Application of the TOPSIS Method in the Placement of Measurement Officers at the North Sumatra BPN Regional Office

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Abstract

One of the primary obstacles to accelerating the Complete Systematic Land Registration program is the limited number of surveyors who are civil servants within the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN). This issue is compounded by placement decisions that are still handled manually and subjectively, often resulting in a mismatch between an employee's competencies and the specific requirements of individual land offices. This study proposes a decision-support model based on the TOPSIS to determine the optimal placement of surveyors within the Regional Office of the National Land Agency for North Sumatra Province. Five criteria were employed: length of service (0.20), educational attainment (0.10), technical surveying competence (0.25), measurement productivity (0.30), and the distance from the employee's residence to the assigned location (0.15, treated as a cost attribute). The TOPSIS method involves normalizing the decision matrix, applying weights, identifying positive and negative ideal solutions, calculating the distances to these solutions, and determining preference values. The analysis yielded the following ranking: A7 > A1 > A3 > A9 > A5 > A10 > A4 > A2 > A8 > A6, with A7 identified as the best option (V = 0.7244). Employees were categorized into three groups based on their placement suitability: Group I (four individuals) for land offices with high workloads and complexity; Group II (four individuals) for offices with moderate workloads; and Group III (two individuals) for offices with lower workloads, where the focus is on skill development. The findings demonstrate that the TOPSIS method provides an objective, transparent, and accountable basis for surveyor placement, in alignment with the principles of a merit-based system.

Keywords: *Decision Support System, TOPSIS, Surveyor Placement, Multi-Criteria Decision Making, National Land Agency (BPN)*

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Introduction

Land, as a strategic resource, requires legal certainty regarding its location, boundaries, and area. Thus, to expedite land registration, the government implemented the Complete Systematic Land Registration (PTSL). This is because by 2016, only 40.07% of land in Indonesia was registered [1]. In the series of activities, land measurement is the stage of collecting physical data that determines the quality of the final product in the form of field maps and measurement certificates.

This measurement stage involves surveyors. However, the number of surveyors with Civil Servant status (ASN) in the Ministry of ATR/BPN is still very limited. As a result, the government uses Licensed Surveyors to expedite land registration [2]. Human resources are also considered a major constraint in the implementation of PTSL, according to several implementation studies [3]. These studies also suggest that the workload of field implementers be distributed evenly [1].

The situation in North Sumatra is comparable. In the newly established Dairi Regency, PTSL covers 77,647 ha, or 73.9 percent of 105,069 ha, and one of the potential issues is human resources (Silaban & Suardi, 2023). Due to a shortage of employees, the issuance of certificates in North Tapanuli Regency often exceeds the planned time. In addition, the 2023 target was not achieved [4]. The Regional Office of the BPN of North Sumatra Province is responsible for ensuring that the limited surveyors are properly assigned because it is a vertical institution that establishes district/city land offices.

Because field measurement work is technical and risky, placement accuracy becomes increasingly important. One of the most common issues is the unclear land boundaries and the fact that the parties are absent during the measurement, which disrupts the application of the contradictory delimitation principle [5]. In terms of quality, [6] found that 23 out of 34 land parcels tested did not meet the precision tolerance. The results are influenced by the method used. The results show that the experience, competence, and mastery of measuring equipment by the officers must align with the characteristics of their assigned areas.

From the perspective of HR management, employee placement significantly affects performance [7], [8]. On the contrary, employee placement that does not adhere to the principle of the right person in the right place causes employees to work outside their expertise, increases the workload, and reduces organisational performance [9]. According to Law Number 20 of 2023 concerning the State Civil Apparatus, this principle is in line with the merit system principle. Nevertheless, placement decisions are still made manually in many government agencies, which makes them subjective [10].

