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Decision Support System for Selecting BPS Central Tapanuli Partners Using the SMART Method

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Abstract
The selection of partners at the Central Statistics Agency (BPS) of Central Tapanuli is a very important process because it determines the quality of supporting staff in census and survey activities. One of the core stages in the selection process is the interview, which functions to directly evaluate the abilities and character of prospective partners. The assessment in the interview covers several main aspects, namely analytical skills, communication, appearance, and politeness. This study aims to design a decision support system based on the SMART (Simple Multi Attribute Rating Technique) method that can help process interview results systematically and objectively. Each criterion in the interview is given a weight based on the level of importance, then the value of each candidate is processed through mathematical calculations that produce a final score. This score is used to determine the candidate's ranking and provide recommendations to the selection committee. The system is developed in the form of a web-based application with a user-friendly interface, and supports data input, value processing, and automatic presentation of results. The implementation results show that the SMART method is able to improve assessment accuracy, reduce subjectivity, and accelerate the decision-making process in partner selection. With this system, the interview process is not only a fairer and more transparent means of assessment, but also supports work efficiency and consistency of selection results in the BPS environment.

1. Introduction

The Central Statistics Agency (BPS) of South Tapanuli is a non-ministerial government institution that plays a crucial role in providing accurate and reliable basic statistical data for government and community needs at both national and regional levels [1]. In conducting surveys and censuses, BPS does not solely rely on internal staff but also requires field partners with high technical competence and strong work integrity. Therefore, the partner selection process is a critical stage, as it directly affects the quality of the data collected [2] To ensure an objective and accurate selection process, a decision support system is needed to assist in identifying the best partners based on predetermined criteria. Additionally, BPS is also responsible for data collection, preparation of statistical publications, and data analysis that serves as the foundation for government policy-making [2]

However, in reality, the partner selection process at BPS South Tapanuli is still carried out manually and tends to be subjective [3]. This condition may lead to selection outcomes that do not align with technical needs in the field, thereby potentially reducing the quality of the data obtained. Furthermore, the manual process is prone to recording errors, less efficient in terms of time, and lacks consistency in decision-making [4] One solution that can be applied is the implementation of a decision support system [5], which is an information system specifically designed to help management make decisions for semi-structured and unstructured problems [6]. Previous studies in business and financial management contexts have also addressed application selection based on specific criteria using various decision-making approaches, indicating that similar methods are very feasible and relevant to be applied in institutional contexts like BPS [7]

The SMART (Simple Multi-Attribute Rating Technique) method has been identified as a suitable approach due to its clarity, flexibility, and ability to generate accurate and objective decisions [8] Compared to other methods such as MOORA and SAW, SMART tends to yield higher decision accuracy. However, in situations involving smaller datasets, the MOORA (Multi-Objective Optimization on the basis of Ratio Analysis) method is also considered effective due to its efficiency in processing limited data . SMART offers advantages in handling various types of criteria—both quantitative and qualitative—in a systematic and measurable manner [9] This method enables the grouping and evaluation of alternatives based on predefined attributes or criteria, resulting in a more structured and objective decision-making process [10].

While SMART is widely known and used in decision support systems, this study presents a novel contribution by applying SMART specifically to the context of partner selection for BPS operations—an area with limited prior research[11]. Unlike previous applications of SMART in general public sector recruitment, this study incorporates criteria tailored to BPS's specific statistical, administrative, and collaborative requirements [12] The SMART method is highly suitable for the partner selection process at BPS South Tapanuli, considering that the process involves various aspects such as analysis skills, communication, appearance, politeness, and courtesy [9] With SMART, each criterion can be weighted appropriately, and the final score for each candidate can be calculated based on defined preferences [13]. This allows the selection process to be carried out more objectively, efficiently, and fairly. Additionally, applying the SMART method strengthens the decision support system by improving the accuracy and transparency of partner selection while minimizing subjectivity often found in manual procedures [14]

The data used in this study were obtained from the 2024 BPS South Tapanuli partner selection interview documents, which contain information about candidate identities, individual criterion scores, and final results in the form of recommendations (Recommended, Highly Recommended, or Not Recommended). By applying the SMART method to this data, the system provides objective final score calculations, enabling the selection committee to identify the best candidates more easily, fairly, and transparently [15]

Therefore, the development of a decision support system based on the SMART method is not only a solution to technical issues in the partner selection process [16] but also represents an innovation in enhancing human resource governance within BPS. This system is expected to accelerate the selection process, reduce the workload of the committee, and improve the quality of the outcomes, making them more measurable and accountable.

