weightings constitute essential components for solving the KPPS member selection decision-making problem. This determination requires comprehensive data collection from the PPS Chairperson of Anjani Village regarding criterion significance and relative importance. The research employs four primary evaluation criteria: educational qualifications, age classification, health status, and prior electoral experience. The specific criteria definitions and their corresponding weightings are detailed in Table 1 below

Table 1: Criteria and Weightings
[Source: Author, 2025]

Criterion Code	Criterion Name	Weight
K1	Education	30
K2	Health Status	20
K3	Age	10
K4	Experience	25
K5	Interview Performance	5
K6	Test Score	10

b. Parameter Values for Evaluation Criteria

Following the establishment of evaluation criteria and their respective weightings, parameter values for each criterion category are subsequently determined and specified. The parameter values are designed to allow future modification and adjustment according to the operational decisions or institutional policies established by the relevant administrative officers. The specific parameter values for each evaluation criterion, derived from primary data collection with the Chairperson of PPS Anjani Village, are presented in Table 2 below.

Table 2: Criterion Parameter Values
[Source: Author, 2025]

Criterion Code	Criterion Name	Sub-Criterion	Parameter Value	Weight
K1	Education	High School (SMA)	20	30%
		Bachelor's Degree (S1)	30	
		Master's Degree (S2)	50	
K2	Health Status	Healthy (Sehat)	100	20%
		Unhealthy (Tidak Sehat)	0	
K3	Age	Age 17-35 years	50	10%
		Age 26-40 years	30	
		Age 41-55 years	20	
K4	Experience	Highly Experienced	45	25%
		Moderately Experienced	35	
		No Experience	20	
K5	Interview Performance	Score 90-100	50	5%
		Score 70-89	35	
		Score 50-69	20	
		Score <50	10	
K6	Test Score	Score 90-100	50	10%
		Score 70-89	35	
		Score 50-69	20	
		Score <50	10	

c. Alternative Candidates

In this research, the decision alternatives represent prospective KPPS member candidates derived from the roster of previous electoral cycle participants.

The alternative candidate dataset was systematically collected from PPS members of Anjani Village representing prior election administration experience. The comprehensive list of alternative candidates is presented in Table 3 below.

Table 3: Alternative Candidates
[Source: Author, 2025]

No	Code	Name Alternative	No TPS
1	A1	Azman Ali, S.Pd	01
2	A2	Dwiki Amar Anshori	01
3	A3	Wira Hadi Kusuma	01
4	A4	Alfan Jayadi Saputra, S.H	02
5	A5	Rifki Amalia	02
6	A6	Astika Wahyuni, S.Pd	02
7	A7	Teni Susanti, S.Ak	02
8	A8	Almuhajiri	03
9	A9	Endi Hartono, S.Sos	03
10	A10	Yusraini Nazri Alfia	03

2.5 Manual Computation Process

2.5.1 Weight Normalization

Normalization constitutes the initial computational step wherein individual criterion weights are standardized through division by the total sum of all criterion weights. This procedure is executed by first calculating the aggregate sum of all criterion weight values, followed by dividing each respective criterion weight by this total sum to obtain normalized weight values. The results of the criterion weight normalization process are presented in Table 4 below

Table 4: Normalization
[Source: Author, 2025]

Criterion Code	Criterion Name	Weight	Normalisasi
K1	Education	30	30/100
K2	Health Status	20	20/100
K3	Age	10	10/100
K4	Experience	25	40/100
K5	Interview Performance	5	5/100
K6	Test Score	10	10/100

2.5.2 Alternative Performance Values

Performance values for each candidate alternative are systematically assigned across all evaluation criteria. These alternative values constitute the input data necessary for executing the SMART methodology calculation procedures. The comprehensive tabulation of alternative performance values across all criteria is presented in Table 5 below.

