

Decision Support System for Selection of the Best Employees based on Performance using the Topsis Method

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Abstract

Selection of the best employees at Wali Nagari is an activity carried out by the Wali Nagari by carrying out this activity to determine the best employees at the Nagari. In determining the selection of the best employee candidates in Nagari Singguling, this research uses a decision support system (SPK) concept with the TOPSIS method. The decision support system that was built can provide recommendations to Nagari for the best employee candidates at Nagari Singguling. The TOPSIS method used can carry out a calculation that starts by determining the criteria for the variables used, then creates a matrix and continues with the solution matrix process and then finally the process will enter the ranking stage until the output can recommend the best prospective employees at Nagari Singguling. The results obtained in the research also provide a model or form of a semi-structured system, in determining the best employee candidates in Nagari Singguling using the TOPSIS method decision support system. The results of this research are based on data testing of 9 alternatives, it can be determined that alternative A5 in the name of Dona Riona S.Pd is the best employee with a score of 0.63. So the benefit that will be obtained is providing easy recommendations for Nagari to select the best prospective employees at Nagari Singguling precisely and accurately 80.

Keywords: Decision Support System, Employees, Matrix, Recommendations, TOPSIS Method

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1. Introduction

At the Wali Nagari office there is no system that supports selecting employees according to the performance that has been carried out. So it is difficult to select the best employees to be appointed to a higher level according to their performance. All existing data is processed manually so it takes time to select the performance of existing employees.

To solve this problem, the computer-based Decision Support System (DSS) method, namely the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), is used to facilitate performance in completing the selection results in selecting the best employees. TOPSIS is a multi-criteria decision making method or alternative choice which is an alternative that has the smallest distance from the positive ideal solution and the largest distance from the negative ideal solution from the point of view of [1]

Decision Support Systems (DSS) are systems that provide information, modeling and data engineering. This system is used to assist decision making in semi-structured and unstructured situations where no one knows exactly how the decision should be made [2].

System (DSS) is a computer-based system intended to assist decision makers in utilizing certain data and models to solve various semi-structured and unstructured problems [3]

TOPSIS is a method for solving multi-criteria decision making problems which is based on the concept that the best selected alternative not only has the shortest distance from the positive ideal solution but also has the longest distance from the negative ideal solution. However, the alternative that has the smallest distance from the positive ideal solution does not necessarily have the largest distance from the negative ideal solution. Therefore, TOPSIS considers both, the distance to the positive ideal solution and the distance to the negative ideal solution simultaneously. The optimal solution in the TOPSIS method is obtained by determining the relative closeness of an alternative to the positive ideal solution. The alternatives that have been ranked are then used as a reference for decision makers to choose the best desired solution [4].

In previous research on the Decision Support System for Employee Performance Assessment Using the Topsis Method at the Maja Baru Village Government Office. The problem discussed in this research is that employee performance assessments are currently carried out using subjective assessments. This makes the Maja Baru Village Government Office less effective in taking employee assessment actions. Therefore, researchers used the Technique For Order Preference by Similarity to Ideal Solution (TOPSIS) method to help solve difficulties in assessment which is one of the problems in assessing employee performance. The use of the TOPSIS method is expected to facilitate the assessment of employee

performance in making decisions and as a basis for calculations that are useful for decision making [5]

In previous research on the Decision Support System for selecting the best employees using the TOPSIS method, 3 criteria were obtained for determining the best employees, including Period of Service (A1), the length of time the employee worked, employee performance and Attendance (A3) obtained from employee attendance conditions. The Decision Support System or SPK developed using the Topsis Method can help in making decisions in determining the best employees. Calculations using the TOPSIS method resulted in the decision that V5 (Employee 5) was the best employee because he had the best grades [6].

Previous research on decision support systems for assessing work performance using the SAW, AHP and TOPSIS methods produced a decision support system that can recommend the best employees to bank bjb based on predetermined criteria, namely individual performance value, work unit performance value, attendance, behavior, target achievement work, years of service, education, paper assessments, presentations, and interview results [7].

Research on the decision support system for selecting rubber seeds using the TOPSIS method where calculating the normalization value and multiplying the weights for each criterion and sub-criteria for each alternative can provide a good seed selection decision. Superior seeds are seeds with the criteria of a semicircular umbrella shape, horizontal leaf petiole position, straight leaf petiole shape, green leaf color, oval leaf shape, pinnate leaf veins and leaf thickness of 0.21-0.24 mm. Based on the test results, the superior seed system is Seed 1 with a preference value of 1[8].

