

Decision Support System to Determine the Best Employees at Yogi Banyumas Repair Shop using Topsis Method

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Abstract

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The assessment system to determine the best employees at the Yogi shop has not been systemized. It is still limited to the regular assessment assessing the best employees to get an annual bonus based on the owner and manager's assessment, so it seems less accurate and less targeted towards employees who will be given annual bonuses. This study aims to build a decision support system to determine the best employees using the TOPSIS method to make it easier for owners and managers to determine the best employees. The data processing method in this study is the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method. The criteria used in this research are attendance, work attitude, responsibility, discipline, cooperation and creativity. From the results of the tests, it concluded that the blackbox testing process was successful. The results of this study are a decision support system to determine the best employees at the Yogi Banyumas store.

Keywords: *Best employees, Decision support system, TOPSIS (Technique for Order Preference by Similarity to Ideal Solution)*

Abstrak

Sistem penilaian untuk menentukan karyawan terbaik di toko Yogi belum tersistem dan masih sebatas penilaian biasa dalam menilai karyawan terbaik untuk mendapatkan bonus tahunan berdasarkan penilaian owner dan manager, sehingga terkesan kurang akurat dan kurang tepat. ditargetkan untuk karyawan yang akan diberikan bonus tahunan. Tujuan dari penelitian ini adalah membangun sistem pendukung keputusan penentuan karyawan terbaik dengan menggunakan metode TOPSIS untuk memudahkan pemilik dan manajer dalam menentukan karyawan terbaik. Metode pengolahan data dalam penelitian ini adalah metode TOPSIS (Technique for Order Preference by Similarity to Ideal Solution). Kriteria yang digunakan dalam penelitian ini adalah kehadiran, sikap kerja, tanggung jawab, disiplin, kerja sama dan kreativitas. Dari hasil pengujian yang dilakukan dapat disimpulkan bahwa proses pengujian blackbox berhasil. Hasil dari penelitian ini adalah sistem pendukung keputusan untuk menentukan karyawan terbaik di toko Yogi Banyumas.

Kata-kata kunci: *Karyawan terbaik, Sistem pendukung keputusan, TOPSIS (Technique for Order Preference by Similarity to Ideal Solution)*



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1. Introduction

Advances in information technology are now growing in all aspects of life that can make everyday life easier. Humans in everyday life often encounter problems in making decisions. The problems faced can be problems on a large or small scale that are very influential in the results of decisions made. Now humans are starting to develop systems that can help determine the best alternative to a problem, namely a decision support system (DSS) [1]. The decision support system has alternatives, criteria and weights used to determine the best solution.

The best employee [2] and quality are company assets enabling the company to increase. Employee performance is quite decisive in the profits obtained by a company. Therefore, it takes human resources which have high competence and loyalty. Maximum effort is needed to improve employee performance. One of them is choosing the best employees to stimulate employees so that employees can improve their performance. Increasing employee performance is an important point that can improve the company's overall performance. To improve employee performance, therefore, the company needs to conduct a performance assessment to determine the best employees each period with the terms and conditions that apply to the company.

The technique for Order by Similarity to Ideal Solution (TOPSIS) method [3] is one of the methods in the decision-making system where a decision can be made more quickly and precisely, according to the desired criteria or at least close to the selected criteria. Kwangsun Yoon Dan Hwang Cin-Lai developed this method in 1980. This method is widely used because the concept is simple and easy to understand, computationally efficient, and can measure the relative performance of decision alternatives in a simple mathematical form. Through this application, the application user will be able to consider making decisions with other options and criteria based on their individual needs.

Yogi Banyumas shop is a store that provides daily necessities such as vegetables, soap, household appliances, cosmetics, electronic furniture, office stationery, clothing and many more. Yogi Banyumas store has 115 employees divided into 10 sections: manager, accounting, buyer, administration, supervisor, customer service, cashier, security, warehouse, and salesperson. In carrying out store operations, Yogi gives annual bonuses to employees by

selecting the best employees every year before Hari Raya. It is intended to increase employees' enthusiasm for work, especially in serving consumers.

Currently, the assessment of the best employees is still done manually by the assessment team, namely the owner and manager of the Yogi Banyumas supermarket. The best employees are selected based on criteria that business owners and managers have determined. Such as the results of attendance records and work attitudes in serving consumers, but without being supported by decision-support methods that can produce good employee ratings.

