Journal of Information Systems Engineering and Management
2025, 10(52s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Analysis of the Effectiveness of Topsis, Electre, and Profile Matching Algorithms to Support Managerial Decision Making at Al Azhar Memorial Garden

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ARTICLE INFO

Received: 25 Dec 2024

Revised: 14 Feb 2025

Accepted: 22 Feb 2025

ABSTRACT

The funeral industry faces hurdles in intricate decision-making processes owing to technological improvements and evolving consumer preferences. This study seeks to assess the efficacy of the TOPSIS, ELECTRE, and Profile Matching algorithms in improving managerial decision-making in Al Azhar Memorial Garden. The questionnaire and interview data were employed under the theoretical framework of the Theory of Planned Behavior to comprehend customers' perceptions. The results gathered from the questionnaire and interview will be used to develop multiple viable marketing strategies as potential alternatives for reaching consumers. The alternatives obtained from the questionnaire and interview will be evaluated using TOPSIS, ELECTRE, and Profile Matching methods. Deterministic modelling will be utilized to assess the efficacy and precision of each algorithm. This study assesses the viability of consolidating the three algorithms into a cohesive system to improve future decision-making processes. Based on the TOPSIS method, it is shown that "Personalization of Services," "Online Booking System," and "Limited-Time Promotions" emerged as the most effective tactics according to consumer preferences.

Keywords: *TOPSIS, ELECTRE, Profile Matching, Funeral Industry*

Introduction

As more people choose cremation over conventional burial techniques, the funeral industry is undergoing significant change. Despite the continued use of traditional burials, cremation has grown in popularity. [1]. Government regulations may also impact this shift, influencing choices between cremation and burial. For example, in some U.S. states, embalming requirements have been shown to lower cremation rates by roughly 16% while increasing funeral expenses by 2.6% [2]. Various factors, including social influences and government regulations, play a significant role in shaping public preferences for burial methods. The evolution of services and marketing strategies significantly affects consumer decisions in this sector. [3]. Consequently, funeral practice decisions are heavily influenced by the prevailing social climate. Changes in these social dynamics pose challenges for the funeral business in attracting and retaining clients.

As technology advances, the funeral industry has also experienced substantial changes. Facilitating digital services during funeral processes is one of the new responsibilities of funeral service providers. They can serve as intermediaries between digital service providers and families. One example of this innovation is offering webcasting capabilities, enabling family members who cannot attend in person to watch the funeral procession virtually. Funeral providers can assist families in selecting this service and introducing such technology to a sector historically slow in adopting innovations [4]. Some funeral companies have continually leveraged technological

Journal of Information Systems Engineering and Management
2025, 10(52s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

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advancements to evolve and adapt to modern needs and preferences despite financial crises driving many people toward cremation [5]. This situation highlights the need for the funeral business to innovate continually, adapting to changing social dynamics and technological advancements.

The funeral business in Indonesia faces similar challenges. For instance, Al Azhar Memorial Garden still uses manual decision-making in its marketing department. This results in low managerial precision and efficiency, slowing daily operations (Personal Interview, 2024). Manual systems often cannot handle the complexities of decision-making and market dynamics [6]. Additionally, difficulties in understanding customer preferences can hinder marketing strategies and customer relationships. [7]. Although technology-based Decision Support Systems (DSS) have been proven to enhance decision-making speed and accuracy, the absence of such systems exacerbates the situation. [8]. Al Azhar Memorial Garden must effectively manage resources, accurately determine services, and adapt to market changes to ensure efficient service, customer satisfaction, and business sustainability. The funeral industry faces challenges that require precise managerial decisions and innovative strategies.

Al Azhar Memorial Garden, a contemporary Islamic cemetery, offers a well-organized environment, comprehensive amenities, and professional services compliant with Islamic law. [9], [10]. Despite its excellent services and products, its marketing decisions are still made manually. This study, therefore, proposes applying a DSS based on the TOPSIS, ELECTRE, and Profile Matching algorithms. This DSS is expected to enhance managerial accuracy and efficiency while helping Al Azhar Memorial Garden adapt to ever-changing market conditions. Data-driven and technology-based decision-making enables valid data analysis, better evaluation of alternatives, and prediction of each option's outcomes. [11], [12]. Accordingly, this study explores how management can be supported in making marketing decisions by utilizing the three DSS algorithms: TOPSIS, ELECTRE, and Profile Matching.

