International Journal Of Health, Engineering And Technology (IJHET) *E-ISSN 2829 - 8683*
Volume 5, Number 2, July 2026, *Page. 2384 - 2390*
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Web-Based Decision Support System For Selecting The Best Field Work Practice Placement Using The Topsis Method

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Abstract

The selection of an optimal internship placement represents a significant challenge for students and schools due to the large number of partner companies available and the diversity of evaluation criteria involved. This study develops a Decision Support System (DSS) to determine the best internship placement using the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method. The system was developed using PHP and MySQL technologies and is accessible through a web browser to facilitate user access and interaction. The study utilized data from 10 internship partner companies of SMK Islam Nusantara Comal in 2024, evaluated based on five criteria: distance, position quota, field suitability, facilities, and company reputation. The calculation results indicate that PT Laksana Manufacturing ranked first with a preference value of 0.7884. The developed system proved effective in supporting objective and efficient decision-making processes.

Keywords: Decision Support System, TOPSIS, Internship Placement, Multi-Criteria Decision Making, Web-Based System

INTRODUCTION

Internship or Field Work Practice (PKL) is an essential component of vocational education aimed at providing students with real-world work experience through the application of knowledge and skills acquired during the learning process at school (Paramitha et al., 2024). Through internship activities, students not only gain practical experience relevant to their field of expertise but also develop an understanding of industrial work culture, improve their professional competencies, and prepare themselves to enter the labor market after graduation (Yasin et al., 2026). Therefore, the success of internship implementation is highly influenced by the suitability between the internship placement and the students' areas of expertise.

Selecting an appropriate internship placement presents a considerable challenge for vocational high schools because it requires consideration of various factors, such as the relevance of job assignments to the study program, the quality of supervision provided by the company, supporting facilities, institutional reputation, and the distance between the company location and the students' residences or the school (Murniati & Usman, 2021). The large number of internship placement alternatives and the diversity of evaluation criteria make the selection process increasingly complex (Hutagalung et al., 2025). When this process is conducted manually, the resulting decisions tend to be subjective, time-consuming, and potentially lead to mismatches between students' competencies and industry requirements (Jauhar, 2025).

SMK Islam Nusantara Comal is one of the vocational high schools in Pemalang Regency, Indonesia, offering several study programs, including Computer and Network Engineering, Accounting and Institutional Finance, Light Vehicle Automotive Engineering, Motorcycle Engineering and Business, and aviation-related competencies. In the 2023/2024 academic year, the school placed hundreds of students in various partner companies to undertake internships. The large number of participants and the variety of partner companies require a system capable of supporting the placement process in an effective, efficient, and objective manner.

One approach that can be employed to address this issue is the implementation of a 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 utilization of data, models, and specific

analytical methods (Aronson et al., 2005). In the context of internship placement selection, a DSS can process multiple evaluation criteria simultaneously, thereby generating recommendations that are more objective and justifiable.

The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method is one of the most widely used multi-criteria decision-making approaches due to its simple concept, ease of implementation, and ability to provide accurate ranking results (Salim et al., 2022). The fundamental principle of TOPSIS is to select alternatives that have the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution (Mulya & Hadikurniawati, 2024). Through this approach, the TOPSIS method is capable of producing the best alternative recommendations based on all criteria involved in the decision-making process.

Previous studies by (Kristina, 2018) have applied the TOPSIS method in various fields, including employee selection, supplier evaluation, business location determination, and other decision alternative assessments. However, the application of TOPSIS in decision support systems for internship placement selection, particularly in vocational high school environments, remains relatively limited. Furthermore, most previous studies have not integrated the calculation process and recommendation presentation into a web-based application that can be easily accessed by both schools and students.

Based on these issues, this study aims to design and develop a web-based Decision Support System for selecting the best internship placement using the TOPSIS method. The developed system is expected to assist schools in determining internship locations that match students' competencies in a faster, more objective, transparent, and efficient manner, thereby improving the quality of internship implementation and supporting graduates' readiness to enter the workforce.

RESEARCH METHODS

Research Design

This study employed a Research and Development (R&D) approach to design and develop a web-based Decision Support System (DSS) for selecting the best internship placement using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. The R&D approach was chosen because the study focused not only on the development of an information system product but also on testing the functionality and effectiveness of the resulting system.