Table 5: Alternative Values
[Source: Author, 2025]

No	Alternative code	K1	K2	K3	K4	K5
1	A1	S1	Healthy	17 s/d 25 years	Highly Experienced	Score 90-100
2	A2	SMA	Healthy	17 s/d 25 years	Moderately	Score 90-100
3	A3	SMA	Healthy	17 s/d 25 years	Highly Experienced	Score 70-89
4	A4	S1	Unhealthy	17 s/d 25 years	No Experience	Score 70-89
5	A5	SMA	Healthy	17 s/d 25 years	Highly Experienced	Score 70-89

6	A6	S1	Healthy	17 s/d 25 years	Moderately	Score 70-89
7	A7	S1	Healthy	26 s/d 40 years	Highly Experienced	Score 70-89
8	A8	SMA	Healthy	17 s/d 25 years	Moderately	Score 90-100
9	A9	S1	Unhealthy	26 s/d 40 years	Highly Experienced	Score 90-100
10	A10	SMA	Healthy	17 s/d 25 years	Highly Experienced	Score 70-89

2.5.3 Utility Value Determination

The utility value computation process requires preliminary data conversion wherein raw criterion data are transformed to conform with established parameter value specifications. The complete criterion parameter value scheme is presented in Table 2. Following parameter value definition, the subsequent procedural step involves systematic data conversion whereby raw criterion values are mapped to established parameter values, and the maximum and minimum values of the converted dataset are identified and documented. These converted criterion values are essential for subsequent utility function calculations. The comprehensive data conversion results are presented in Table 6.

Table 6: Data Conversion
[Source: Author, 2025]

Alternative Code	K1	K2	K3	K4	K5
A1	30	100	50	45	35
A2	20	100	50	35	35
A3	20	100	50	45	35
A4	30	0	50	20	50
A5	20	100	50	45	50
A6	30	100	50	35	50
A7	30	100	30	45	35
A8	20	0	50	35	50
A9	30	100	30	45	35
A10	20	100	50	35	35
Nilai Max	**30**	**100**	**50**	**45**	**50**
Nilai Min	**20**	**0**	**30**	**20**	**35**

Upon completion of data conversion, the subsequent computational step involves calculating utility values for each criterion according to the appropriate utility transformation function. For cost-type criteria wherein minimal values are preferable, Equation (2.1) is employed; for benefit-type criteria wherein maximal values are desirable, Equation (2.2) is utilized. The computed utility values derived from the aforementioned calculation procedures are presented in Table 7 below.

Table 7: Computing Utility Values
[Source: Author, 2025]

Alternative Code	K1	K2	K3	K4	K5	K6
A1	100	100	100	100	0	50
A2	0	100	100	60	0	100
A3	0	100	100	100	100	0
A4	100	0	100	0	100	50
A5	0	100	100	100	100	0
A6	100	100	100	60	100	0
A7	100	100	0	100	0	50
A8	0	0	100	60	100	0
A9	100	100	0	100	0	50
A10	0	100	100	100	0	0

2.5.4 Final Score Computation

Upon completion of utility value calculation for each candidate alternative across all evaluation criteria, the subsequent procedural step involves aggregating these utility values to compute the final overall score for each alternative. The final score computation is performed according to Equation (2.3), which aggregates weighted utility values across all criteria.

Based on the comprehensive computational analysis of all candidate alternatives utilizing the SMART methodology, final aggregate scores have been systematically calculated. The qualification thresholds were established through consultation with the PPS Chairperson. Candidate alternatives are classified into three categories according to their final scores: candidates achieving final scores of 60 points or above are classified as "SELECTED" for primary consideration; those achieving scores between 40 and 59 points are classified as "ALTERNATE" for secondary consideration; and those achieving scores below 40 points are classified as "NOT SELECTED." The comprehensive final results with corresponding candidate classifications are presented in Table 8 below.

Table 8: Final Score Computation
[Source: Author, 2025]

No TPS	Alternative	Final Score	Result
01	A1	105	SELECTED
03	A2	64	SELECTED
01	A3	75	SELECTED
01	A4	50	ALTERNATE
02	A5	75	SELECTED
01	A6	89	SELECTED
01	A7	95	SELECTED
03	A8	39	ALTERNATE
02	A9	95	SELECTED
03	A10	70	SELECTED

2.6 System Design Architecture

The system design and development workflow utilizes UML (Unified Modeling Language) tools, encompassing use case diagrams, activity diagrams, and class diagrams[14].