Based on the results of direct interviews with Mas Tian, a yogi shop employee whom the yogi shop manager assigned as the resource person in this study, 6 indicators were obtained in the assessment process. It is, namely, attendance which was calculated based on the recapitulation of the attendance percentage taken from the attendance fingerprint, responsibility in carrying out their duties, attitude work, discipline, cooperation and creativity.

Based on the identification of the problem above, the author will build a website-based decision support system using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method as the method used. It is used for data processing which is expected to help determine the best employees at Yogi Banyumas Store.

2. Method

a. Research Concept

Research concept [4] The framework is a series of parts describing the research process flow in a decision support system to determine the best employees at Yogi Banyumas Shop using the TOPSIS method. Here is a framework chart. The flow of the research concept will be described in **Figure 1** as follows:



Figure 1. Draft Study

1) Data collection

Data collection is an activity to collect data or information needed for research. The techniques used to collect data are interviews, and documentation, literature study.

2) Identification of problems

Problem identification begins with knowing the research object's needs and the problems that this research can solve. This stage begins by discussing previous research related to the method used.

3) Application Development

a) Application Development Using the Waterfall Method

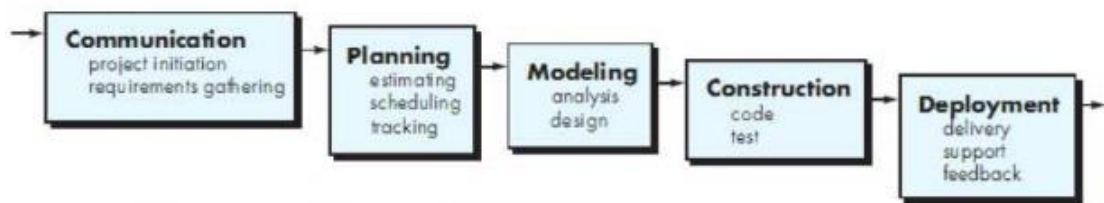


Figure 2. Draft Study Waterfall Method [5]

After identifying the problem, collecting data, and analyzing system requirements, the next step is to design the application. At this application design stage, it is useful to provide an overview of the functionality of the system that will be created. The design of this system will be explained through data design, application design and interface design. The application development method applied in this research is the waterfall method.

b) Data Processing Using TOPSIS Method

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) is one of the multi-criteria decision support methods. TOPSIS method stages:

1) Create a normalized pairwise comparison matrix [6].

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^m X_{ij}^2}} \quad (1)$$

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

Where :

r_{ij} = Element Matrix normalized [i][j]

X_{ij} = Element matrix X's decision

- 2) Create a weight normalized decision matrix

$$y_{ij} = w_j r_{ij} \quad (2)$$

w_j = weight criteria to -j

r_{ij} = elements of the normalized decision matrix

- 3) Determine the positive ideal (A^+) solution matrix and the negative ideal solution matrix(A^-)

$y_j^+ =$

y_{ij} jika j adalah atribut keuntungan (benefit), y_{ij} jika j adalah atribut biaya (cost)
(3)

$y_j^- =$

$\{y_{ij}$ jika j adalah atribut keuntungan (benefit) y_{ij} jika j adalah atribut biaya (cost) (4)

$$A^+ = (y_1^+ + y_2^+ + y_3^+, \dots, + y_n^+ \quad (5)$$

$$A^- = (y_1^- + y_2^- + y_3^-, \dots, + y_n^- \quad (6)$$

- 4) Determine the distance between the values of each alternative with a positive ideal solution matrix and a negative ideal solution matrix

$$D_i^+ = \sqrt{\sum_{i=1}^n (y_i^+ - y_{ij})^2} \quad (7)$$

$$D_i^- = \sqrt{\sum_{i=1}^n (y_{ij} - y_i^-)^2} \quad (8)$$

- 5) Determine the preference value for each alternative

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \quad (9)$$

3. Results and Discussion

a. Design Using the Waterfall Method

1) Functional Needs Analysis

a) Input Needs

Input requirements needed to meet the needs of this system include:

1. Admin data includes *username* and *password*.
2. Alternative data include employee code, alternative name, and part
3. Criteria data includes criteria code, criteria name, and weight
4. Score on each criterion

b) Process Requirements

Process requirements needed to meet the needs of this system include:

1. Login, which is the process of entering the system by entering a username and password.
2. The process of adding, editing and deleting employee data, criteria, and values.

c) Output Requirements

The output requirements resulting from data processing are in the form of ranking results from a decision support system to determine the best employees using the TOPSIS method.

d) Non-Functional Needs Analysis

Non-functional requirements are divided into two, namely analysis of hardware requirements (hardware) and analysis of software requirements (software) while the non-functional requirements in this study are as follows:

1) Planning

At the planning stage, a system design is carried out based on some of the above needs that have been analyzed. The design starts with creating a unified modeling language (UML).

a) Use Case Diagrams

Use Case diagrams [7] are used to describe an interaction of one or more actors with the system from the point of view of system users.