Understanding customer wants and preferences is crucial for management when devising marketing strategies. [13]. This knowledge offers deep insights into customer perspectives and helps understand their purchase intentions. This analysis leads to the identification of potential alternatives. The DSS serves as a decision-making tool to identify the best option. Moreover, the selection criteria are aligned with customer viewpoints. Based on consumer insights, this study first develops several potential alternatives and criteria before employing the TOPSIS, ELECTRE, and Profile Matching algorithms. These alternatives and criteria are then analyzed using the three algorithms. Thus, this study uses the Theory of Planned Behavior as a reference framework for understanding customers.

This study focuses on managerial decision-making at Al Azhar Memorial Garden, specifically in understanding customer perceptions and order placement intentions. The Theory of Planned Behavior (TPB), which posits that attitudes toward behavior, subjective norms, and perceived behavioral control influence an individual's intention, is employed to analyze these intentions. [14], [15]. These factors are evaluated using data collected through questionnaires and interviews, which serve as the foundation for designing various potential strategies to attract customers. Based on data analysis from questionnaires and interviews, this study establishes relevant criteria as references in the decision-making process, including potential alternatives further analyzed using the TOPSIS, ELECTRE, and Profile Matching algorithms. Thus, determining alternatives and criteria is based on an analysis of consumer understanding derived from the questionnaire and interview data before computations using the three algorithms.

The efficacy of the three algorithms—TOPSIS, ELECTRE, and Profile Matching—in supporting marketing decision-making at Al Azhar Memorial Garden is assessed. This study seeks to identify the most suitable algorithm among the three for the Al Azhar Memorial Garden. These algorithms were chosen because each has unique strengths in helping select the optimal alternative based on complex criteria. Furthermore, the study makes an academic contribution by performing a detailed analysis of these algorithms to determine their feasibility for integration into a single system. Thus, the study investigates the viability of integrating these three algorithms into a system that can assist Al Azhar Memorial Garden in decision-making. Integrating these algorithms into a single system, uncommon in the funeral industry, could significantly contribute to the literature on information system management and funeral services.

This study evaluates how well TOPSIS, ELECTRE, and Profile Matching support Al Azhar Memorial Garden decision-making. Deterministic modeling ensures consistent and predictable results by eliminating uncertainty and random variables when running the model with the same input. [16]. This model is frequently applied in DSS because it provides precise and reliable results for decision-making processes. Through deterministic modeling, this study examines the outcomes of the three algorithms to identify the most appropriate approach for cemetery management. Although these algorithms have proven effective in various domains [17], [18], [19]Their

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application in the funeral industry remains under-researched. Hence, this study aims to provide data-driven recommendations to help Al Azhar Memorial Garden optimize its management and marketing strategies.

By adhering to deterministic modeling principles of certainty and reliability, the use of deterministic modeling ensures that algorithm evaluations yield accurate and consistent results. [16]. This approach also evaluates the effectiveness of integrating the three algorithms into a single DSS. This study offers a novel academic contribution through an in-depth analysis of the TOPSIS, ELECTRE, and Profile Matching algorithms. It evaluates their potential integration to support decision-making at Al Azhar Memorial Garden. This integration is expected to contribute significantly to information system management and the funeral services literature. Consequently, the study titled "**Analysis of the Effectiveness of** TOPSIS, ELECTRE, and Profile Matching Algorithms to Support Managerial Decision-Making at Al Azhar Memorial Garden" was conducted.

Research Methods

Referring to Figure 3, this research method begins with:

Problem Identification This study reveals inefficiencies in the manual decision-making process at Al Azhar Memorial Garden, which impact managerial accuracy and everyday operations. Obstacles in comprehending customer preferences exacerbate the challenges, affecting marketing strategy and customer interactions.