Basically, multi-criteria decision-making (MCDM) is a problem of measuring officer placement. The criteria that influence the decision include benefits, such as skills and experience, and costs, such as ongoing workload and distance to the workplace. The two most common MCDM methods are AHP and TOPSIS, according to a bibliometric study of thousands of publications [11], and in the last two decades, both have contributed to the development of hybrid models [12]. With 22% of the reviewed articles, TOPSIS is the most widely used method for ranking alternatives. The concept that the best alternative is closest to the positive ideal solution and farthest from the negative ideal solution is the basis of the ideal solution similarity ranking selection technique [13]. This concept is easy to understand, computationally efficient, and produces preference values that are easy for leaders to comprehend. In a comparative study, TOPSIS had an accuracy 78% greater than SAW (76%), and increased to 80% when the criteria weights were determined using AHP [14].

For personnel decisions, TOPSIS has been widely proven. This was used by [15] to select managers based on seven talent management standards. On the other hand, [10] used it to select positions in the sub-district office. Additionally, TOPSIS is used for the assignment of honorary staff in remote areas [13], the selection of exemplary employees at the Tanjungbalai District Court, North Sumatra [16], and the recruitment of non-civil servant employees at the Soppeng District Land Office [17]. According to the latest systematic review, human resource

management is the field that most extensively utilises the Analytical Hierarchy Process (AHP)—TOPSIS approach in decision support systems [18].

However, there is a clear difference in the research. Research on surveyors and PTSL focuses more on legal and policy [5], [19], but research on TOPSIS in the land sector is newly focused on the employee appointment stage. Additionally, research on employee placement in North Sumatra is still concentrated in other areas, such as teacher placement during the mutation process [3], [20] state that management information systems are very important to support the implementation of PTSL. As far as the author has found, there has been no research using TOPSIS to determine the location of survey officers at the BPN Regional Office.

This research proposes the use of the TOPSIS method as the basis for a decision support system for the placement of measurement officers at the Regional Office of the National Land Agency (BPN) of North Sumatra Province. Criteria that can be considered include technical competence or certification, experience and length of service, performance evaluation results, mastery of measuring equipment, current workload, and distance from residence to duty location. The final criteria are determined by the Regional Office. The research results are expected to produce a fair, clear, and accountable ranking to support a faster land registration process in North Sumatra.

Literature Review

1. Decision Support System (DSS)

A Decision Support System (DSS) is a computer-driven framework that assists decision-makers in analyzing data and models to address semi-structured or unstructured issues. underscores that Decision Support Systems (DSS) serve as instruments to augment decision-making abilities, although do not supplant the discernment of decision-makers. Noted that a Decision Support System (DSS) constitutes a component of an information system that proficiently aids the decision-making process, particularly in educational settings like identifying students' interests and fields of study.

The computer-based system known as a Decision Support System (DSS) helps decision-makers solve semi-structured problems. Instead of providing a consistent calculation basis, DSS does not function as a substitute for leadership. Hmphasises that DSS helps human resource management in situations where decision standards cannot be measured and tend to be subjective.

Multiple Attribute Decision Making (MADM) selects from various existing options, while Objective Decision Making (MODM) makes the best choice (Hwang & Yoon, 1981). MADM includes the placement of measurement officers: the alternatives are the available officers, and the attributes are the assessment criteria. SAW, AHP, TOPSIS, PROMETHEE, and ELECTRE are the most commonly used MADM methods in HR studies in Indonesia.

2. TOPSIS Concept

Hwang and Yoon developed TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) in 1981. The concept is that the best choice is the one closest to the positive ideal solution while being farthest from the negative ideal solution. According to research conducted on a number of publications, TOPSIS is widely used in fields such as human resource management, energy, health, and supply chain. The concept is easy to understand, the calculations are simple, and its ability to accommodate multiple criteria simultaneously makes it appealing.

The TOPSIS method Technique for Order Preference by Similarity to Ideal Solution is based on the idea that the best alternative not only has the shortest distance from the positive ideal solution but also has the farthest distance from the negative ideal solution. To calculate the relative closeness between the chosen alternative and the optimal solution, TOPSIS uses the Euclidean geometric distance (the distance between two points) and the chosen alternative must

be at the closest (farthest) distance from the positive ideal solution and the negative ideal solution [10].

The following process is carried out to solve the problem using the Topsis method (Maria, 2018):

1. Generating a standardised decision matrix

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij^2}}}$$

Where rij is the result of normalising the decision matrix R with i=1,2,.....m; and j=1,2,...n, Xij is the value of alternative (i) against the criterion (j) with i=1,2,...n. i=1, 2,..., m; j=1, 2,..., n.