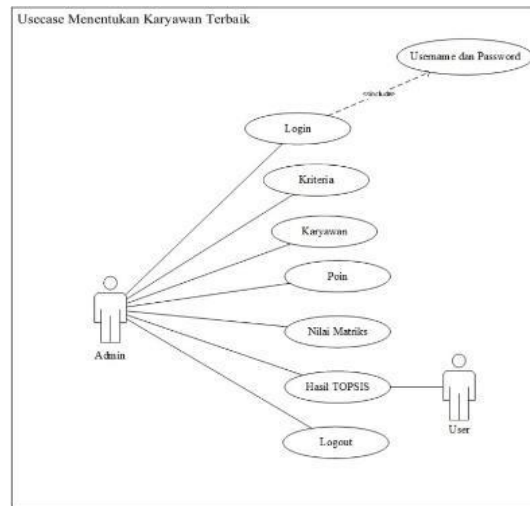


Figure 3 Use Case Diagram [7]

Figure 3 shows the use case diagram of the decision support system that will be made. Description of the use case diagram as follows:

1. Use case login: make the login process performed by the admin so that it can be accessed.
2. Use case data criteria: contains the process of entering criteria data..
3. Employee data use case: contains the process of entering employee data.
4. Use case data points: contains entering data points.
5. Use case value matrix: contains the process of entering employee values in each criterion.
6. Topsis results use case: displays data processing results using the topsis method.
7. Use case logout: load the process to exit the running system.

b) Activity Diagrams

Activity Diagram [8] is a description/design of the flow of activity or workflow in a system being designed. Activity diagrams are also used to group the flow of the system view that is being designed. Activity diagrams designed for decision support systems to determine the best employees are as follows:

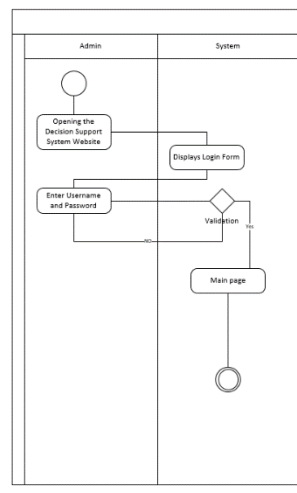


Figure 4. Activity Diagram Login [8]

Figure 4 shows the user activity diagram when logging in to the application by opening the decision support system website and then the system will display the login page. Then the user will enter the username and password then the system will validate if it is correct. Then it can directly enter the main system page, but if it is wrong, the system will return to the login page.

c) Sequence Diagrams

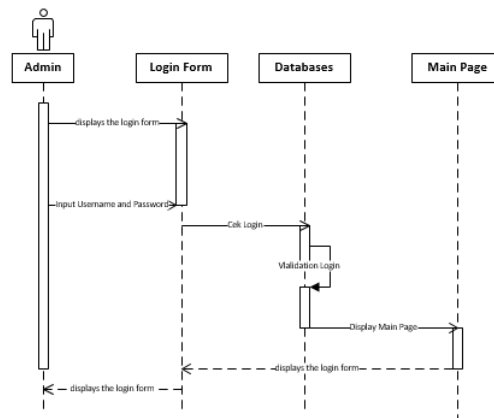


Figure 5. Sequence Diagram Login [9]

In Figure 5, Sequence Diagram [9] Login describes a scenario or series of steps performed when logging in. Starting from the admin inputting the username and password followed by clicking Login. After that, the system will validate if the username and password are correct then the admin can enter the main menu, but if it is wrong, it will return to the login page.

d) Class Diagram

4 tables are used in the decision support system to determine the best employees of the Yogi store:

- 1) Login table: to store username and password data to log in to the system created.
- 2) Alternative table: to store employee data.
- 3) Criteria table: to store criteria data used in calculations in a decision support system
- 4) Topsis table: to store data used for calculations in decision support systems.

