

TOPSIS-BASED SYSTEM FOR THE SELECTION OF TRAINING PARTICIPANT CANDIDATES AT THE ASAHAN MANPOWER OFFICE

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Abstract: Job training is one of the government's efforts to improve the quality of human resources so that they possess competencies that meet labor market demands. The process of selecting training participants at the Department of Manpower of Asahan Regency is still carried out manually, which can lead to subjectivity and inefficiency in determining the most eligible candidates. This study aims to develop a decision support system using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method to assist the selection process objectively and systematically. The study applies four evaluation criteria, namely education level, age, work experience, and interview, with a dataset consisting of 31 training candidates. The system is developed as a web-based application using PHP programming language and MySQL database. The TOPSIS method is applied through decision matrix normalization, weighting, determination of positive and negative ideal solutions, and preference value calculation to produce a ranking of candidates. The results show that the proposed system can provide objective recommendations for selecting training participants, improve the efficiency of the selection process, and support decision makers in producing more accurate and reliable decisions.

Keywords: decision support system; selection; training; TOPSIS.

Abstrak: Pelatihan tenaga kerja merupakan salah satu upaya pemerintah dalam meningkatkan kualitas sumber daya manusia agar memiliki kompetensi yang sesuai dengan kebutuhan dunia kerja. Proses pemilihan calon peserta pelatihan di Dinas Tenaga Kerja Kabupaten Asahan selama ini masih dilakukan secara manual sehingga berpotensi menimbulkan subjektivitas dan kurang efektif dalam menentukan peserta yang paling layak. Penelitian ini bertujuan untuk membangun sistem pendukung keputusan menggunakan metode Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) untuk membantu proses seleksi peserta pelatihan secara objektif dan sistematis. Penelitian ini menggunakan empat kriteria penilaian yaitu pendidikan, usia, pengalaman kerja, dan wawancara dengan jumlah data sebanyak 31 calon peserta pelatihan. Sistem dikembangkan berbasis web menggunakan bahasa pemrograman PHP dan database MySQL. Metode TOPSIS digunakan untuk melakukan normalisasi matriks keputusan, pembobotan, penentuan solusi ideal positif dan negatif, serta perhitungan nilai preferensi untuk menghasilkan perankingan peserta pelatihan. Hasil penelitian menunjukkan bahwa sistem yang dibangun mampu memberikan rekomendasi peserta pelatihan secara objektif, meningkatkan efisiensi proses seleksi, serta membantu pihak dinas dalam pengambilan keputusan yang lebih akurat.

Kata kunci: pelatihan; seleksi; sistem pendukung keputusan; TOPSIS.

INTRODUCTION

The development of information technology has had a significant influence in various fields, including decision-making processes in government institutions. The utilization of computer-based systems allows data processing to be carried out more quickly, accurately, and efficiently. One of the technologies widely used to support decision-making processes is the Decision Support System (DSS). A DSS is a computer-based system designed to assist decision-makers in solving semi-structured and unstructured problems through the use of data, models, and certain analytical methods [1]. With the existence of a DSS, the decision-making process can be conducted more objectively and systematically compared to conventional methods that still depend on human subjective judgment.

The Asahan Regency Manpower Office is a government institution that has an important role in improving the quality of human resources through job training programs. These training programs aim to enhance community skills so that individuals are able to compete in the labor market and reduce unemployment rates. However, in its implementation, the selection process for training participant candidates is still carried out manually by considering several criteria such as education level, age, work experience, and interview. Manual selection often creates several problems, including subjectivity in assessment, errors in data processing, and a relatively long time required to determine the most eligible participants.

Various previous studies have shown that the application of decision support systems can improve the quality of selection processes in various fields.

Multi-criteria decision-making methods are widely used to systematically determine the best alternative based on several evaluation criteria [2]. However, most recent studies (2024–2025) primarily focus on general selection domains and lack direct implementation in government-based training participant selection systems.

This research differentiates itself by developing a web-based TOPSIS system specifically tailored for the Asahan Manpower Office, integrating real-world criteria such as education, age, work experience, and interview to support a more objective, transparent, and practical decision-making process. The TOPSIS method can provide objective ranking results by considering the distance of each alternative from the positive ideal solution and the negative ideal solution [3][4][5]. Several studies have shown that the TOPSIS method can be applied in various fields such as employee selection, teacher recruitment, supplier selection, and training program evaluation[6][7][8]

Other studies also indicate that the TOPSIS method has advantages in terms of relatively simple calculations, the ability to handle multiple criteria, and the capability to generate clear and measurable rankings of alternatives [9][10]. In addition, the TOPSIS method is often used in various decision support systems such as beneficiary selection, training program evaluation, and best candidate selection in different organizations [11]. The implementation of TOPSIS in decision support systems has been proven to improve accuracy and transparency in decision-making processes [12].