2. Research Method

The method used in this research involved several stages. During the data collection process, the author conducted direct observations of the 2024 partner registration selection stages at the Central Statistics Agency (BPS). These observations were carried out meticulously by referring to the official guidebook provided by the Head of BPS. This guidebook served as a crucial reference in understanding the flow and mechanisms of the selection process, ensuring that the information collected was accurate and reflected the real conditions in the field.

In addition to observation, a literature review was conducted by exploring various relevant sources to support the system development process. The literature reviewed included documents related to BPS partner recruitment and studies discussing the implementation of the SMART method in decision support systems. This helped establish a theoretical foundation and ensured the study was aligned with prior work in the field.

Furthermore, the author conducted a real (non-synthetic) interview with the Head of the Central Statistics Agency of Central Tapanuli, who was directly involved in the partner recruitment process. The interview was semi-structured, allowing deeper exploration of specific themes relevant to the study. To ensure research ethics and data privacy, the interview data were anonymized by removing any personal identifiers. The validity of the interview data was confirmed through member checking, where the key points obtained were re-verified with the interviewee to ensure accuracy and credibility of the information [17]

To evaluate the selected partners, the Simple Multi-Attribute Rating Technique (SMART) method was applied. The process begins by assigning weights to each criterion, which are then normalized so that their total equals one

$$w_i = \frac{b_i}{\sum b_i}$$

where w_i is the normalized weight of criterion i, and b_i is the original weight of the criterion

To provide a clearer understanding of the system logic, a flowchart was designed to illustrate the decision-making process in the SMART-based decision support system. Figure 1 presents the visual representation of the system flow, starting from data input and criteria weighting, to the evaluation and ranking of alternative candidates.

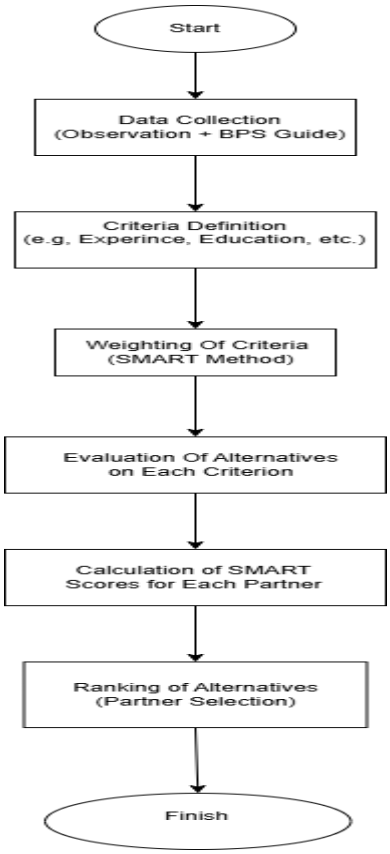

Figure 1. System Flow

In addition to data analysis and system design, this study also employs a system development approach that focuses directly on implementation through a website-based platform. This strategy was selected to enable immediate testing of the previously designed decision support system, as well as to evaluate its functionality and effectiveness in supporting the partner selection process at the Central Statistics Agency (BPS).