Research Question Formulation

1. What obstacles are faced in decision-making at Al Azhar Memorial Garden?
2. How effective are the TOPSIS, ELECTRE, and Profile Matching algorithms in supporting managerial decisions?
3. Is integrating these algorithms into a unified system feasible and beneficial?

Literature Search A comprehensive review of prior research was conducted, focusing on the application of DSS, decision-making algorithms (TOPSIS, ELECTRE, Profile Matching), and the Theory of Planned Behavior to support decision-making processes.

The selection procedure focused on peer-reviewed publications, conference proceedings, and case studies pertinent to Decision Support Systems and multi-criteria decision-making methodologies. The criteria encompassed the influence of Decision Support Systems (DSS) on managerial decision-making and comparative analyses of algorithms within decision support frameworks. TOPSIS and Profile Matching have been employed to enhance selection precision in student competitions and customer loyalty initiatives [35], [36]. ELECTRE and TOPSIS have been amalgamated to address decision-making amongst ambiguity, particularly in fuzzy environments [37]Profile Matching and TOPSIS have improved supplier recommendations. [38]. Comparative analyses, such as the assessment of environmental conservation initiatives in the EU, revealed that ELECTRE II yielded more consistent rankings than TOPSIS. [39]. Although research often integrates many DSS algorithms, none have specifically evaluated the combination of TOPSIS, ELECTRE, and Profile Matching in marketing decision-making or within the context of the Theory of Planned Behavior. This study aims to address these shortcomings.

Data Extraction. Primary data was collected through structured surveys and discussions with prospective clients. Secondary data obtained from pertinent literature offered insights into performance indicators and decision-making frameworks, facilitating the analysis of Al Azhar Memorial Garden's decision-making processes.

Data Analysis and Synthesis The data analysis utilizes both quantitative and qualitative methodologies. Quantitative analysis is performed on structured questionnaire data, while qualitative insights are obtained from conversations with prospective clients. These strategies elucidate customer perceptions, which underpin the development of alternatives and criteria that correspond with their preferences. Subsequently, the three algorithms (TOPSIS, ELECTRE, and Profile Matching) are assessed by deterministic modelling to determine their efficacy. This method guarantees a comprehensive evaluation of the algorithms' efficacy in facilitating decision-making, thereby identifying the optimal approach for Al Azhar Memorial Garden's marketing tactics.

Framework Development: A decision-making framework incorporating the three algorithms was established to assess their efficacy. This approach integrates the Theory of Planned Behavior to synchronize marketing efforts with consumer intent and preferences.

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Results and Discussions

Before analyzing the TOPSIS, ELECTRE, and Profile Matching algorithms, the initial phase in this study is the formulation of a questionnaire directed at prospective clients of Al Azhar Memorial Garden. The research questions are formulated based on the framework of the Theory of Planned Behavior, which is specifically intended to examine intentions. The respondents' responses will yield data that will then be analyzed using the TOPSIS, ELECTRE, and Profile Matching algorithms. The research inquiries, formulated in alignment with the Theory of Planned Behavior, are as follows:

1. Attitude Toward Behavior

A. Cognitive Dimension (Belief about Outcomes)

a. I believe that purchasing a burial plot at Al Azhar Memorial Garden will provide comfort and peace of mind for me and my family.

b. I feel that Al Azhar Memorial Garden is the right choice for a funeral due to its facilities and good location.

B. Affective Dimension (Emotional Response)

a. I feel at peace when purchasing a burial plot at Al Azhar Memorial Garden.

b. I feel that choosing Al Azhar Memorial Garden for a funeral is a pleasant decision and does not cause stress.

2. Subjective Norms

A. Injunctive Norms

a. My family and friends support my decision to purchase a burial plot at Al Azhar Memorial Garden.

b. Important people in my life expect me to choose Al Azhar Memorial Garden as a burial site.

B. Descriptive Norms

a. I see that many people in my community have chosen Al Azhar Memorial Garden for their family burials.

b. I often hear that Al Azhar Memorial Garden is a popular choice among friends and family.

3. Perceived Behavioral Control

A. Internal Control

a. I am confident that I can purchase a burial plot at Al Azhar Memorial Garden.

b. I feel that the process of purchasing a burial plot at Al Azhar Memorial Garden will not be difficult for me.