2.6.1 Use Case Diagram

Use case diagrams are employed to illustrate how actors interact with the system. The developed system incorporates two primary actors: the Voting Committee (PPS) and community members registering as candidates. The interactions between actors and system components are illustrated in Figure 1.

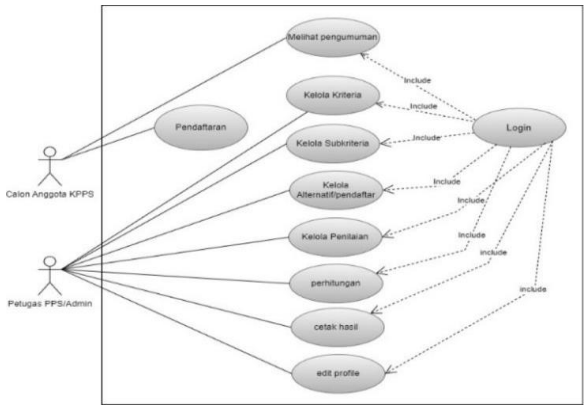

Figure 1. Use Case Diagram
[Source: Author, 2025]

2.6.1 Activity Diagram

a. Candidate Registration Activity Diagram

Community members and prospective KPPS member candidates must complete system registration to establish user accounts. Following complete data entry, the information is stored in the database. If data entry is incomplete or fails validation, users must repeat the registration process until all form fields are properly completed. The registration activity diagram is presented in Figure 2.

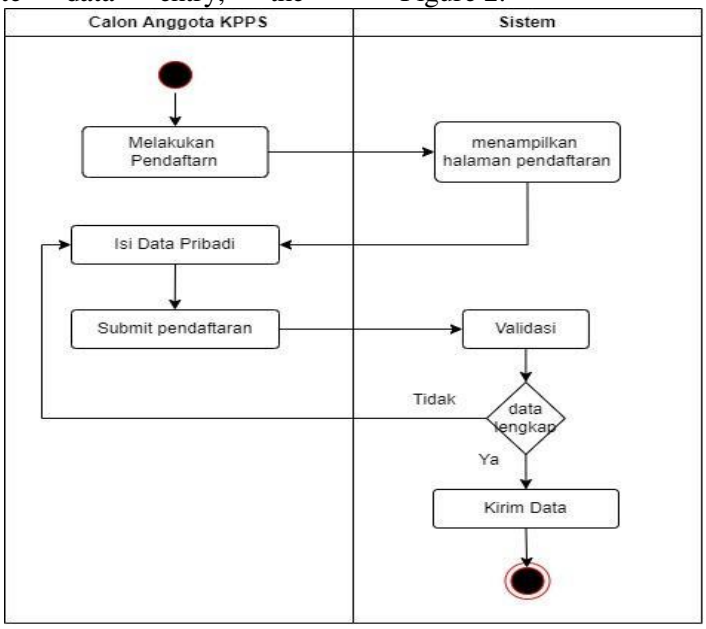

Figure 2. Registration Activity Diagram
[Source: Author, 2025]

2.6.2 Candidate Evaluation Activity Diagram

Administrative officers possess the capability to add, edit, delete, and view evaluation details. Following evaluation completion, the system executes SMART methodology calculations. Upon successful computation, the system displays calculation results to the officer. The evaluation activity diagram is presented in Figure 3.