2) Construction

At the construction stage is translating the design form into code or language that the machine can understand. The data structure design used in this decision support system includes:

a. Coding

Made a website with PHP and HTML code by applying the topsis method to determine the best employee at Yogi Banyumas shop.

b. Table design

1) Login Table

The login table consists of a username and password content, with the data type varchar and contains a maximum of 50 data, with the username as the primary key.

2) Criteria Table

The criteria table consists of id_criteria content as the primary key and name_criteria with the data type varchar with a maximum of 50 data. Weight with the data type float.

3) Alternative Table

The Alternative table consists of id_alternative content as the primary key with data type int and alternative name seta Part with data type varchar.

4) Topsis table

Table Topsis consists of content id_alternative, id_criteria, score, id, and date as a container table for existing data processing.

3) Deployment

At this stage is the stage of testing the decision support system. In this test, the researcher uses black-box testing [11]. This software test tests functionality in a system that aims to avoid bugs and errors.

| Nilai Preferensi(V _i) | | | |
|-----------------------------------|-------------|---------------|------------------|
| No | Id Karyawan | Nama | V _i |
| 1 | A1 | Latifah Indri | 0.34344954591994 |
| 2 | A2 | Bragi | 0.92476154850416 |
| 3 | A3 | Cici | 0.37941887614826 |
| 4 | A4 | Catur | 0.71720574809509 |
| 5 | A5 | Diana | 0.22524246991475 |
| 6 | A6 | Resdiyanti | 0.53772004872077 |
| 7 | A7 | Lilis | 0.5616024468801 |
| 8 | A8 | Tia | 0.74043523950431 |
| 9 | A9 | Mei | 0.81962514949538 |
| 10 | A10 | Marino | 0.75393675579709 |

Figure 6. Implementation of Topsis Results page

Figure 6 implementation of the login page used by the admin to be able to enter the system by entering a username and password.

Table 1. Login Page Testing

| Testing Scenario | Test Case | Test results | Results |
|------------------|---|--|---------|
| Login Process | Enter <i>username</i> and <i>password</i> | If the username and password input are correct, then the login is successful, and you can enter the main page. If it is wrong, it will re-enter the <i>username</i> and <i>password</i> . | Succeed |

Employee Page Testing

Table 2. Employee Page Testing

| Test Scenarios | Test Cases | Test Results | Results |
|----------------------|--|---|---------|
| Add employee data. | Select add employee data, enter all employee data, and click the add button. | All data is entered. There must be no data that is not filled in; then, the data will be successfully saved. One of the data is not filled in; then there will be a message to enter empty data | Succeed |
| Change employee data | Click the change icon, then immediately move to the employee edit page | All data is entered, and there must be no data that is not filled in then the data will be successfully saved. If one of the data is not filled in, then there will be a | Succeed |

| | | | |
|----------------------|--|--|---------|
| | | message to enter empty data | |
| Delete Employee data | Select the trash can icon, then the automation will be deleted | When pressing the trash can icon, it will automatically be deleted | Succeed |

Data Processing Using TOPSIS

The data collection process carried out at the research location obtained results in the form of employee data. In order to facilitate understanding and presentation of data, only a sample of 10 employees was presented in this study.

Data is also collected to obtain the criteria used as an employee assessment tool. This data will be implemented in the TOPSIS calculation. Criteria used as a reference for the assessment of each alternative. The weighting of each criterion is carried out to determine the assessment size for each criterion. In this study, the company's decisions are given weights for each criterion as can be seen in **Table 3** as follows:

Table 3. Employee Page Testing Criteria and sub-criteria

| Code | Criteria | Weight | Sub Criteria | Score |
|------|----------------|--------|--------------|-------|
| K1 | Presence | 5 | 0-20 | 1 |
| K2 | Work attitude | 4 | 21-40 | 2 |
| K3 | Responsibility | 5 | 41-60 | 3 |
| K4 | Discipline | 4 | 61-80 | 4 |
| K5 | Cooperation | 3 | 81-100 | 5 |
| K6 | Creativity | 3 | | |