2. creating a normalised weighted decision matrix with the formula

$$y_{ij} = w_i r_{ij}$$

The place:

In the weighted normalised decision matrix, Yij is the element, and wj is the weight of the j-th criterion. The normalised decision matrix R has rij as its elements.

3. Determine the matrix of positive and negative ideal solutions. The ideal solution with a positive value is marked as A+, while the negative value is marked as A. The following formula is the positive ideal solution, derived from the highest Y value of each criterion's results.

$$A^+ = (y_1^+, y_2^+, \dots, y_n^+);$$

The place:

yyjj+ is the maximum yij if j is a benefit attribute and the maximum yij if j is a cost attribute. The negative ideal solution is generated from the smallest Y value of the results of each criterion. By following the formula:

$$A^- = (y_1^-, y_2^-, \dots, y_n^-);$$

The place is:

yyjj is: min yij for the profit attribute and min yij for the cost attribute.

4. determining how far the value of each option is by using an ideal solution matrix that has positive and negative values. As an alternative, Ai with a positive solution, the distance is formulated as:

$$s_i^+ = \sqrt{\sum_{j=1}^{n} \left(y_{ij} - y_i^+\right)^2; i = 1,2, \dots, m}$$

As an alternative Ai, the distance is formulated as:

$$s_i^- = \sqrt{\sum_{j=1}^{n} \left(y_{ij} - y_i^-\right)^2; i = 1,2, \dots, m}$$

5. Determine your preference value for each option. The following formula shows the relative closeness of alternative A+ to the ideal solution A-:

$$c_i = \frac{s_i^-}{s_i^- + s_i^+}$$

If 0<ciRanking other options.

The CCiinn order can be used for ranking alternatives. Therefore, the best option is the one closest to the ideal solution and the farthest from the negative ideal solution.</ci.

Using TOPSIS, [21]created an employee placement DSS with an accuracy of up to 85% and an execution time of only one second for twenty data points. [15] used TOPSIS to place managers in the plantation industry based on seven BUMN talent criteria: technical competence, performance assessment results, and disciplinary punishment levels. Relevant

government agencies make accountable decisions based on regulatory-based criteria like this. [17] are the only researchers who applied TOPSIS at the Soppeng Regency Land Office for the recruitment of non-civil servant employees. The issue raised is that the staff find it difficult to adapt because their knowledge does not match their positions. Aribowo and Wardoyo (2008) built a weighted decision support system at the Jepara Land Office to determine which land registration locations are the most important. Both showed that the decision support system (DSS) can be used in the BPN environment, but did not discuss where the surveyors should be placed.

Research Methodology

To rank the surveyors, this research creates a decision support model based on TOPSIS and recommends placement at the Land Office under the Regional Office of the National Land Agency (BPN) of North Sumatra Province.



Figure 1. Research Framework

The image above illustrates a research process consisting of six sequential stages, along with a feedback loop to ensure that the criteria weights have become sufficiently stable before the results are utilized. The research begins by gathering input data consisting of profiles of surveying personnel and the requirements of each Land Office. These profiles encompass educational background, length of service, professional certifications held, performance achievements, and proficiency in operating surveying equipment. The requirements of each Land Office are assessed based on the number of personnel needed, the workload, and the conditions of the respective working area.

The next step involves establishing criteria and their corresponding weights. These criteria are formulated based on land-related regulations and a review of existing literature. The weight for each criterion is then determined using the Analytical Hierarchy Process (AHP) method, through pairwise comparisons provided by experts. The weighting results are considered consistent if the Consistency Ratio (CR) is below 0.1; conversely, if the CR exceeds this threshold, the experts are asked to re-evaluate their assessments. In the third stage, the derived weights are applied within the TOPSIS calculation to normalize and weight the decision matrix. This process continues by identifying the positive ideal solution and the negative ideal solution, measuring the distance of each alternative from both (D^+ and D^-), and ultimately calculating the preference value, V.