A review of several previous studies shows that most research has focused only on the application of

TOPSIS in the context of employee selection, beneficiary selection, or best supplier determination. Research that specifically discusses the application of TOPSIS in the selection process of job training participants in government institutions is still relatively limited. In addition, some government agencies still conduct selection processes manually without the support of computerized decision support systems. This condition indicates a research gap between the development of technology-based decision-making methods and the conventional selection practices still applied in some government institutions.

Based on these problems, this research aims to develop a decision support system using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method in determining training participant candidates at the Asahan Regency Manpower Office. The developed system is expected to assist the institution in conducting the selection process in a more objective, effective, and efficient manner by considering several predetermined evaluation criteria. With this system, it is expected that the decision-making process for determining training participants can be carried out more transparently and accurately so that the training programs provided can deliver optimal benefits to the community.

METHOD

Decision Support System (DSS) approach with the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method to determine the most eligible training participant candidates at the Asahan Regency Manpower Office.

The TOPSIS method is one of the multi-criteria decision-making methods based on the concept that the best alternative is the one that has the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution [3]. This method has been widely used in various decision support system studies because it is able to provide objective ranking results based on several evaluation criteria [13].

This research was conducted through several stages, namely data collection, determination of criteria and weights, application of the TOPSIS method, and alternative ranking. The data used in this study consist of 31 training participant candidates from the Asahan Regency Manpower Office. Each alternative was assessed based on four criteria: education (C1), age (C2), work experience (C3), and interview (C4). The criteria of education, work experience, and interview are categorized as benefit criteria, while age is categorized as a cost criterion.

Table 1. Criteria Data

No	Code	Criteria	Weight
1	C1	Education	0.30
2	C2	Age	0.25
3	C3	Work Experience	0.20
4	C4	Interview	0.25

The determination of criteria weights in this study is based on expert judgment from the Asahan Regency Manpower Office. The weights reflect the relative importance of each criterion in the selection process. Education is assigned the highest weight (0.30) as it represents the fundamental competency of candidates. Age (0.25) is considered important in terms of productivity and adaptability. work experience (0.20) supports practical capability while

Interview (0.25) reflect soft skills and communication ability.

To begin the TOPSIS calculation process, criteria data and sub-criteria data are required so that calculations can be performed on the predetermined criteria and sub-criteria weights in selecting training participant candidates at the Asahan Manpower Office. The following are the sub-criteria values for each criterion.

Table 2. Sub-Criteria Data for Each Criterion

Education (C1)

SMA/SMK	1
D1	2
D3	4
S1	5
Age (C2)	
18–24 years	1
25-30 years	3
31 years or older	5
Work Experience (C3)	
None	1
Available	5
Interview (C4)	
Poor	1
Fairly Good	2
Good	4
Very Good	5

Table 3. Candidate Training Participant Scores

No	Alternative	C1 (Benefit)	C2 (Cost)	C3 (Benefit)	C4 (Benefit)
1	Abdul Alrofiq	SMA	27	Available	Fairly Good
2	Al Farizi	SMA	25	Available	Very Good
3	Andi Muhammad Reza	SMA	31	Available	Good
4	Andri Wibowo	D3	27	Available	Very Good
5	Arief Kurniawan	D3	22	Available	Very Good
6	Arif Rakhmat Islami	SMA	21	None	Very Good
7	Dimas Nurhidayah	D3	31	None	Very Good
8	Dzakwan Marsandi Pratama	S1	30	Available	Very Good
9	Efri Al Azri	SMK	22	Available	Good
10	Eriadi Utama	SMA	28	None	Very Good
...
30	Sri Yanti	SMA	25	Available	Good
31	Syuja Zaky Najwan	S1	25	None	Fairly Good

From the data in Table 3, each value is then converted into sub-criteria weight values for each alternative, and the divisor value (X(n)) for each criterion is calculated. The divisor value (X(n)) for each criterion is obtained by taking the criterion data for each candidate using the following formula:

$$X(n) \text{ Value} = \sqrt{C(i)^2 + \dots + C(n)^2} \quad (1)$$

Description:

C(i) = data value on the criterion and
C(n) = final data value on the criterion.