This study also employs a system development approach that focuses directly on implementation through a website-based platform. This strategy was selected to enable immediate testing of the previously designed decision support system, as well as to evaluate its functionality and effectiveness in supporting the partner selection process at the Central Statistics Agency (BPS). Several important activities were carried out during the implementation phase, including user interface design, programming, and comprehensive testing to ensure the system meets the requirements and expectations of its users. The development process began with the construction of the basic page structure using HTML (HyperText Markup Language), which forms the foundational layout of the website. To enhance the visual quality and adaptability of the interface across various devices, CSS (Cascading Style Sheets) was used to manage the appearance and layout of web elements. Additionally, the Bootstrap framework was integrated to enable the development of an interactive and responsive interface, significantly expediting the interface design process. For the backend functionality, the system utilized PHP (Hypertext Preprocessor) to handle application logic and serve as a bridge between the user interface and the database. Data management and storage were handled using MySQL, a reliable relational database management system particularly suitable for managing information related to BPS partner recruitment. The synergy between PHP and MySQL ensured that the application performed efficiently and responsively, fulfilling the intended functions designed during the system development phase.

3. Result and Discussions

The Simple Multi Attribute Rating Technique (SMART) is one of the approaches in multi-criteria decision making, developed by Edward in 1977. This technique operates on the principle that every alternative in a decision-making process consists of multiple criteria, each carrying a specific value. Every criterion is assigned a weight that represents its relative importance compared to the others. These weights are essential in evaluating and comparing the available alternatives in order to identify the most optimal option. In practice, the SMART method applies a linear additive model to estimate the value of each alternative being considered. This model enables a systematic and structured process in evaluating and ranking alternatives based on the weight assigned to each criterion. Due to its ability to handle both quantitative and qualitative data, SMART is regarded as a flexible method suitable for a wide range of decision-making contexts and can be easily tailored to meet various user needs. The calculation process using the SMART method involves several stages. It begins with the identification of criteria that serve as the basis for evaluating alternatives. These criteria must be relevant, measurable, and clearly defined to ensure an effective assessment process. Typically, the determination of criteria is based on input from stakeholders or experts who understand the decision context, which ensures that the evaluation remains objective and justifiable. Once the criteria are established, the next step is to assign weights to each criterion according to their level of importance in the decision-making process. After assigning weights, a normalization process is conducted to ensure that all weights are scaled consistently and can be compared proportionally across criteria.

$$w_i = \frac{w^i j}{\sum_{j=1}^{m} wj}$$

where w_i is the normalized weight of the i criterion, wij is the raw weight of the i criterion, and m is the total number of criteria.

After assigning scores to each criterion for every alternative, the next step is to calculate the utility value by normalizing the scores into a standard scale. This normalization considers whether the criterion falls under the *benefit* or *cost* category. For *cost* criteria, the utility value is calculated using:

$$u_j(a_i) = \frac{c_{max} - c_{out}}{c_{max} - c_{min}}$$

Meanwhile, for *benefit* criteria, the formula used is:

$$u_j(a_i) = \frac{c_{out} - c_{min}}{c_{max} - c_{min}}$$

where $u_j(a_i)$ is the utility value of the j −th criterion for the i-th alternative, c_{max} is the maximum score of the criterion, c_{min} is the minimum score, and c_{out} is the actual score for that criterion. Once the utility values are obtained, the final value for each alternative is calculated by multiplying each utility value with its corresponding normalized weight and summing the results:

$$u_j(a_i) = \sum_{j=1}^{m} wj * u_j(a_i)$$

where $u_j(a_i)$ is the final score of the i-th alternative, wj is the normalized weight of the j-th criterion, and $u_j(a_i)$ is the utility value for that criterion. Finally, alternatives are ranked from the highest to the lowest final score, with the highest score indicating the most recommended choice in the decision-making process.

At the system implementation stage, the development process is structured into several key components to support the decision-making mechanism in selecting BPS partners in Central Tapanuli Regency. One of the initial steps involves determining the criteria that form the basis for evaluation. The criteria used in this system include analytical ability, communication skills, appearance, and politeness or courtesy. Each criterion is assessed on a scale ranging from 1 to 100, allowing a standardized evaluation for every candidate. Analytical ability reflects logical thinking and problem-solving skills; communication skills assess how effectively a candidate conveys ideas; appearance relates to neatness and professional presentation; and politeness and courtesy gauge respectful behavior during interactions.