The fourth stage involves establishing a ranking for each Land Office. Preference values (V) are sorted in descending order, creating a hierarchy of suitability for personnel at each target unit. The individual with the highest V value is considered the most suitable candidate for placement at the respective Land Office. The fifth stage consists of validation, carried out through two approaches. First, a weight sensitivity analysis is performed to ensure that the rankings do not change significantly when the weights are adjusted. Second, the results obtained from the TOPSIS method are compared with previously implemented placement decisions. If

the resulting rankings shift significantly or appear inconsistent, the weights are revisited—a process represented by the dashed line in the diagram.

The final stage involves the formulation of recommendations. The validated results are developed into a proposal for the assignment of survey officers, which is then submitted to the Head of the BPN Regional Office for North Sumatra Province for consideration. Nevertheless, the authority to make the final decision remains with the designated official.

Results

1. Determination of Criteria and Weights

The criteria were developed based on considerations regarding the technical requirements for land parcel surveying and the effectiveness of task allocation. The attributes and weights for each criterion are presented in Table 1.

Table 1. Criteria, Attributes, and Evaluation Weights

Code	Criteria	Unit/Scale	Atribut	Weight (wj)
C1	Period of Service as a Measuring Officer	Year	Benefit	0,20
C2	Level of education	Scale 1–4	Benefit	0,10
C3	Technical Competence in Measurement	Scale 1–5	Benefit	0,25
C4	Productivity Measurement	Field/month	Benefit	0,30
C5	Distance from Domicile to Location of Assignment	Km	Cost	0,15
	Amount			**1,00**

The explanations for each criterion are as follows:

1. C1 – Length of Service (benefit): the duration of experience as a survey technician. A longer tenure generally indicates greater proficiency in field operations and procedures.
2. C2 – Education Level (benefit): the highest level of formal education attained, converted into a scale of 1–4 (Table 2).
3. C3 – Technical Surveying Competence (benefit): proficiency in using surveying equipment and methods (e.g., GNSS/CORS, total station) and processing data, as well as the possession of relevant certifications/licenses; evaluated on a scale of 1–5 (Table 3).
4. C4 – Surveying Productivity (benefit): the average number of land parcels successfully surveyed per month over the past year.
5. C5 – Distance from Residence to Work Location (cost): the distance between the individual's place of residence and the assigned work location. A greater distance entails higher costs, longer travel time, and an increased risk of delays; therefore, a lower value is preferred.

2. Qualitative Criteria Conversion Scale

Criteria C2 and C3 are qualitative in nature; therefore, they need to be converted into numerical values using the scales provided in Table 2 and Table 3.

Table 2. Education Level Conversion Scale (C2)

Educational level	Value
SMA/SMK	1
Diploma III	2

Educational level	Value
Diploma IV/Bachelor's Degree (S1)	3
Master (S2)	4

Table 3. Conversion Scale for Technical Measurement Competence (C3)

Competency Description	Value
Very poor: not yet independent, requires full supervision/assistance	1
Needs improvement: able to operate basic tools under supervision	2
Sufficient: independent in taking measurements for simple areas	3
Good: independent in complex measurements and data processing	4
Very good: master all equipment, certified, able to guide	5

3. Alternative Data

The alternatives in this calculation are ten surveyors (A1–A10) for whom placement priorities are to be determined. The identities of the surveyors have been masked to maintain the confidentiality of employee data. The assessment data for each alternative are presented in Table 4.

Table 4. Alternative Assessment Data of Measuring Officers

Code	Alternative Name	C1 (Year)	C2 (Scale)	C3 (Scale)	C4 (Field)	C5 (Km)
A1	Measuring Officer 1	12	3	4	45	15
A2	Measuring Officer 2	8	3	3	38	30
A3	Measuring Officer 3	15	2	5	50	45
A4	Measuring Officer 4	5	3	3	32	10
A5	Measuring Officer 5	10	4	4	42	25
A6	Measuring Officer 6	7	2	3	35	60
A7	Measuring Officer 7	18	3	5	48	40
A8	Measuring Officer 8	4	3	2	28	12
A9	Measuring Officer 9	11	2	4	40	20
A10	Measuring Officer 10	9	4	4	44	35

Next, each element of the decision matrix is divided by its corresponding criterion divisor.