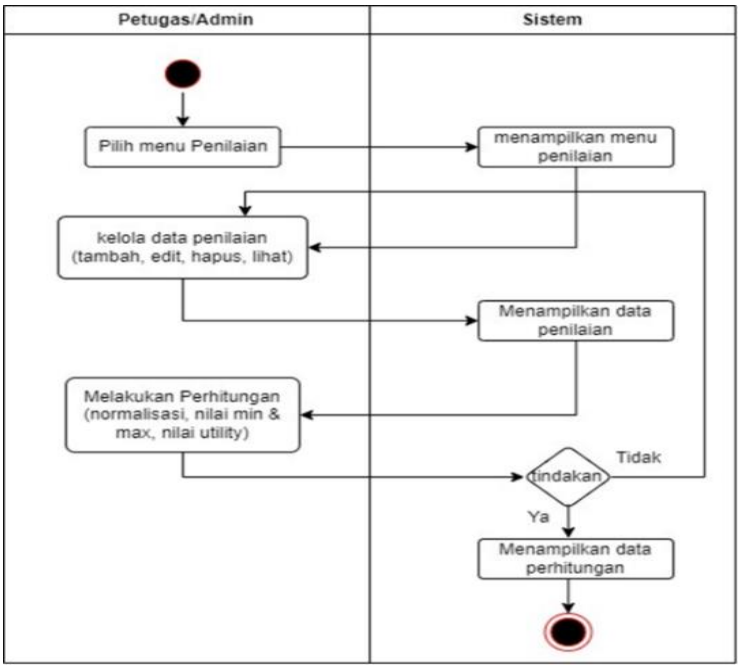

Figure 3. Evaluation Activity Diagram
[Source: Author, 2025]

2.6.3 Final Results Activity Diagram

Administrative officers can print final result data corresponding to the executed SMART calculations. If results are verified as correct, officers proceed with data printing; if discrepancies are identified, the process returns to evaluation for correction. The final results activity diagram is presented in Figure 4.

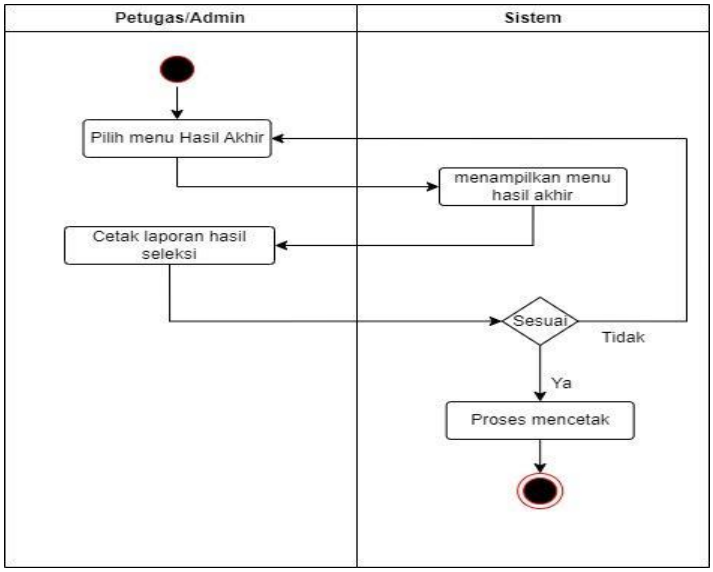

Figure 4. Final Results Activity Diagram
[Source: Author, 2025]

2.7 Class Diagram for KPPS Member Selection

The class diagram illustrates inter-class relationships, class attributes, and methods defining the operational behaviors of each class[15]. The complete class diagram is presented in Figure 5.