B. External Control

a. I have enough time and resources to purchase a burial plot at Al Azhar Memorial Garden.

b. I feel that Al Azhar Memorial Garden provides sufficient information and support to help me through the process of purchasing a burial plot.

4. Intention

a. I intend to purchase a plot at Al Azhar Memorial Garden.

b. I plan to buy a burial plot at Al Azhar Memorial Garden.

c. I intend to make future purchases at Al Azhar Memorial Garden.

Outer Model Test Outer Model Analysis verifies the validity and reliability of the dimensions employed for measurement. This model study illustrates the correlation between latent variables and their indices. The following is an outer model analysis to assess the viability of the employed research model:

Convergent Validity Convergent validity refers to indicators resulting from the correlation between individual item or component scores with the overall construct score. Below is an assessment of convergent validity, namely:

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	Attitude	Intention	Perceived Behavioral Control	Subjective Norms
AT1	0.838			
AT2	0.873			
AT3	0.868			
AT4	0.85			
INT1		0.812		
INT2		0.843		
INT3		0.865		
PBC1			0.776	
PBC2			0.816	
PBC3			0.826	
PBC4			0.804	
SN1				0.841
SN2				0.845
SN3				0.816
SN4				0.727

This study adheres to the criterion that convergent validity is achieved when the value attains 0.7 [40]. Consequently, it can be asserted that each indicator above 0.7 in each variable has satisfied the criteria for convergent validity.

Discriminant Validity

The discriminant validity in this study uses the Fornell-Larcker Criterion and Cross Loadings calculations, namely as follows:

	Attitude	Intention	Perceived Behavioral Control	Subjective Norms
Attitude	0.857			
Intention	0.736	0.84		
Perceived Behavioral Control	0.783	0.784	0.806	
Subjective Norms	0.735	0.684	0.756	0.809

The rule used in this study is that if the correlation between a construct and an item in the construct is greater than the correlation with other constructs, then discriminant validity is achieved. [41]. Based on this rule, it can be stated that it has met the requirements for discriminant validity according to the Fornell-Larcker version. Next is the Cross Loadings version, namely as follows:

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e-ISSN: 2468-4376
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	Attitude	Intention	Perceived Behavioral Control	Subjective Norms
AT1	0.838	0.608	0.644	0.627
AT2	0.873	0.652	0.684	0.638
AT3	0.868	0.656	0.698	0.659
AT4	0.85	0.604	0.659	0.596
INT1	0.647	0.812	0.721	0.582
INT2	0.576	0.843	0.607	0.538
INT3	0.624	0.865	0.638	0.6
PBC1	0.606	0.603	0.776	0.616
PBC2	0.65	0.613	0.816	0.681
PBC3	0.655	0.665	0.826	0.58
PBC4	0.614	0.644	0.804	0.563
SN1	0.621	0.545	0.603	0.841
SN2	0.608	0.565	0.603	0.845
SN3	0.566	0.532	0.568	0.816
SN4	0.579	0.566	0.662	0.727

According to the calculation results, all indicators exhibit the maximum value on the construct intended for measurement. For instance, in the Attitude variable, the indication for this variable is most significant when evaluated against itself, specifically Attitude. Similarly, for other variables, it can be asserted that discriminant validity is achieved when each indicator has a stronger correlation with the targeted construct than with alternative constructs, hence ensuring the model possesses robust discriminant validity.

Reliability and Validity Test

The tests used in this study are reliability and validity tests, namely as follows:

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Attitude	0.88	0.881	0.917	0.735
Intention	0.792	0.793	0.878	0.706
Perceived Behavioral Control	0.82	0.821	0.881	0.649
Subjective Norms	0.822	0.822	0.883	0.654

Based on the results of this study, it can be seen that all reliability tests have met the requirements because they are greater than 0.7, so they pass the reliability test. While for the validity test with AVE, the value is greater than 0.5, so it passes the validity test.

Inner Model Test The next test is the inner model test to determine whether or not there is a causal relationship in the variables studied.