Following the determination of criteria, the next stage involves assigning weights to each criterion according to its level of importance in the overall decision-making process. This weighting is essential to ensure that more critical attributes have a greater impact on the final selection outcome. In this study, analytical ability is given the highest weight of 50, considering its significant role in field data collection and processing. Communication skills are assigned a weight of 30, while appearance and politeness each receive a weight of 10. These weights are then normalized during the calculation process to maintain proportionality and comparability in the final scoring system.

Table 1. Criteria name

Criteria	**Weight**
Analytical Ability (C1)	50
Communication Skills (C2)	30
Appearance (C3)	10
Polite and Courteous (C4)	10

At this stage, each alternative is assessed based on previously established criteria. Details of the alternatives and their scores against each criterion are shown in the following table.

Table 2. Alternative

ALTERNATIVE	CRITERIA			
	C1	C2	C3	C4
A1	60	80	80	70
A2	80	90	70	60
A3	90	80	70	60
A4	80	90	90	90
A5	80	90	70	80

In this section, the SMART method calculation begins with the normalization of each criterion's weight using a predetermined equation. This normalization ensures that the contribution of each criterion is proportional in the overall scoring system. The normalization formula used is:

$$w_i = \frac{w^i j}{\sum_{j=1}^{m} wj}$$

Information :
w_i: normalized criteria weight
w^i: weight of the i-th criterion wj:
weight of jth criterion
j:1, 2,3,…, m number of criteria

The results of the normalization calculations are as follows:

Table 3. Normalization calculations

CRITERIA	**C1**	**C2**	**C3**	**C4**
WEIGHT	0.5	0.3	0.1	0.1

At this stage, the utility value is calculated with the following results.

Table 4. Alternative utility value

ALTERNATIVE	**C1**	**C2**	**C3**	**C4**
A1	0	0	0.5	0.333333
A2	0.666667	1	0	0
A3	1	0	0	0
A4	0.666667	1	1	1
A5	0.666667	1	0	0.666667

This stage is used to calculate the final result using the following equation.

$$u_j(a_i) = \sum_{j=1}^{m} wj * u_j(a_i)$$

Information:
$u_j(a_i)$: total value for the i-th alternative
w_j : normalized value of the jth criterion weight
$u_j(a_i)$: utility value of the jth criterion for the i-th alternative

Table 5. Final Result

ALTERNATIVE	**C1**	**C2**	**C3**	**C4**	**RESULTS**	**RANK**
A1	0	0	0.05	0.033333	0.083333	5
A2	0.333333	0.3	0	0	0.633333	3
A3	0.5	0	0	0	0.5	4
A4	0.333333	0.3	0.1	0.1	0.833333	1
A5	0.333333	0.3	0	0.066667	0.7	2

This stage includes the system design process through context diagram modeling, which is used to describe the entire system and identify users who interact directly with the system. The context diagram is shown in the following figure.

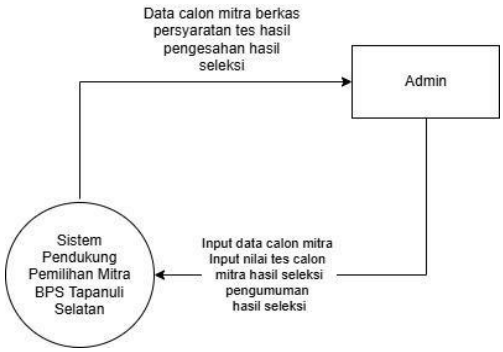

Figure 2. Context Diagram

At this stage, the system implementation begins with writing the program code using the PHP programming language. The results can be seen below:

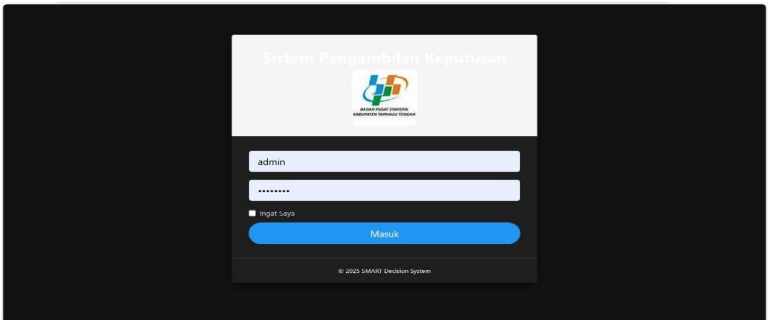

Figure 3. Log in Page

The login page provides columns for entering a username and password, along with a Log In button which is used to access the system.