The research process consisted of five main stages: needs analysis, system design, implementation, testing, and evaluation. The needs analysis stage was conducted to identify problems associated with the internship placement process, which had previously been carried out manually. The system design stage included the development of system flow diagrams, use case diagrams, and database designs utilized in the application. Subsequently, the implementation stage involved developing a web-based application using the PHP programming language and the MySQL database management system. The testing stage employed the black-box testing method to ensure that all system functions operated according to user requirements. The final stage, system evaluation, aimed to assess the system's ability to generate internship placement recommendations objectively and efficiently.

The research data were obtained from the internship implementation records of SMK Islam Nusantara Comal in 2024, involving 424 students from 14 classes and 10 partner companies that served as alternatives in the decision-making process.

Implementation of the TOPSIS Method

The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method was employed to determine the best internship placement alternatives based on a set of predefined evaluation criteria. The fundamental principle of this method is to select alternatives that have the shortest distance from the positive ideal solution and the greatest distance from the negative ideal solution.

Construction of the Decision Matrix

The first stage involved constructing a decision matrix containing the values of each company alternative for all evaluation criteria. In this study, 10 partner companies and five evaluation criteria were used, resulting in a decision matrix of size 10 × 5.

Normalization of the Decision Matrix

The second stage involved normalizing the decision matrix using the vector normalization method to eliminate differences in measurement scales among criteria. The normalized values were calculated using the following equation: rij = xij / sqrt(Σxij²), where rij represents the normalized value, xij denotes the element of the decision matrix, and sqrt(Σxij²) is the square root of the sum of squares of all elements in criterion column (j). This normalization process is essential to remove differences in units and scales among the evaluation criteria.

Construction of the Weighted Normalized Decision Matrix

The third stage involved constructing the weighted normalized decision matrix by multiplying each normalized value by the corresponding criterion weight using the following equation: vij = wj × rij where wj is the weight assigned to criterion j. The criterion weights were determined according to the relative importance of each criterion in the internship placement selection process. Criteria with higher weights exerted greater influence on the final ranking results.

Determination of Positive and Negative Ideal Solutions

The next stage involved determining the positive ideal solution ((A^+)) and the negative ideal solution ((A^-)). The positive ideal solution was derived from the best value of each criterion, whereas the negative ideal solution was derived from the worst value of each criterion according to whether the attribute was categorized as a benefit or a cost criterion.

Calculation of Separation Measures

The distances of each alternative from the positive and negative ideal solutions were then calculated using Euclidean distance as follows: Di+ = sqrt(Σ(vij - vj+)²) dan Di- = sqrt(Σ(vij - vj-)²), where vj^+ and vj^- represent the positive and negative ideal solution values for criterion (j), respectively. These distances measure how close or far each alternative is from the desired ideal conditions.

Calculation of Preference Values

The preference value for each alternative was calculated using the relative closeness coefficient to the ideal solution. The resulting preference values ranged from 0 to 1, where a higher value indicated a greater level of suitability as a recommended internship placement.

Ranking Process

The final stage involved ranking all alternatives in descending order based on their preference values, resulting in a prioritized list of partner companies ranging from the most recommended internship placement to the least preferred alternative.

System Specifications

The decision support system was developed using a web-based client–server architecture to enable flexible access for users through both the internet and the school's intranet network. The server-side application was developed using PHP version 8.2, while data management was handled using MySQL version 8.0 as the relational database management system. The user interface was built using HTML5, CSS3, and the Bootstrap 5 framework to provide a responsive display across various devices. In addition, JavaScript was utilized to enhance application interactivity and perform client-side data validation. The application was deployed using the Apache web server integrated within the XAMPP package. The system can be accessed through various web browsers, including Google Chrome, Mozilla Firefox, and Microsoft Edge. To ensure data security and restrict user privileges, the system incorporates a user authentication mechanism.

Evaluation Criteria

The selection of internship placements was based on five main criteria considered most relevant to the needs of students and the school. These criteria include the distance of the company location

from the school, the number of available internship positions, the degree of alignment between the company's field of work and the students' competencies, the facilities provided by the company, and the reputation of the partner company.