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e-ISSN: 2468-4376
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Uji R Square Below is the R Square test in this study as part of the inner model test, namely as follows:

	R-square	R-square adjusted
Intention	0.659	0.657

Based on the adjusted R Square value, it was found that the value obtained was 65.7%, which means that the remaining 34.3% was influenced by other factors not examined by this study.

Total Effect Test The following is a test to understand how much influence the independent variables have on the dependent variable.

	T statistics	P values
Attitude -> Intention	4.721	0
Perceived Behavioral Control -> Intention	8.437	0
Subjective Norms -> Intention	2.454	0.014

The results of this Total Effect test indicate a strong influence of Attitude on Intention. A T-statistic of 4.721 and a P-value of 0 show that an individual's attitude towards a conduct significantly influences their intention to engage in that action. A more favorable disposition toward an action will motivate people to be more inclined to execute it. Within the framework of the Theory of Planned Behavior, attitude signifies an individual's subjective assessment of the advantages or repercussions of a conduct, and this examination substantiates that a favorable attitude is vital in influencing intention. The correlation between Perceived Behavioral Control and Intention yields significant results, evidenced by a T-statistic of 8.437 and a P-value of 0. A greater T-statistic value relative to other factors signifies that perceived behavioral control exerts the most substantial influence on intention. This indicates that an individual's confidence in their capability and resources to do an action correlates positively with their intention to engage in that conduct.

Perceived control instills confidence in individuals while confronting potential hurdles or problems, hence enhancing their confidence and intention to act. Additionally, Subjective Norms exert a considerable impact on intention, evidenced by a T-statistic of 2.454 and a P-value of 0.014. Subjective norms denote the social pressures experienced by individuals from their surroundings, including family, friends, or society at large. Despite being less significant than the other two factors, these findings indicate that social norms play a significant role in shaping individuals' intentions. When individuals perceive support or social pressure from significant figures in their lives, their propensity to adhere to the recommended conduct will increase. Consequently, societal standards establish a contextual framework that either enhances or diminishes an individual's intention to engage in an activity.

Interview Results The interview results reveal that consumer preferences for cemetery services at Al Azhar Memorial Garden center on emotional, practical, and social support dimensions. The emotional components emphasize individualized bereavement counseling and the establishment of a tranquil atmosphere. Pragmatic preferences encompass intuitive digital instruments, such as online reservation systems and virtual tours. Social effects indicate a preference for community-oriented efforts such as referral schemes and partnerships with local religious leaders. Insights obtained from direct consumer feedback provide a basis for developing focused marketing strategies and service improvements aligned with customer requirements.

Deterministic Modelling for TOPSIS, ELECTRE, and Profile Matching. Deterministic model testing can be done using a sensitivity test. This process aims to evaluate and compare the results of two MADM methods. By applying a sensitivity test to the system, users can easily choose the most appropriate method. In addition, the sensitivity test also functions to provide a more precise solution in solving multi-attribute decision-making (MADM) problems using the most suitable method. This test can be done by adding a 10 percent weight to the weights that have been previously used. The weights in this study are as follows 4,3,5,2,3. With the addition of 10 percent to some of the weights that have been used, the additions are as follows:

1. **4 + (10% dari 4)** = 4+0.4=4.44 + 0.4 = 4.44+0.4=4.4

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e-ISSN: 2468-4376
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2. **5 + (10% dari 5)** = 5+0.5=5.55 + 0.5 = 5.55+0.5=5.5
3. **3 + (10% dari 3)** = 3+0.3=3.33 + 0.3 = 3.33+0.3=3.3

Thus, the data in this study, along with the weights that have been added, are as follows:

WEIGHT	4.4	3	5.5	2	3.3
Alternative	**K001**	**K002**	**K003**	**K004**	**K005**
ALT001	**1**	**1**	**2**	**1**	**2**
ALT002	**3**	**2**	**2**	**3**	**3**
ALT003	**1**	**3**	**2**	**2**	**3**
ALT004	**3**	**3**	**1**	**2**	**2**
ALT005	**1**	**1**	**1**	**1**	**3**
ALT006	1	1	2	1	2
ALT007	3	2	2	3	3
ALT008	1	3	2	2	3
ALT009	3	3	1	2	2
ALT010	1	1	1	1	3
ALT011	3	3	2	1	3
ALT012	3	3	1	1	3