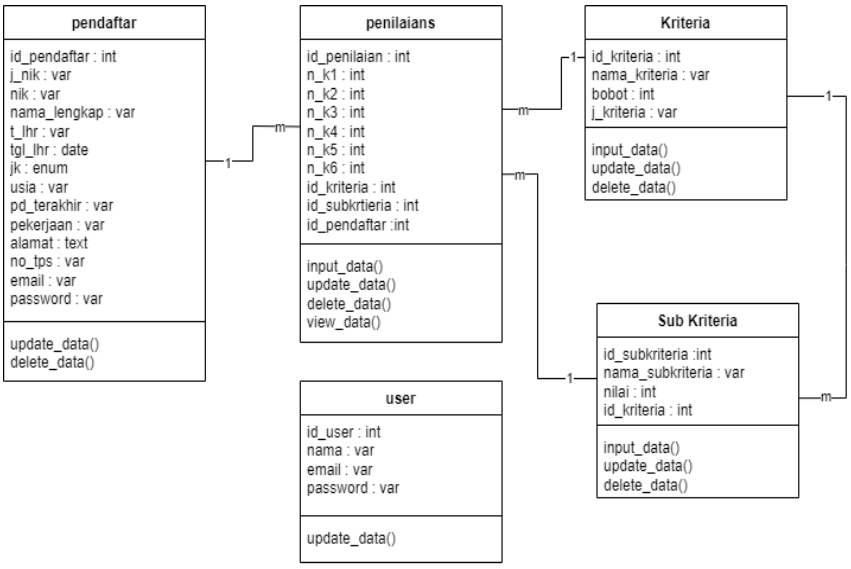

Figure 5. Class Diagram
[Source: Author, 2025]

2.7 System Testing and Evaluation Scenarios

2.7.1 Black Box Testing

The primary objective of Black Box Testing is to evaluate the functionality of the software based on user requirement specifications without considering the internal structure or source code of the application[16]. This testing approach focuses on the external behavior of the system by assessing the consistency

between the provided inputs and the generated outputs.

The testing scenarios implemented using the Black Box technique include the following processes: registration, evaluation, and announcement.

2.7.2 User Acceptance Test

A User Acceptance Test (UAT) was conducted to assess the level of user satisfaction and system effectiveness from the end-user perspective[17] regarding the web-based Decision Support System employing the SMART method for the selection of KPPS members. The primary objective of this evaluation was to ensure that the developed system met user requirements, demonstrated ease of use, and provided accurate as well as efficient decision-making outcomes.

The UAT involved 12 respondents, consisting of 10 prospective KPPS members, 1 village-level PPS operator, and 1 internal supervisor. The testing process was carried out through direct observation and the administration of questionnaires utilizing a five-point Likert scale (1–5) to evaluate several key aspects, including ease of use, system responsiveness, clarity of decision-making results, reliability, and overall user satisfaction.

Table 9: Test Scenario
[Source: Author, 2025]

No	Test Scenario	Expected Result
1	Login and access the main menu	The dashboard is displayed correctly
2	Input KPPS candidate data	Data is saved without errors and properly validated
3	Automatic selection process using the SMART method	The system generates accurate recommendations according to the defined criteria
4	Review and export decision results	The decision report can be downloaded in PDF
5	User feedback through questionnaire	Users provide system evaluations using a 1–5 rating scale

3. RESULT AND DISCUSSION

3.1 System Implementation and User Interface

The following section presents the user interface displays and implementation results of the Decision Support System for KPPS Member Selection developed utilizing the Simple Multi-Attribute Rating Technique (SMART) methodology

3.1.1 Candidate Registration Interface

Prospective KPPS members must complete system registration to participate in the KPPS member selection process. The registered account enables users to subsequently access selection announcement information and participate in the evaluation procedures. The candidate registration interface is presented in Figure 6

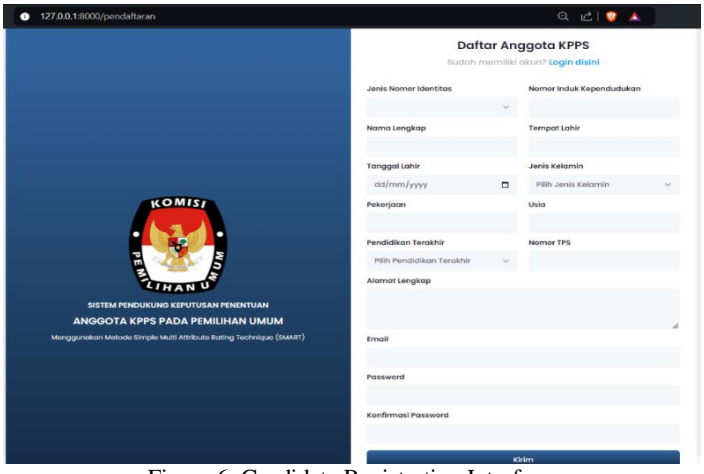

Figure 6. Candidate Registration Interface
[Source: Author, 2025]