The distance criterion was categorized as a cost attribute because shorter distances are more beneficial for students in terms of time efficiency and transportation costs. In contrast, the number of available positions, field suitability, facilities, and company reputation were classified as benefit attributes, as higher values indicate better alternative quality.

Table 1. Evaluation Criteria and Weights

Code	Criteria	Weight	Attribute Type	Description
C1	Distance	0.25	Cost	The shorter the distance, the better
C2	Position Quota	0.20	Benefit	The larger the quota, the better
C3	Field Suitability	0.30	Benefit	The higher the relevance, the better
C4	Facilities	0.15	Benefit	The more complete the facilities, the better
C5	Company Reputation	0.10	Benefit	The better the reputation, the better

The weight assigned to each criterion was determined according to its level of importance in the internship placement selection process. Field suitability received the highest weight because it was considered the most important factor in supporting students' competency development during the internship program.

RESULTS AND DISCUSSION

Alternative Data

The data used in this study were obtained from the 2024 internship records of SMK Islam Nusantara Comal. A total of 10 partner companies were selected as internship placement alternatives, each possessing different characteristics in terms of travel distance, position quotas, field suitability, facilities, and company reputation. The alternative data and corresponding criterion values used in the TOPSIS calculation are presented in Table 2.

Table 2. Alternative Data and Evaluation Criteria

No	Alternative	C1 (km)	C2 (positions)	C3 (1–5)	C4 (1–5)	C5 (1–5)
1	PT. Laksana Manufacturing	3	57	3	5	5
2	Hutomo Digital Printing Ulujami	8	8	5	4	5
3	TEFA Center TKRO	3	8	5	4	4
4	Karima Pharmacy	3	6	4	5	4
5	Comal District Office	10	6	4	5	4
6	Jaya Komputer Sragi	12	6	3	4	3
7	Comal Post Office	20	5	5	3	5
8	PT BPR BKK Taman (Perseroda) Branch C	25	5	5	5	3
9	UPPD SAMSAT Pemalang Regency	5	5	5	4	4
10	PT BPR BKK Taman (Perseroda) Branch C	25	5	5	4	5

TOPSIS Calculation Results

The TOPSIS calculations were performed automatically by the developed system based on the input alternative data and evaluation criteria. The calculation process began with the construction of the decision matrix, followed by matrix normalization, weighted normalization, determination of positive and negative ideal solutions, distance calculations, and computation of the preference value

((C_i)) for each alternative. The preference value ranged from 0 to 1, where higher values indicated better alternative performance.

The complete TOPSIS calculation results for the ten partner companies are presented in Table 3.

Table 3. TOPSIS Calculation Results

No	Alternative	D+	D−	Ci	Ranking
1	PT. Laksana Manufacturing	0.0424	0.2143	0.8347	1
2	TEFA Center TKRO	0.1642	0.1309	0.4435	2
3	Karima Pharmacy	0.1718	0.1267	0.4243	3
4	UPPD SAMSAT Pemalang Regency	0.1746	0.1200	0.4075	4
5	Hutomo Digital Printing Ulujami	0.1664	0.1060	0.3890	5
6	Comal District Office	0.1762	0.0894	0.3365	6
7	Jaya Komputer Sragi	0.1835	0.0734	0.2857	7
8	Comal Post Office	0.1991	0.0529	0.2099	8
9	PT BPR BKK Taman (Perseroda) Branch C	0.2132	0.0477	0.1829	9
10	PT BPR BKK Taman (Perseroda) Branch C	0.2129	0.0462	0.1784	10

The results indicate that PT. Laksana Manufacturing achieved the highest preference value of 0.8347, making it the most recommended internship placement alternative according to the evaluation criteria and weights used in this study.