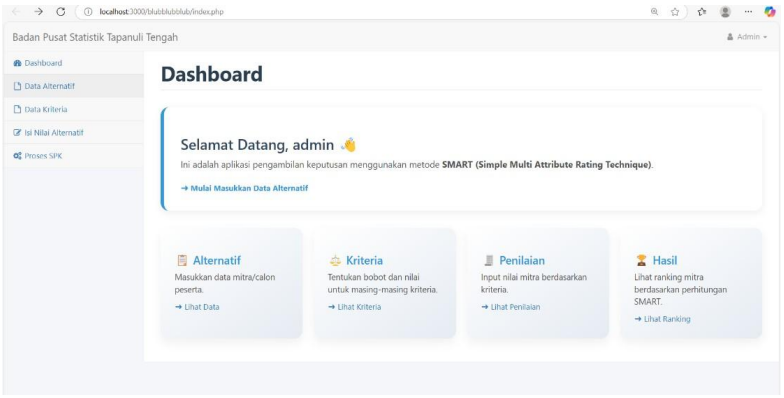

Figure 4. Main Page

The main page will be displayed after the user has successfully logged in. In it there are several menus, such as the data menu which is used to add alternatives and criteria, as well as weighting their values. The Calculate menu functions to run the calculation process using the SMART method based on the data that has been entered.

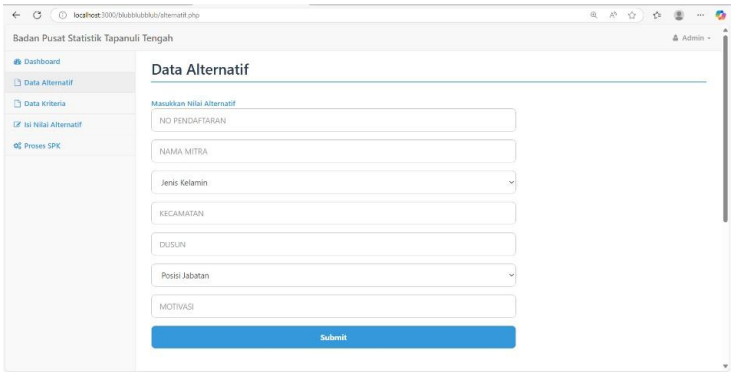

Figure 5. Alternative Data Page

The Alternative Data page is used to enter information on prospective BPS partners, such as registration number, name, gender, sub-district, hamlet, job position, and motivation. The data entered will be stored in the system as material in the decision calculation process using the SMART method.

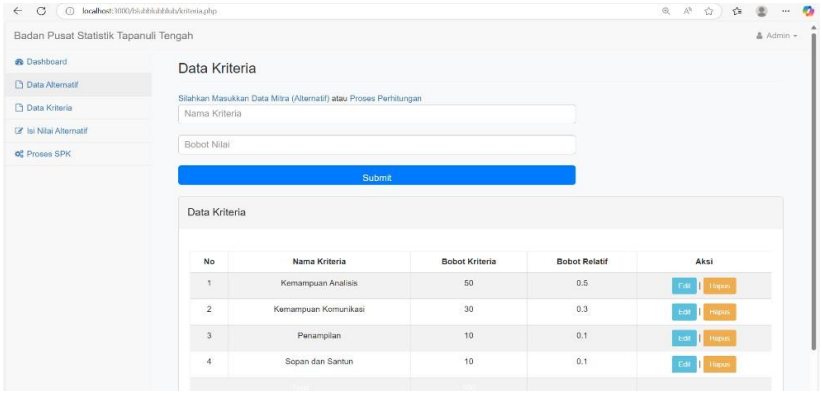

Figure 6. Criteria Page

The Criteria Data page is used to add and manage the assessment criteria for potential partners. Admin can enter the criteria name and its weight, then the system will calculate the relative weight automatically.