3.1.2 SMART Computation Results Display Interface

This interface displays the SMART methodology computational processes and results including criterion weight normalization through utility value determination. The computation results display interface is presented in Figure 7

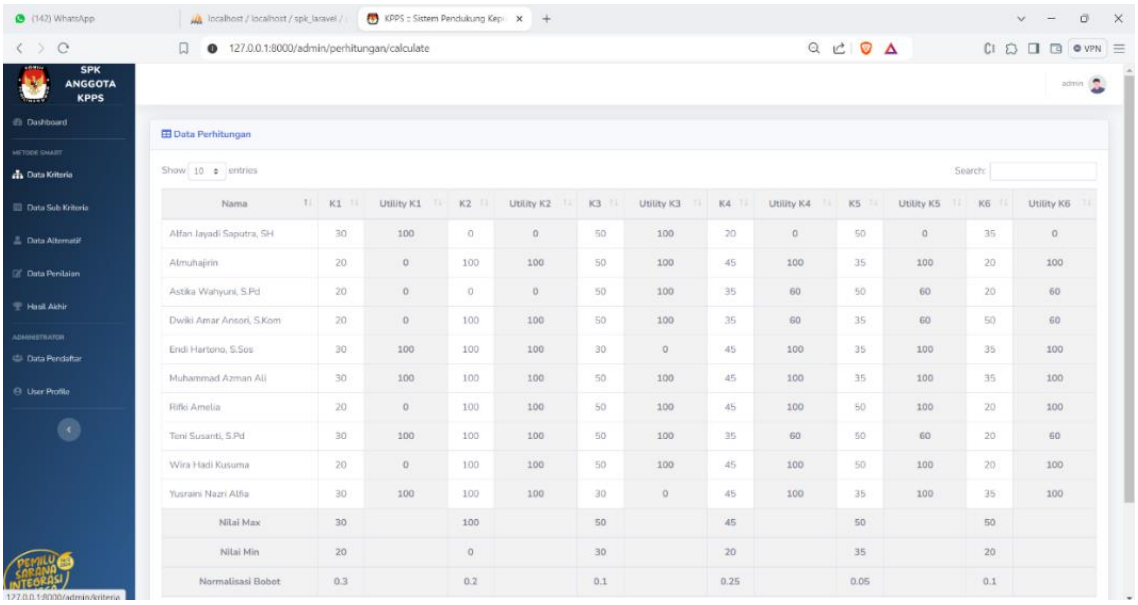

Figure 7. SMART Computation Results Display Interface
[Source: Author, 2025]

3.1.3 Final Results Display and Reporting Interface

This interface displays the final evaluation results generated by administrative officers according to SMART methodology computations. The interface provides functionality to export evaluation results as printed reports for official documentation. The final results interface is presented in Figure 8