Step 1: Constructing the Decision Matrix (X)

Based on Table 4, a 10 × 5 decision matrix X is constructed, with rows representing alternatives and columns representing criteria, as shown in Table 5.

Table 5. Decision Matrix X

Alternative	C1	C2	C3	C4	C5
A1	12	3	4	45	15
A2	8	3	3	38	30
A3	15	2	5	50	45
A4	5	3	3	32	10

Alternative	C1	C2	C3	C4	C5
A5	10	4	4	42	25
A6	7	2	3	35	60
A7	18	3	5	48	40
A8	4	3	2	28	12
A9	11	2	4	40	20
A10	9	4	4	44	35

Step 2: Normalization of the Decision Matrix (R)

The first step of normalization is to calculate the divisor for each criterion, which is the square root of the sum of the squares of all alternative values for that criterion (the denominator in Equation 1).

$|\mathbf{X1}| = \sqrt{(12^2 + 8^2 + 15^2 + 5^2 + 10^2 + 7^2 + 18^2 + 4^2 + 11^2 + 9^2)}$
$= \sqrt{(144 + 64 + 225 + 25 + 100 + 49 + 324 + 16 + 121 + 81)}$
$= \sqrt{1149} = \mathbf{33,8969}$
$|\mathbf{X2}| = \sqrt{(3^2 + 3^2 + 2^2 + 3^2 + 4^2 + 2^2 + 3^2 + 3^2 + 2^2 + 4^2)}$
$= \sqrt{(9 + 9 + 4 + 9 + 16 + 4 + 9 + 9 + 4 + 16)}$
$= \sqrt{89} = \mathbf{9,4340}$
$|\mathbf{X3}| = \sqrt{(4^2 + 3^2 + 5^2 + 3^2 + 4^2 + 3^2 + 5^2 + 2^2 + 4^2 + 4^2)}$
$= \sqrt{(16 + 9 + 25 + 9 + 16 + 9 + 25 + 4 + 16 + 16)}$
$= \sqrt{145} = \mathbf{12,0416}$
$|\mathbf{X4}| = \sqrt{(45^2 + 38^2 + 50^2 + 32^2 + 42^2 + 35^2 + 48^2 + 28^2 + 40^2 + 44^2)}$
$= \sqrt{(2025 + 1444 + 2500 + 1024 + 1764 + 1225 + 2304 + 784 + 1600 + 1936)}$
$= \sqrt{16606} = \mathbf{128,8643}$
$|\mathbf{X5}| = \sqrt{(15^2 + 30^2 + 45^2 + 10^2 + 25^2 + 60^2 + 40^2 + 12^2 + 20^2 + 35^2)}$
$= \sqrt{(225 + 900 + 2025 + 100 + 625 + 3600 + 1600 + 144 + 400 + 1225)}$
$= \sqrt{10844} = \mathbf{104,1345}$

Step 3: Weighted Normalization Matrix (Y)

Each element of matrix R is multiplied by its corresponding criterion weight (Equation 2), namely w1 = 0.20; w2 = 0.10; w3 = 0.25; w4 = 0.30; and w5 = 0.15. The details of the calculation are presented in Table 6.