Table 4. Employee Data

| Alternative / Criteria | K1 | K2 | K3 | K4 | K5 | K6 |
|------------------------|----|----|----|----|----|----|
| Latifah | 5 | 4 | 4 | 3 | 4 | 3 |
| Resdiyanti | 5 | 3 | 5 | 3 | 4 | 4 |
| Cici | 4 | 5 | 3 | 4 | 5 | 3 |
| Diana | 5 | 3 | 3 | 4 | 3 | 5 |
| Lilis | 5 | 4 | 4 | 5 | 4 | 3 |
| Bragi | 5 | 5 | 5 | 4 | 5 | 4 |
| Chess | 5 | 4 | 4 | 5 | 3 | 5 |
| Tia | 5 | 4 | 4 | 5 | 4 | 5 |
| May | 4 | 5 | 4 | 5 | 5 | 5 |
| Mario | 4 | 5 | 4 | 4 | 5 | 4 |

Furthermore, it is processed using the TOPSIS method to be able to calculate the ranking. Moreover, determine who is eligible to become an employee with the weight of the criteria that have been determined. The calculation steps using the TOPSIS method are as follows:

a. Creating a normalized decision matrix.

$$|X_1| = \frac{5}{\sqrt{5^2 + 5^2 + 4^2 + 5^2 + 5^2 + 5^2 + 5^2 + 5^2 + 4^2 + 4^2}} = 14,933 \quad |X_4| = \frac{3}{\sqrt{3^2 + 3^2 + 4^2 + 4^2 + 5^2 + 4^2 + 5^2 + 5^2 + 5^2 + 4^2}} = 13,491$$

$$R_{11} = \frac{5}{14,933} = 0,335, R_{21} = \frac{5}{14,933} = 0,335 \quad R_{14} = \frac{3}{13,491} = 0,222, R_{24} = \frac{3}{13,491} = 0,222$$

$R_{31} \text{ dst}$

$R_{34} \text{ dst}$

$$|X_2| = \frac{4}{\sqrt{4^2 + 3^2 + 5^2 + 3^2 + 4^2 + 5^2 + 4^2 + 4^2 + 5^2 + 5^2}} = 13,491 \quad |X_5| = \frac{4}{\sqrt{4^2 + 4^2 + 5^2 + 3^2 + 4^2 + 5^2 + 3^2 + 4^2 + 5^2 + 5^2}} = 13,491$$

$$R_{12} = \frac{4}{13,491} = 0,296, R_{22} = \frac{3}{13,491} = 0,222 \quad R_{15} = \frac{4}{13,491} = 0,296, R_{25} = \frac{4}{13,491} = 0,296$$

$R_{32} \text{ dst}$

$R_{35} \text{ dst}$

$$|X_3| = \frac{4}{\sqrt{4^2 + 5^2 + 3^2 + 3^2 + 4^2 + 5^2 + 4^2 + 4^2 + 4^2 + 4^2}} = 12,806 \quad |X_6| = \frac{3}{\sqrt{3^2 + 4^2 + 3^2 + 5^2 + 3^2 + 4^2 + 5^2 + 5^2 + 5^2 + 4^2}} = 13,229$$

$$R_{13} = \frac{4}{12,806} = 0,312, R_{23} = \frac{5}{12,806} = 0,390 \quad R_{16} = \frac{3}{13,229} = 0,227, R_{26} = \frac{4}{13,229} = 0,302$$

$R_{33} \text{ dst}$

$R_{36} \text{ dst}$

So that a normalized matrix (Matrix R) and a weight-normalized matrix (Y) are obtained

b. Creating a Normalized Decision Matrix.

$$R \begin{bmatrix} 0,335 & 0,296 & 0,312 & 0,335 & 0,222 & 0,390 & 0,268 & 0,371 & 0,234 & 0,222 & 0,296 & 0,227 & 0,222 \\ 0,296 & 0,302 & 0,296 & 0,371 & 0,227 & 0,335 & 0,222 & 0,234 & 0,335 & 0,296 & 0,312 & 0,335 & 0,371 \\ 0,390 & 0,296 & 0,222 & 0,378 & 0,371 & 0,296 & 0,227 & 0,296 & 0,371 & 0,302 & 0,335 & 0,296 & 0,312 \\ 0,335 & 0,296 & 0,312 & 0,268 & 0,371 & 0,312 & 0,268 & 0,371 & 0,312 & 0,371 & 0,222 & 0,378 & 0,371 \\ & & & 0,296 & 0,378 & 0,371 & 0,371 & 0,378 & 0,296 & 0,371 & 0,302 & & \end{bmatrix}$$