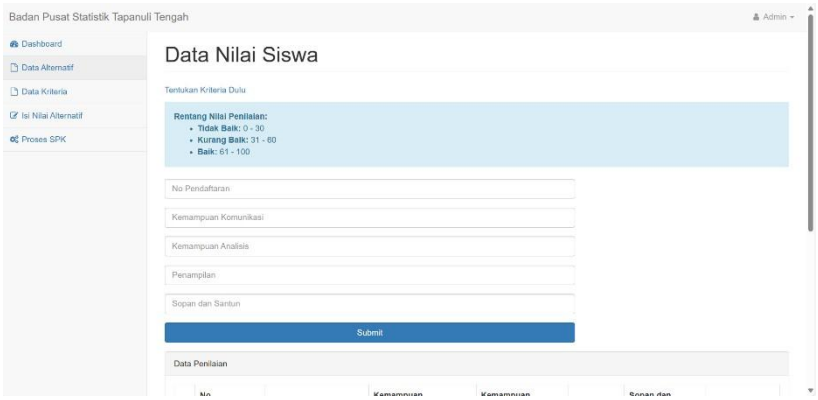

Figure 7. Student Grade Page

The Student Grade Data page is used by the admin to fill in the grades of each prospective partner based on previously determined criteria. The admin enters the registration number and fills in the grades in each criteria column such as Communication Skills, Analytical Skills, Appearance, and Manners.

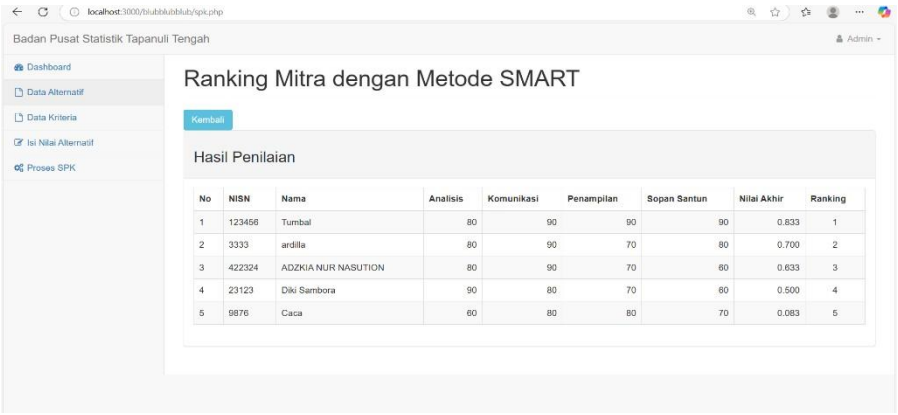

Figure 8. Partner Ranking Page

The Partner Ranking Page with the SMART Method is the final result of the Decision Support System (DSS) calculation process using the SMART (Simple Multi Attribute Rating Technique) method.

4. Conclusions and Future Works

Based on the research results, it can be concluded that interviews are a crucial stage in the partner selection process at BPS Tapanuli Tengah, as they provide a direct means to assess the competencies and personalities of prospective partners. By integrating the SMART method into the decision support system, the evaluation process becomes more structured and objective. Each interview criterion—such as analytical skills, communication, appearance, and manners—is assigned a specific weight that reflects its importance. The system calculates final scores based on these weighted criteria, allowing for fair and transparent ranking of candidates. The implementation of the SMART-based system has proven to improve efficiency, minimize subjective bias, and assist the selection committee in making more accountable and appropriate decisions.

For future research, it is recommended to enhance the system by integrating artificial intelligence (AI)-based ranking mechanisms, which could allow real-time adaptive weighting or automated interview analysis. Additionally, cross-validation with historical recruitment results could be conducted to ensure the reliability and predictive accuracy of the decision support system. Expanding the implementation of this system to other regional BPS offices or even other government institutions could also provide broader insights into its effectiveness and scalability.

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