Comparison of the results of the TOPSIS method before and after sensitivity analysis is as follows:

Before Sensitivity Analysis		After Sensitivity Analysis	
V	Results	V	Results
0.374443676	Grief Counseling Services	0.383951557	Grief Counseling Services
0.809517881	Personalization of Services	0.820968963	Personalization of Services
0.531812412	Thematic Pilgrimage	0.524043844	Thematic Pilgrimage
0.571838575	Collaboration with Community Leaders	0.565778148	Collaboration with Community Leaders
0.161186667	Funeral Education through Recitation	0.16535808	Funeral Education through Recitation
0.374443676	Community Referral Program	0.383951557	Community Referral Program
0.809517881	Online Booking Application	0.820968963	Online Booking Application
0.531812412	Virtual Cemetery Tour	0.524043844	Virtual Cemetery Tour
0.571838575	AI-Based Chatbot	0.565778148	AI-Based Chatbot
0.161186667	Family Discount Package	0.16535808	Family Discount Package
0.713133769	Limited-Time Promotion	0.728384002	Limited-Time Promotion
0.54893432	Consumer Loyalty Points	0.549558678	Consumer Loyalty Points

The results of the sensitivity analysis show that the values and rankings of the alternatives remain consistent even though there is a weight change, such as an increase in weight by 10%. Although there is a slight change in

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2025, 10(52s)
e-ISSN: 2468-4376
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the value of V, this change does not affect the overall order of the decision results. This shows that the decision-making model used has high stability to changes in parameters. In addition, the consistency of these results also indicates that the modified criterion weights are not sensitive to variations, so they do not have a significant effect on the final decision. For example, services such as "Personalization of services" and "Online booking application" remain in the highest ranking both before and after the sensitivity analysis, while other options also maintain the same order. Therefore, it can be concluded that the method used in this model is reliable and robust in producing consistent decisions, even though the weight parameters change.

Before Sensitivity Analysis		After Sensitivity Analysis	
G	Results	G	Results
0	Grief Counseling Services	0	Grief Counseling Services
0	Personalization of Services	0	Personalization of Services
4	Thematic Pilgrimage	4	Thematic Pilgrimage
2	Collaboration with Community Leaders	2	Collaboration with Community Leaders
1	Funeral Education through Recitation	1	Funeral Education through Recitation
2	Community Referral Program	2	Community Referral Program
0	Online Booking Application	0	Online Booking Application
4	Virtual Cemetery Tour	4	Virtual Cemetery Tour
1	AI-Based Chatbot	1	AI-Based Chatbot
0	Family Discount Package	0	Family Discount Package
2	Limited-Time Promotion	2	Limited-Time Promotion
2	Consumer Loyalty Points	2	Consumer Loyalty Points

Based on the results of the sensitivity analysis with the ELECTRE method, it can be seen that there is no change in the ranking of alternatives before and after the sensitivity analysis. Despite changes in the weight parameters, the ranking results remain consistent. For example, options such as "Grief counseling services" and "Personalization of services" remain at the same number, namely 0, while other options, such as "Thematic pilgrimage" and "Virtual funeral tour," remain at number 4 both before and after the sensitivity analysis. This consistency shows that the ELECTRE method has high stability against changes in the weight of the criteria. This indicates that the method is reliable in producing consistent decision results even though there are variations in parameters. So the ELECTRE method can provide robust results amid weight changes. Next are the calculation results with the Profile Matching method:

Before Sensitivity Analysis		After Sensitivity Analysis	
Ranking		Ranking	
1	ALT005	1	ALT005
2	ALT002	2	ALT002
3	ALT001	3	ALT001
4	ALT004	4	ALT004
5	ALT003	5	ALT003
6	ALT006	6	ALT006
7	ALT007	7	ALT007
8	ALT009	8	ALT009
9	ALT008	9	ALT008
10	ALT009	10	ALT009