$$Y \begin{bmatrix} 1,674 & 1,186 & 1,562 & 1,674 & 0,889 & 1,952 & 1,339 & 1,482 & 1,171 & 0,889 & 1,186 & 0,680 & 0,889 \\ 1,186 & 0,907 & 1,186 & 1,482 & 0,680 & 1,674 & 0,889 & 1,171 & 1,674 & 1,186 & 1,562 & 1,674 & 1,482 & 1,952 \\ 1,186 & 0,889 & 1,134 & 1,482 & 1,186 & 0,680 & 1,186 & 1,482 & 0,907 & 1,674 & 1,186 & 1,562 & 1,674 \\ & & 1,186 & 1,562 & 1,339 & 1,482 & 1,562 & 1,339 & 1,482 & 1,562 & 1,482 & 0,889 & 1,134 & 1,482 \\ & & & 1,186 & 1,134 & 1,482 & 1,482 & 1,134 & 1,186 & 1,482 & 0,907 & & & \end{bmatrix}$$

c. Looking for a positive ideal solution in each alternative

$$A^+ = \{ 1,674; 1,482; 1,952; 1,482; 1,482; 1,134 \}$$

$$A^- = \{ 1,339; 0,889; 1,171; 0,889; 0,889; 0,907 \}$$

d. Find the distance of each alternative to the positive ideal solution

$$D_1^+ = 0,941, D_2^+ = 0,918, D_3^+ = 1,008, D_4^+ = 1,184, D_5^+ = 0,731$$

$$D_6^+ = 0,373, D_7^+ = 0,769, D_8^+ = 0,573, D_9^+ = 0,514, D_{10}^+ = 0,63$$

e. Find the distance of each alternative to the negative ideal solution

$$D_1^- = 0,664$$

$$D_2^- = 0,928, D_3^- = 0,889, D_4^- = 0,637, D_5^- = 0,890, D_6^- = 1,251, D_7^- = 0,954$$

$$D_8^- = 0,999, D_9^- = 1,189, D_{10}^- = 0,998$$

f. Preference value for each alternative

$$V_1 = \frac{0,664}{0,664 + 0,941} = 0,414 \quad V_2 = \frac{0,928}{0,928 + 0,918} = 0,503$$

$$V_3 = \frac{0,889}{0,889 + 1,008} = 0,469 \quad V_4 = \frac{0,637}{0,889 + 1,184} = 0,350$$

$$V_5 = \frac{0,890}{0,890 + 0,731} = 0,549 \quad V_6 = \frac{1,251}{1,251 + 0,337} = 0,770$$

$$V_7 = \frac{0,954}{0,954 + 0,769} = 0,554 \quad V_8 = \frac{0,999}{0,999 + 0,573} = 0,635$$

$$V_9 = \frac{1,189}{1,189 + 5,14} = 0,698 \quad V_{10} = \frac{0,998}{0,998 + 0,636} = 0,611$$

$$V_1 = \frac{0,664}{0,664 + 0,941} = 0,414 \quad V_2 = \frac{0,928}{0,928 + 0,918} = 0,503$$

$$V_3 = \frac{0,889}{0,889 + 1,008} = 0,469 \quad V_4 = \frac{0,637}{0,889 + 1,184} = 0,350$$

$$V_5 = \frac{0,890}{0,890 + 0,731} = 0,549 \quad V_6 = \frac{1,251}{1,251 + 0,337} = 0,770$$

$$V_7 = \frac{0,954}{0,954 + 0,769} = 0,554 \quad V_8 = \frac{0,999}{0,999 + 0,573} = 0,635$$

$$V_9 = \frac{1,189}{1,189 + 5,14} = 0,698 \quad V_{10} = \frac{0,998}{0,998 + 0,636} = 0,611$$

Table 9. Final Results

| Employee name | The final result |
|---------------|------------------|
| Latifah | 0,414 |
| Resdiyanti | 0,503 |
| Cici | 0,469 |
| Diana | 0,350 |
| Lilis | 0,549 |
| Bragi | 0,770 |
| Chess | 0,554 |
| Tia | 0,635 |
| May | 0,698 |
| Mario | 0,611 |

Based on calculations using the TOPSIS method, it can be concluded that the most significant value is 0.770 with the alternative name Bragi because it has the best value.

4. Conclusion

Based on the discussion and description above, the following conclusions can be drawn:

- a. Has succeeded in making a decision support system to determine the best employees using the TOPSIS method.
- b. Determination of the best employees using the TOPSIS method using the criteria of attendance, work attitude, responsibility, discipline, cooperation, and creativity to overcome problems in determining employees.
- c. From the results of the tests that have been carried out, it can be concluded that the black box testing was successful.

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