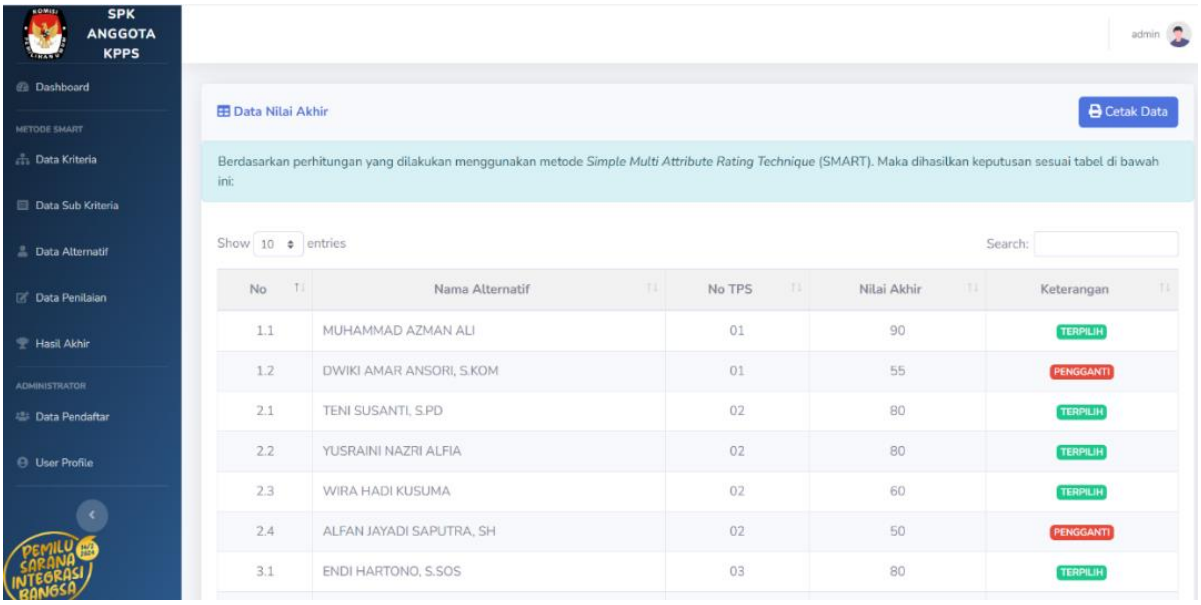

Figure 8. Final Results Display and Reporting Interface
[Source: Author, 2025]

3.2 System Testing and Validation

3.2.1 Black Box Testing

The KPPS member selection decision support system undergoes evaluation using black-box testing methodology. Black-box testing focuses on software correctness determined solely by the outputs produced by the system in response to specified input data and

conditions, without examining the internal processing procedures. Through analysis of system outputs, both the program's capability to satisfy user requirements and potential system errors can be identified and measured.

Table 10: Black Box Testing
[Source: Author, 2025]

No.	Function Tested	Testing Procedure	Expected Results	Test Results	Status
01	Registrant Data Page	Select registrant data menu	Display all registered KPPS candidate applicant data; enable document download	All registered candidates displayed with download capability	Passed
02	Evaluation Page	Select evaluation menu; perform: 1. Add evaluation, 2. View data, 3. Edit data, 4. Delete data, 5. Execute calculation	a. Display add form and successfully save, b. Display evaluation details including biodata and scores, c. Display edit form and successfully update, d. Display saved data, e. Display SMART calculation results including weights, criterion values, and utility values	All functions executed successfully with correct calculations	Passed
03	Final Results Page	Select final results menu and print data to generate report	Display final scores from calculation process; enable document download	Results displayed and document export functional	Passed

3.2.2 User Acceptance Test Result

The results of the User Acceptance Test (UAT) indicate that, among the 12 respondents who participated in the system trial, the average user satisfaction level reached 4.3 on a 5-point scale. Furthermore, the system's effectiveness in supporting the decision-making process was recorded at 93%. These findings demonstrate that the system has performed effectively, is user-friendly, and provides tangible benefits to its users.

Table 11: User Acceptance Test Result
[Source: Author, 2025]

Testing Aspect	Average Score (1–5)	Description
Ease of Use	4.4	Excellent
System Speed	4.2	Good
Clarity of Decision Results	4.3	Good
System Reliability	4.1	Good
Overall Satisfaction	4.3	Excellent

4. CONCLUSION

Based on the results of Black Box Testing and User Acceptance Testing (UAT), it can be concluded that the web-based Decision Support System (DSS) for the selection of KPPS members using the SMART (Simple Multi-Attribute Rating Technique) method successfully met the objectives of this

research. The findings from the Black Box Testing indicate that all major system functionalities—including registration, evaluation, and the presentation of final selection results—performed correctly and produced outputs consistent with the expected outcomes. These results demonstrate the reliability and computational accuracy of the system in processing data related to prospective KPPS members and generating appropriate decision recommendations based on the SMART method.

Furthermore, the UAT findings gathered from twelve (12) respondents revealed an average user satisfaction score of 4.3 out of 5, with a system effectiveness rate of 93%. These results suggest that the developed system is user-friendly, efficient, and capable of providing effective decision support, particularly in facilitating the objective selection of KPPS members.

Overall, the evaluation confirms that the developed Decision Support System is functionally robust, easy to use, and effective in enhancing a transparent and objective selection process for KPPS membership.

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