System Testing

Table 4. System Testing Results

No	Feature	Result
1	Add/Edit/Delete Alternatives	Successful
2	Add/Edit/Delete Criteria	Successful
3	Automatic TOPSIS Calculation	Successful
4	Display Ranking Results	Successful
5	Export to PDF/Excel	Successful

System testing was conducted using the black-box testing method, which evaluates system functionality without considering the internal code structure. The testing process involved three primary scenarios: alternative management (adding, editing, and deleting company alternative data), criteria management (adding, editing, and deleting evaluation criteria and their associated weights), and automatic TOPSIS calculations (processing input data to generate final rankings). All testing scenarios were completed successfully with satisfactory results, indicating that the system functions in accordance with the predefined specifications. The computational time required to perform TOPSIS calculations involving 10 alternatives and 5 criteria was less than one second, demonstrating excellent computational efficiency. In addition, the system provides export functionality for PDF and Excel formats to facilitate documentation and reporting purposes. Overall, the testing results demonstrate that all major system features operate properly and can be reliably utilized to support the internship placement selection process.

Discussion

Based on the TOPSIS calculation results, PT. Laksana Manufacturing achieved the highest ranking with a preference value ((C_i)) of 0.8347. The company demonstrated significant advantages, particularly in terms of the largest internship quota, accommodating up to 57 students, and a high level of suitability for the Light Vehicle Engineering (TKRO) study program. Combined with its relatively short distance from the school location (3 km), the company emerged as the most optimal choice for internship placement. The substantially higher preference value compared with other alternatives indicates that PT. Laksana Manufacturing possesses characteristics that are closest to the positive ideal solution.

The second rank was occupied by TEFA Center TKRO, which obtained a preference value of 0.4435. This alternative had the same travel distance as the highest-ranked company (3 km) but offered

a smaller internship quota of only eight positions. Nevertheless, TEFA Center TKRO demonstrated a high level of field suitability (score = 5) and good supporting facilities (score = 4), making it a strong alternative for internship placement. The third position was occupied by Karima Pharmacy, with a preference value of 0.4243, which exhibited similar characteristics but provided a smaller internship quota of six positions.

The lowest-ranked alternative was PT BPR BKK Taman (Perseroda) Branch C, with a preference value of 0.1784. Although the company provided an adequate internship quota and a relatively high degree of field suitability, its considerable distance from the school location (25 km) substantially reduced its overall preference score. This finding indicates that the distance criterion (C1), with a weight of 0.25, exerted a considerable influence on the final ranking results.

Overall, the findings demonstrate that the TOPSIS method is capable of generating objective and consistent rankings based on predefined evaluation criteria. The substantial difference between the preference values of the highest-ranked and lowest-ranked alternatives (0.8347 versus 0.1784) indicates that the method is sensitive to variations in alternative characteristics. Based on the obtained preference values, companies with (C_i > 0.50) can be categorized as highly recommended internship placements, those with (0.30 \leq C_i \leq 0.50) can be classified as moderately recommended, and companies with (C_i < 0.30) can be considered less recommended compared with other available alternatives.

CONCLUSIONS

This study successfully designed and developed a web-based Decision Support System (DSS) for selecting the best internship placement using the TOPSIS method. The developed system is capable of assisting students and school administrators in the internship placement process in a more objective, transparent, and efficient manner. By integrating five evaluation criteria distance, position quota, field suitability, facilities, and company reputation the system generates rankings based on objective mathematical calculations, thereby reducing the subjectivity that frequently occurs in manual decision-making processes.

The TOPSIS calculation results indicate that PT. Laksana Manufacturing achieved the highest ranking with a preference value ((C_i)) of 0.8347, followed by TEFA Center TKRO in second place with a preference value of 0.4435. The findings demonstrate that the TOPSIS method is effective in handling multi-criteria decision-making problems by producing consistent and academically justifiable rankings. One of the main advantages of TOPSIS in this study is its ability to process criteria with different measurement scales and generate preference values that are straightforward to interpret.

Several recommendations can be proposed for future research. First, increasing the number of partner company alternatives and evaluation criteria could improve the accuracy and comprehensiveness of the analysis. Second, integrating the system with a student database would enable personalized recommendations based on individual study programs and interests. Third, incorporating recommendation features based on students' individual preferences through the use of the Analytic Hierarchy Process (AHP) or other multi-criteria decision-making methods for weight determination could further enhance decision quality. Finally, conducting large-scale system implementation and evaluation involving users from multiple vocational schools would provide a more comprehensive assessment of system effectiveness and user satisfaction.

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