The TOPSIS method uses the principle that the selected alternative must have the shortest distance from the positive ideal solution and the farthest from the negative ideal solution. The TOPSIS method is widely used to select problems from making reports, employee achievements, selecting the best employees, and so on.

Therefore, the author has the idea to create a "Decision Support System for Selecting the Best Employees Based on Performance at the Wali Nagari Singguling Padang Pariaman Office Using the TOPSIS Method Using the PHP Programming Language and MySQL Database"

2. Research methodology

Research methodology is a branch of science that discusses/questions ways of carrying out research (which includes the activities of searching, recording, formulating, analyzing and compiling reports) based on facts. In conducting research in order to obtain the expected results, a research framework is needed, where the research framework carried out is depicted in Figure 1 below:

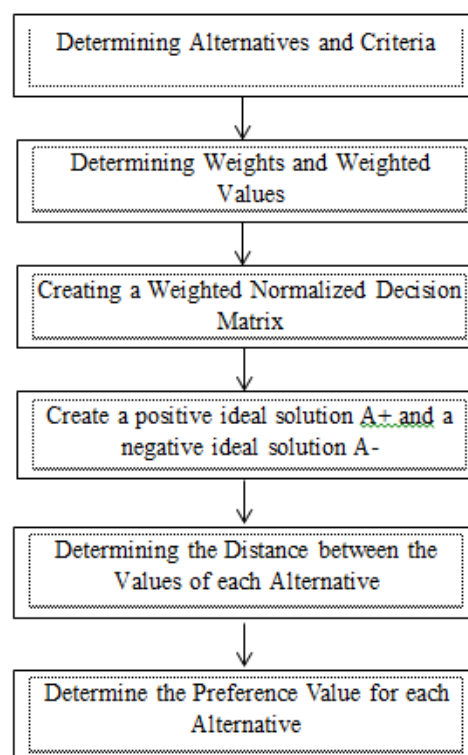


Figure 1. Research Framework

The stages in the TOPSIS method are as follows.

1. Create a normalized decision matrix
2. Create a weighted normalized decision matrix
3. Create a positive ideal solution matrix and a negative ideal solution matrix
4. Determine the distance between the value of each alternative and the positive ideal solution matrix and negative ideal solution matrix.
5. Determine the preference value for each alternative
 - a. Decision Matrix D refers to m alternatives that will be evaluated based on defined criteria
 - b. Where x_{ij} represents the performance of the calculation for the i-th alternative for the j-th attribute.

After knowing the steps that must be taken, then use the TOPSIS method solution formula

1. Building a normalized decision matrix
- The R_{ij} element resulting from normalizing the decision matrix R using the Euclidean length of a vector method is:

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

with $i=1,2,3, \dots, m$; and $j=1,2,3, \dots, n$

2. Building a weighted normalized decision matrix

The positive ideal solution A^+ and negative ideal solution A^- can be determined based on the normalized weight rating (Y_{ij}) as:

$$y_{ij} = W_i R_{ij}$$

with $i=1,2,3, \dots m$ and $j=1,2,3, \dots n$

3. Determine the ideal solution matrix and matrix solution Positive ideal solution (A^+) is calculated based on:

$$A^+ = (y_1^+, y_2^+, y_3^+, \dots, y_n^+)$$

The negative ideal solution (A^-) is calculated based on:

$$A^- = (y_1^-, y_2^-, y_3^-, \dots, y_n^-)$$

4. Determine the distance between the value of each alternative and the positive ideal solution matrix and negative ideal matrix.

The distance between alternative A_i and the positive ideal solution is formulated as:

$$Di^+ = \sqrt{\sum_{j=1}^n (y_{ij} - y_i^+)^2}, i = 1,2,3, \dots m$$

The distance between alternative A_i and the negative ideal solution is formulated as:

$$Di^- = \sqrt{\sum_{j=1}^n (y_{ij} - y_i^-)^2}, i = 1,2,3, \dots m$$

5. Determine the preference value for each alternative

The closeness of each alternative to the ideal solution is calculated based on the formula:

$$V = \frac{Di^-}{Di^- + Di^+}, i = 1,2,3 \dots m$$

The preference value for each alternative is the final result of the TOPSIS method calculation, the higher the value, the alternative is the desired alternative

3. Results and Discussion

3.1 Current System Analysis

In the process of selecting the best employees at the Wali Nagari Singguling office, there is no system that supports selecting employees according to the performance that has been implemented. So it is difficult to select the best employees to be appointed to a higher level according to their performance. All

existing data is processed manually based only on daily activities without any notes in a report. So it takes time to select the performance of existing employees and not in the selection process. In determining the selection of the best employee candidates at the Nagari Singguling mayor's office using the TOPSIS method, the following is the discussion and calculations.