The results of converting alternative weights and divisor values

(X(n)) for each criterion can be seen in Table 4. The next step is to calculate the normalized decision matrix, in which each candidate’s criterion weight matrix C(i) is divided by the divisor value X(n) for each criterion, as shown in the following formula:

$$R(i) = \frac{C(i)}{X(n)} \quad (2)$$

Description:

R(i) = normalized decision matrix value

C(i) = criterion matrix value

X(n) = divisor value for each criterion.

The recapitulation of the normalized decision matrix (R(i)) can be seen in Table 5. Next, the weighted normalized matrix is calculated by multiplying each normalized decision matrix value by the weight of each criterion in Table 1. The formula used is:

$$Y(i) = R^i * W^i \quad (3)$$

Description:

Y(i) = weighted normalized decision matrix value

R(i) = normalized decision matrix value

W(i) = criterion weight value.

The results of the weighted normalized decision matrix Y(i) can be seen in Table 6. The next step is to determine the positive ideal solution distance (D⁺) and the negative ideal solution distance (D⁻) for each alternative. The D⁺ value shows how far an alternative is from the best ideal solution (maximum value), while the D⁻ value shows its proximity to the worst ideal solution (minimum value). In this context, benefit attributes are expected to have a small D⁺ value and a large D⁻ value, while cost attributes are expected to show the opposite. These values then serve as the basis for determining the preference score of each alternative to obtain the final ranking. The positive and negative ideal solution distances for each attribute can be seen in Table 7.

Next, the positive ideal value (D⁺(i)) and the negative ideal value (D⁻(i)) are calculated using the formula for positive ideal value:

$$D^+(i) = \sqrt{\sum(Y(i) - \text{Max}(Y(i)))^2} \quad (4)$$

Formula for negative ideal value:

$$D^-(i) = \sqrt{\sum(Y(i) - \text{Min}(Y(i)))^2} \quad (5)$$

Description:

D⁺(i) = positive ideal value

D⁻(i) = negative ideal value

Y(i) = weighted normalized decision matrix value

Max(Y(i)) = highest value in the criterion matrix

Min(Y(i)) = lowest value in the criterion matrix.

The resulting positive ideal solution D⁺(i) and negative ideal solution D⁻(i) for each alternative can be seen in Table 7. After obtaining the positive and negative ideal values, the final step is to calculate the final score and ranking. The formula used to obtain the final value and ranking for each alternative is:

$$V = \frac{D_i^-}{D_i^- + D_i^+} \quad (6)$$

Description:

V = ranking value

D⁺(i) = positive ideal value

D⁻(i) = negative ideal value.

The preference values and ranking results for each alternative can be seen in Table 9.

RESULT AND DISCUSSION

The implementation of the TOPSIS method in this study produces a ranking of training participant candidates based on four criteria: education, age, work experience, and interview results. The calculation process involves normalization, weighting, and distance measurement to the positive and negative ideal solutions, as presented in Tables 4–9.

Table 4. Alternative Weight Table for Training Participant Candidates (Alternatives)

Alternati ve	C1 (Benefit)	C2 (Cost)	C3 (Benefit)	C4 (Benefit)
A1	1	3	5	2
A2	1	3	5	5
A3	1	5	5	4
A4	4	3	5	5
A5	4	1	5	5
...
A31	5	3	1	2
Divisor (X(n))	18.761 7	15.968 7	23.130 1	24.454 0

Table 5. Normalized Decision Matrix

Alternati ve	C1 (Benefit)	C2 (Cost)	C3 (Benefit)	C4 (Benefit)
A1	0.0533	0.1879	0.2162	0.0818
A2	0.0533	0.1879	0.2162	0.2045
A3	0.0533	0.3131	0.2162	0.1636
A4	0.2132	0.1879	0.2162	0.2045
A5	0.2132	0.0626	0.2162	0.2045
...
A31	0.2665	0.1879	0.0432	0.0818

Table 6. Weighted Normalized Decision Matrix (Y(i))

Alternati ve	C1 (Benefit)	C2 (Cost)	C3 (Benefit)	C4 (Benefit)
A1	0.0160	0.0470	0.0432	0.0204
A2	0.0160	0.0470	0.0432	0.0511
A3	0.0160	0.0783	0.0432	0.0409
A4	0.0640	0.0470	0.0432	0.0511
A5	0.0640	0.0157	0.0432	0.0511
...
A31	0.0800	0.0470	0.0086	0.0204

Table 7. Positive Ideal Solution Distance (D⁺) and Negative Ideal Solution Distance (D⁻) for Each Attribute