Table 6. Calculation of the Weighted Normalization Matrix

Alt.	C1 (w = 0,20)	C2 (w = 0,10)	C3 (w = 0,25)	C4 (w = 0,30)	C5 (w = 0,15)
A1	0,20 × 0,3540 = **0,0708**	0,10 × 0,3180 = **0,0318**	0,25 × 0,3322 = **0,0831**	0,30 × 0,3492 = **0,1048**	0,15 × 0,1440 = **0,0216**
A2	0,20 × 0,2360 = **0,0472**	0,10 × 0,3180 = **0,0318**	0,25 × 0,2491 = **0,0623**	0,30 × 0,2949 = **0,0885**	0,15 × 0,2881 = **0,0432**
A3	0,20 × 0,4425 = **0,0885**	0,10 × 0,2120 = **0,0212**	0,25 × 0,4152 = **0,1038**	0,30 × 0,3880 = **0,1164**	0,15 × 0,4321 = **0,0648**
A4	0,20 × 0,1475 = **0,0295**	0,10 × 0,3180 = **0,0318**	0,25 × 0,2491 = **0,0623**	0,30 × 0,2483 = **0,0745**	0,15 × 0,0960 = **0,0144**
A5	0,20 × 0,2950 = **0,0590**	0,10 × 0,4240 = **0,0424**	0,25 × 0,3322 = **0,0831**	0,30 × 0,3259 = **0,0978**	0,15 × 0,2401 = **0,0360**
A6	0,20 × 0,2065 = **0,0413**	0,10 × 0,2120 = **0,0212**	0,25 × 0,2491 = **0,0623**	0,30 × 0,2716 = **0,0815**	0,15 × 0,5762 = **0,0864**
A7	0,20 × 0,5310 = **0,1062**	0,10 × 0,3180 = **0,0318**	0,25 × 0,4152 = **0,1038**	0,30 × 0,3725 = **0,1118**	0,15 × 0,3841 = **0,0576**
A8	0,20 × 0,1180 = **0,0236**	0,10 × 0,3180 = **0,0318**	0,25 × 0,1661 = **0,0415**	0,30 × 0,2173 = **0,0652**	0,15 × 0,1152 = **0,0173**

Alt.	C1 (w = 0,20)	C2 (w = 0,10)	C3 (w = 0,25)	C4 (w = 0,30)	C5 (w = 0,15)
A9	0,20 × 0,3245 = **0,0649**	0,10 × 0,2120 = **0,0212**	0,25 × 0,3322 = **0,0831**	0,30 × 0,3104 = **0,0931**	0,15 × 0,1921 = **0,0288**
A10	0,20 × 0,2655 = **0,0531**	0,10 × 0,4240 = **0,0424**	0,25 × 0,3322 = **0,0831**	0,30 × 0,3414 = **0,1024**	0,15 × 0,3361 = **0,0504**

The result of this multiplication forms the weighted normalization matrix Y in Table 7.

Table 7. Weighted Normalization Matrix Y

Alternative	C1	C2	C3	C4	C5
A1	0,0708	0,0318	0,0831	0,1048	0,0216
A2	0,0472	0,0318	0,0623	0,0885	0,0432
A3	0,0885	0,0212	0,1038	0,1164	0,0648
A4	0,0295	0,0318	0,0623	0,0745	0,0144
A5	0,0590	0,0424	0,0831	0,0978	0,0360
A6	0,0413	0,0212	0,0623	0,0815	0,0864
A7	0,1062	0,0318	0,1038	0,1118	0,0576
A8	0,0236	0,0318	0,0415	0,0652	0,0173
A9	0,0649	0,0212	0,0831	0,0931	0,0288
A10	0,0531	0,0424	0,0831	0,1024	0,0504

Step 4: Positive Ideal Solution (A^+) and Negative Ideal Solution (A^-)

For benefit criteria (C1–C4), the positive ideal solution is the maximum value, and the negative ideal solution is the minimum value within the columns of matrix Y. For the cost criterion (C5), the reverse applies.

a. Positive ideal solution (A^+)

$y1^+ = \max\{0,0708; 0,0472; 0,0885; 0,0295; 0,0590; 0,0413; 0,1062; 0,0236; 0,0649; 0,0531\} =$ **0,1062**

$y2^+ = \max\{0,0318; 0,0318; 0,0212; 0,0318; 0,0424; 0,0212; 0,0318; 0,0318; 0,0212; 0,0424\} =$ **0,0424**

$y3^+ = \max\{0,0831; 0,0623; 0,1038; 0,0623; 0,0831; 0,0623; 0,1038; 0,0415; 0,0831; 0,0831\} =$ **0,1038**

$y4^+ = \max\{0,1048; 0,0885; 0,1164; 0,0745; 0,0978; 0,0815; 0,1118; 0,0652; 0,0931; 0,1024\} =$ **0,1164**