3.2 New System Analysis

Based on the analysis of the old system which did not get optimal results, the author built a system that is capable of making quick and accurate decisions, where this research uses the TOPSIS method. This TOPSIS method determines the distance between positive and negative ideal solutions so as to obtain optimal results. In solving a problem, the TOPSIS method has several steps as follows:

Step 1: Determine Alternatives

In this research, alternative determination uses 9 (nine) alternatives (employee names) as objects to be assessed. The alternative data that has been determined can be seen from Table 1 below:

Table 1 Alternative Employee Data

Code	NIP	Position	Name
A1	198705019841001	Head of Government	Princess Elif Rahman AP
A2	1987081819821002	Head of Welfare	Sian Angeli, AP
A3	1992101119891002	Head of Services	Zulisman Veni, AP
A4	1996010919881003	Head of General Affairs and Planning	Anisa Helima, A.Md
A5	1991041619811003	Head of Finance	Dona Riona, S.Pd
A6	1985081227381001	Secretary	Algeri, S.Pd
A7	1981110720002001	Bamus Staff	Benny Harde, A.Md
A8	1984091920082000	Secretariat Staff	Eka Sukaisih, S.Pd
A9	1990072520062002	Wali Nagari staff	Mhd Rezki Al Akbar S.Sn

Step 2: Determining criteria and weight values

Next, determine the criteria, where these criteria will later be assessed as to whether the best employee candidate is good or not. Following is the table 2 assessment criteria and weights.

Table 2 Criteria and Weights

No	Code	Criteria	Weight	Category
1	K001	Age	5	Cost
2	K002	Education	4	Benefits
3	K003	Years of service	5	Benefits
4	K004	Responsibility	4	Benefits
5	K005	Discipline	3	Benefits
6	K006	Absence	3	Benefits
7	K007	Service	3	Benefits

Step 3: Determine the criteria suitability rating value

To make it easier to calculate assessment data, the sub-criteria weight values can be seen in Table 3 below:

Table 3 Sub-Criteria Weights

No	Criteria	Sub Criteria	Weight
1	Age	45-50 yrs	1
		40-45 years old	2
		35-40 yrs	3
		30-35 yrs	4
		20-30 yrs	5
2	Education	JUNIOR HIGH SCHOOL	1
		SENIOR HIGH SCHOOL	2
		D1-D2	3
		D3-S1	4
		S2	5
3	Years of service	< 6 months	1
		1 year - 1.5 years	2
		2 years - 2.5 years	3
		3 years - 3.5 years	4
		>4 years	5
4	Responsibility	Very less	1
		Not enough	2
		Enough	3
		Good	4
5	Discipline	Very good	5
		Very less	1
		Not enough	2
		Enough	3
6	Absence	Good	4
		Very good	5
		0 alpha	1
		1 - 3 alpha	2
		4 - 5 alpha	3
7	Service	5 - 7 alpha	4
		>8 alpha	5
		Very less	1
		Not enough	2
		Enough	3
		Good	4
		Very good	5

The ranking assessment table used for each of these criteria is as in Table 4 below :

Table 4 TOPSIS Calculation Assessment Weights

Mark	Information
1	Very less
2	Not enough
3	Enough
4	Good
5	Very good

Next, an alternative suitability test is carried out against each criterion as in Table 5 below:

Table 5 Criteria Weight Values

No	Alternative	Criteria						
		C1	C2	C3	C4	C5	C6	C7
1	A1	3	3	3	3	2	4	2
2	A2	3	3	4	3	2	3	3
3	A3	4	3	3	2	2	3	4
4	A4	5	4	4	2	3	4	3
5	A5	4	4	5	3	3	3	4
6	A6	3	4	3	3	4	3	5
7	A7	2	4	2	4	3	2	4
8	A8	3	4	3	4	2	1	3
9	A9	4	4	2	3	1	4	2