Attribute	Benefit t	Cost	Benefit t	Benefit t
D ⁺	0.080 0	0.015 7	0.043 2	0.051 1
D ⁻	0.016 0	0.078 3	0.008 6	0.020 4

Table 8. Positive Ideal Solution (D⁺) and Negative Ideal Solution (D⁻) for Each Alternative

Alternative	D ⁺	D ⁻
A1	0.0160	0.0470
A2	0.0160	0.0470
A3	0.0160	0.0783
A4	0.0640	0.0470
A5	0.0640	0.0157
...
A31	0.0800	0.0470

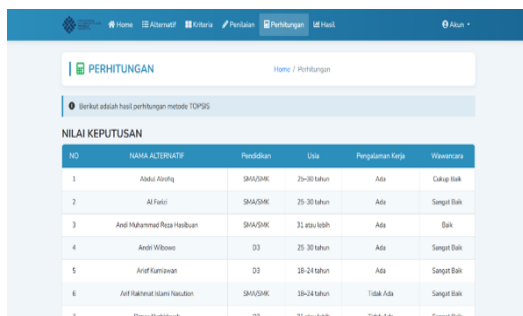
Table 9. Preference Values and Ranking Results for Each Alternative

Alternative	Final Score	Ranking
A1	0.3757	26
A2	0.4395	22
A3	0.3084	31
A4	0.6768	9
A5	0.8511	3
...
A15	1.0000	1
...
A20	1.0000	2
...
A31	0.5605	14

The results of the TOPSIS calculation show that alternatives A15 and A20 achieved the highest preference values (1.0000), indicating that these candidates are the most suitable for the training program. This result is influenced by their strong performance across all criteria, particularly in education level (S1), work experience, and interview. It can be observed that candidates with higher education levels and good interview performance tend to achieve higher rankings. This indicates that these criteria have a significant impact on the final decision. On the other hand, candidates with lower scores in work experience or interview tend to have lower rankings, even if they meet other criteria. Furthermore, the use of TOPSIS allows decision-makers to

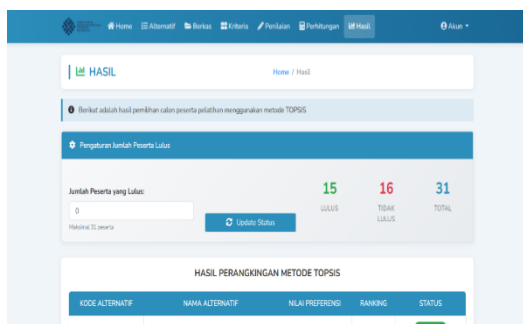
evaluate candidates objectively by considering multiple criteria simultaneously. Compared to manual selection, this approach reduces subjectivity and improves consistency in decision-making.

To validate the effectiveness of the proposed system, the results obtained from the TOPSIS method were compared with manual selection conducted by the decision-makers. The comparison shows that the system produces consistent results with expert judgment while offering faster and more systematic processing. This indicates that the developed system is reliable and can support decision-making in selecting training participants more objectively. The following are the implementation results of the application for selecting training participant candidates at the Asahan Manpower Office using the TOPSIS method and PHP programming language:



NO	NAMA ALTERNATIF	Pendidikan	Usia	Pengalaman Kerja	Wawancara
1	Jakob Arling	SMK/DMK	29-30 tahun	Ada	Cukup Baik
2	Al Fati	SMK/DMK	25-30 tahun	Ada	Sangat Baik
3	Andi Muhamad Riza Hasbiun	SMK/DMK	31 atau lebih	Ada	Baik
4	Andi Wibowo	D3	25-30 tahun	Ada	Sangat Baik
5	Andi Kartawan	D3	18-24 tahun	Ada	Sangat Baik
6	Arif Rahmat Islam Nasution	SMK/DMK	18-24 tahun	Tidak Ada	Sangat Baik
7	Dimas Nurhikmah	D3	31 atau lebih	Tidak Ada	Sangat Baik

Image 1. Calculation Form Display



KODE ALTERNATIF	NAMA ALTERNATIF	NILAI PREFERENSI	RANKING	STATUS
A15	Husna Zaino	1,000	1	Sangat Baik

Image 2. Result Form Display

CONCLUSION

The TOPSIS method can be applied in a decision support system to determine training participant candidates at the Asahan Manpower Office. The developed system is able to process candidate data systematically based on the criteria of education, age, work experience, and interview. The results of the TOPSIS calculation produce preference values that are used to determine the ranking of training participant candidates. With the existence of this system, the training participant selection process becomes more objective, effective, and efficient, thereby supporting faster, more precise, and measurable decision-making.

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