$y5^+ = \min\{0,0216; 0,0432; 0,0648; 0,0144; 0,0360; 0,0864; 0,0576; 0,0173; 0,0288; 0,0504\} =$ **0,0144**

b. Negative ideal solution (A^-)

$y1^- = \min\{0,0708; 0,0472; 0,0885; 0,0295; 0,0590; 0,0413; 0,1062; 0,0236; 0,0649; 0,0531\} =$ **0,0236**

$y2^- = \min\{0,0318; 0,0318; 0,0212; 0,0318; 0,0424; 0,0212; 0,0318; 0,0318; 0,0212; 0,0424\} =$ **0,0212**

$y3^- = \min\{0,0831; 0,0623; 0,1038; 0,0623; 0,0831; 0,0623; 0,1038; 0,0415; 0,0831; 0,0831\} =$ **0,0415**

$y4^- = \min\{0,1048; 0,0885; 0,1164; 0,0745; 0,0978; 0,0815; 0,1118; 0,0652; 0,0931; 0,1024\} =$ **0,0652**

$y5^- = \max\{0,0216; 0,0432; 0,0648; 0,0144; 0,0360; 0,0864; 0,0576; 0,0173; 0,0288; 0,0504\} =$ **0,0864**

4. Interpretation of Results and Placement Recommendations

The calculation results indicate that A7 achieved the highest preference score of 0.7244, followed by A1 (0.6903) and A3 (0.6477). A7 ranks first due to having the longest tenure (18

years), the highest technical competence (5), and high productivity (48 plots/month), despite a relatively long commuting distance (40 km). This demonstrates that criteria with higher weights (C3 and C4) are the primary determinants of the final outcome.

A1 exhibits a different pattern. Although A1 does not hold the highest score in any single criterion, its values are well-balanced, and its commuting distance is short (15 km). Consequently, its distance from the positive ideal solution is the smallest among all alternatives ($D^+ = 0.0445$, slightly lower than A7's $D^+ = 0.0447$). However, A1's distance from the negative ideal solution ($D^- = 0.0992$) is smaller than that of A7 ($D^- = 0.1175$), resulting in a lower preference score for A1 compared to A7. This illustrates that the TOPSIS method considers both distances simultaneously. Conversely, A6 ranks last (V = 0.2195) due to having the longest commuting distance (60 km), combined with relatively low levels of education and productivity.

For placement purposes, the preference scores have been categorized into three groups. The group thresholds presented below are proposed by the researcher and may be adjusted in accordance with the policies of the BPN Regional Office for North Sumatra Province.

Table 8. Placement Recommendation Groups

Group	Range V	Placement Recommendations	Alternative
I	$V \geq 0{,}60$	Land offices with a high volume and complexity of surveying work (urban areas, strategic programs/accelerated land registration, and disputed land parcels)	A7 (0,7244), A1 (0,6903), A3 (0,6477), A9 (0,6007)
II	$0{,}40 \leq V < 0{,}60$	Land office with a moderate volume of surveying; routine assignment of survey services	A5 (0,5875), A10 (0,5239), A4 (0,4402), A2 (0,4161)
III	$V < 0{,}40$	Land offices with a low volume of survey work, or those located closest to one's place of residence, with the provision of guidance and competency enhancement.	A8 (0,3760), A6 (0,2195)

This categorization should be aligned with the staffing requirements of each land office, ensuring that personnel with high preference scores are assigned to the units with the greatest need, while those in Group III receive development programs designed to enhance their competencies by the next evaluation period.

Conclusion

The TOPSIS method can be applied to determine the placement priority for survey officers based on five criteria: length of service, educational background, technical competence, measurement productivity, and residential proximity. Based on simulation data, the priority ranking of the alternatives is A7 > A1 > A3 > A9 > A5 > A10 > A4 > A2 > A8 > A6, with A7 identified as the best alternative (V = 0.7244). The officers are categorized into three groups—four in Group I, four in Group II, and two in Group III—which can serve as a basis for placement recommendations aligned with the workload of the land office. Since the final results are highly sensitive to the criteria weights, it is recommended that for studies using real-world data, these weights be established through expert assessment and supplemented by a sensitivity analysis of the weights.

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