Step 4: TOPSIS results

The next stage is to carry out the normalization process on the decision matrix. So by using the formula, the normalization value is obtained as follows:

1. Create a normalized decision matrix (R)

$$rij = \frac{Xij}{\sum m Xij^2}$$

After carrying out calculations using the formula above, the normalization matrix is obtained

$$R = \begin{matrix} \text{Hasil Normalisasi (R)} \\ \begin{bmatrix} 0,28 & 0,27 & 0,30 & 0,32 & 0,26 & 0,42 & 0,19 \\ 0,28 & 0,27 & 0,40 & 0,32 & 0,26 & 0,32 & 0,29 \\ 0,37 & 0,27 & 0,30 & 0,22 & 0,26 & 0,32 & 0,38 \\ 0,47 & 0,36 & 0,40 & 0,22 & 0,39 & 0,42 & 0,29 \\ 0,37 & 0,36 & 0,50 & 0,32 & 0,39 & 0,32 & 0,38 \\ 0,28 & 0,36 & 0,30 & 0,32 & 0,52 & 0,32 & 0,48 \\ 0,19 & 0,36 & 0,20 & 0,43 & 0,39 & 0,22 & 0,38 \\ 0,28 & 0,36 & 0,30 & 0,43 & 0,26 & 0,11 & 0,29 \\ 0,37 & 0,36 & 0,20 & 0,32 & 0,13 & 0,42 & 0,19 \end{bmatrix} \end{matrix}$$

2. Calculating Weighted Normalization

$$Y_{ij} = w_{ij} \text{ (calculating normalized weights)}$$

$$W = \text{preference weight (5, 4, 5, 4, 3, 3, 3)}$$

$$V = \begin{bmatrix} 1,41 & 1,08 & 1,49 & 1,30 & 0,77 & 1,27 & 0,58 \\ 1,41 & 1,08 & 1,99 & 1,30 & 0,77 & 0,95 & 0,87 \\ 1,88 & 1,08 & 1,49 & 0,86 & 0,77 & 0,95 & 1,15 \\ 2,35 & 1,44 & 1,99 & 0,86 & 1,16 & 1,27 & 0,87 \\ 1,88 & 1,44 & 2,48 & 1,30 & 1,16 & 0,95 & 1,15 \\ 1,41 & 1,44 & 1,49 & 1,30 & 1,55 & 0,95 & 1,44 \\ 0,94 & 1,44 & 0,99 & 1,73 & 1,16 & 0,63 & 1,15 \\ 1,41 & 1,44 & 1,49 & 1,73 & 0,77 & 0,32 & 0,87 \\ 1,88 & 1,44 & 0,99 & 1,30 & 0,39 & 1,27 & 0,58 \end{bmatrix}$$

3. Steps to find the positive ideal solution A+ and the negative ideal solution A-

The ideal solution matrix is obtained based on weighted normalization and criteria attributes (cost or benefit). The positive ideal solution takes the maximum value from the weighted normalization for the benefit criteria attribute, if for cost the minimum value is taken. On the other hand, the negative ideal solution takes the minimum value from the weighted normalization if the attribute is the benefit criterion, if the cost is taken as the maximum.

$$y_j^+ = \max y_{ij}$$

$$y_j^- = \min y_{ij}$$

A^-	0.94	1.44	2.49	1.73	1.55	1.27	1.44
A^+	2.35	1.08	0.99	0.88	0.39	0.32	0.58

After carrying out the calculations, the results are obtained

Table 5 Table of Ideal Solutions and Distances

No	Ideal	Ideal Solution	Distance
1	D1	1.69	1.54
2	D2	1.35	1.64
3	D3	1.88	1.16
4	D4	1.86	1.65
5	D5	1.19	2.03
6	D6	1.22	1.99
7	D7	1.69	1.98
8	D8	1.75	1.50
9	D9	2.32	1.20

4. Determine the preference value for each alternative

$$V = \frac{Di^-}{Di^- + Di^+}$$

$$V1 = \frac{1.54}{1.54 + 1.69} = 0.48$$

$$V2 = \frac{1.65}{1.65 + 1.35} = 0.55$$

$$V3 = \frac{1.65}{1.65 + 1.88} = 0.38$$

$$V4 = \frac{1.65}{1.65 + 1.87} = 0.45$$

$$V5 = \frac{2.03}{2.03 + 1.19} = 0.63$$

$$V6 = \frac{1.99}{1.99 + 1.22} = 0.62$$

$$V7 = \frac{1.98}{1.98 + 1.69} = 0.54$$

$$V8 = \frac{1.50}{1.50 + 1.75} = 0.46$$

$$V9 = \frac{1.20}{1.20 + 2.32} = 0.34$$

From the calculation results above, the criteria weights (5,4,5,4,3, 3, 3) have the highest value and are the best solution for selecting the best employees.

Table 6 Calculation Results

No	Alternative Code	Alternative	Results
1	A1	Princess Elif Rahman AP	0.48
2	A2	Sian Angeli, AP	0.55
3	A3	Zulisman Veni, AP	0.38
4	A4	Anisa Helima, A.Md	0.47
5	A5	Dona Riona, S.Pd	0.63
6	A6	Algeri, S.Pd	0.62
7	A7	Benny Hardes, A.Md	0.54
8	A8	Eka Sukaisih, S.Pd	0.46
9	A9	Mhd Rezki Al Akbar S.Sn	0.34

Based on the calculation results above, the largest value is 0.63, so alternative A5 is the best alternative, in other words Dona Riona, S.Pd is the best employee at the Wali Nagari Singguling Office.

3.1 System Testing

of the decision support information system will be explained. An explanation of the system created includes the appearance of the system, control functions in the system, and how to use it. In the sub-chapter, the use of the menu system will be explained, starting from the login menu display, functions and how to use it until completion.

1. Employee Data Page

page is a page used to view employee data as shown in Figure 5.1 below:

No	NIK	Nama Karyawan	Jenis Kelamin	Jabatan	Alamat	Aksi
1	1987051019841001	Putri Elif Rahman, A.P	Perempuan	Kasi Pemerintahan	Kasak Putih	Tampilkan Data
2	1987081819821002	Dian Angeli, A.P	Perempuan	Kasi Kesejahteraan	Toboh Kotak	Tampilkan Data
3	1992101119891002	Zulisman Veni, A.P	Laki-Laki	Kasi Pelayanan	Punggung Kasak	Tampilkan Data
4	1996010919881003	Anisa Helima, A.Md	Perempuan	Kaur Umum dan Perenc	Simbak Toboh Gadang	Tampilkan Data
5	1991041619811003	Dona Riona, S.Pd	Perempuan	Kaur Keuangan	Pasir Lawah	Tampilkan Data
6	1985081277381001	Algeri S.Pd	Laki-Laki	Sekretaris	Singguling	Tampilkan Data

Figure 2 Employee Data Page

2. Calculation Process Page

page is a page used to view the calculation process as shown in Figure 3 below:

No	Nama	Jarak Ideal Negatif
1	Anisa Helima, A.Md	1.7154477382774
2	Dona Riona, S.Pd	2.2775087041705
3	Algeri S.Pd	1.9399359757882
4	Benny Hardes A.Md	2.4468839018936

No	Nama	Nilai
1	Anisa Helima, A.Md	0.39218023263147
2	Dona Riona, S.Pd	0.54181122653732
3	Algeri S.Pd	0.52795043632631

Figure 3 Calculation Process Page

3. Page Ranking Results Report

report data report page is a page used to view existing ranking result data as shown in Figure 5.4 below:



PEMERINTAH KABUPATEN PADANG PARIAMAN
KECAMATAN LUBUK ALUNG
NAGARI SINGGULUNG LUBUK ALUNG
Jl. Singguling – Lubuk Alung Kode Pos 25581
Website : www.singgulinglubukalung.padangpariamankab.go.id
Email : pemerintahnagarsingguling@gmail.com

Laporan Hasil Perangkingan
Tahun : 2022

No.	Nama Karyawan	Nilai	Ranking
1	Donn Riona, S.Pd	0.541811	1
2	Algesri S.Pd	0.52795	2
3	Benny Hardes A.Md	0.508285	3
4	Anisa Halima, A.Md	0.39218	4

Singguling, 20 Juli 2022

Figure 4 Ranking Results Report Page n

4. Conclusion

Based on research designed and built a Decision Support System (DSS) can help the Wali Nagari Singguling Padang Pariaman in making decisions to determine the best employee performance quickly and accurately, in analyzing the best employee performance assessment data at the Wali Nagari Singguling Padang Pariaman Office it can be processed accurately . The best employee performance assessment data at the Wali Nagari Singguling Padang Pariaman office can be stored properly and safely

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