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e-ISSN: 2468-4376
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Based on the table presented, it can be seen that there is no change in the ranking of alternatives before and after sensitivity analysis using the Profile Matching method. Alternatives with rankings 1 to 10 remain in the same position, such as "ALT005" remains in rank 1, "ALT002" in rank 2, and so on up to "ALT009" in rank 10. This consistency shows that the Profile Matching method used in decision-making analysis has high stability against parameter changes. In other words, changes in the weight parameters or input variables do not affect the final ranking results. This indicates that the Profile Matching method is reliable in producing consistent decisions and is not sensitive to small variations in parameters. The results of the sensitivity analysis carried out on the three methods, namely TOPSIS, ELECTRE, and Profile Matching, it can be stated that the three methods are as follows:

1. TOPSIS shows high stability in the decision-making process. Changes in the criteria weights do not significantly affect the decision results, either in terms of preference values or alternative rankings. This shows that the TOPSIS method is quite reliable for situations with multiple alternatives and complex criteria. This stability makes TOPSIS a suitable choice for decision-making contexts that require solutions that are closest to the ideal point.
2. ELECTRE can also maintain consistency in the ranking results even though there are changes in the criteria weights. The absence of changes in alternative rankings indicates that this method has high reliability in dealing with parameter variations. ELECTRE is very effective in filtering out less relevant alternatives and providing well-structured solutions, especially in cases with many alternatives and interrelated criteria.
3. Profile Matching shows similar results to TOPSIS and ELECTRE, namely, high stability in the decision-making process. Changes in weights do not cause changes in alternative rankings, indicating that this method is reliable in matching ideal profiles with actual profiles based on various criteria. The advantage of this method lies in its ability to measure the level of suitability using the main factors (Core Factor) and supporting factors (Secondary Factor), making it a suitable method for competency-based evaluation.

These three methods, namely TOPSIS, ELECTRE, and Profile Matching, show a high level of reliability and stability in supporting managerial decision making. There is no significant change in the ranking of alternatives even though a sensitivity analysis is carried out, indicating that these methods are quite robust to parameter variations. In the context of Al Azhar Memorial Garden, these three methods can be relied on to support strategic decision-making, both individually and through potential integration into a more comprehensive system. If necessary, further exploration can be carried out to assess the effectiveness of integrating the three in a holistic decision support system.

Conclusions

Potential and Challenges of Advanced Technologies Industry 4.0 technologies, such as artificial intelligence (AI), offer great potential to personalize learning, but also carry the risk of reinforcing existing inequalities if not implemented carefully. This emphasizes the need for a balanced and ethical approach in adopting advanced technology in education. **Framework for Digital Equality** Based on these findings, this study proposes a framework for digital equality in education that includes three main components: infrastructure and access, skills development, and responsible technology integration. This framework offers a holistic approach to overcoming the challenges of digital equality in education.

Need for Multi-stakeholder Collaboration. Effective implementation of the proposed framework will require close collaboration between policymakers, educators, the technology industry, and society. This integrated approach is important to ensure that efforts to overcome digital inequality are in line with the principles of Sustainable Development Goal 4 (Quality Education) and are relevant to the development of Industry 4.0 technology.

Implications for Future Research Although this study provides valuable insights, there remains a need for further research. In particular, empirical studies are needed to test the effectiveness of the proposed framework in various contexts and to continuously adapt it in line with rapid technological developments.

In conclusion, achieving digital equality in education in the Industry 4.0 era is a complex but important challenge to overcome. This requires a multidimensional approach that focuses not only on providing technology access but also on developing digital literacy and integrating advanced technologies ethically and inclusively. By addressing these challenges, we can ensure that the benefits of the digital revolution in education are accessible to all, in line with the principles of Sustainable Development Goal 4 (Quality Education) for inclusive and equitable quality education.

Finally, this study emphasizes that digital equality is not only a technology issue, but also a social justice

issue. Achieving digital equality in education is a critical step in ensuring that future generations have the skills and knowledge necessary to thrive in an increasingly digital world, while ensuring that no one is left behind in this digital transformation.

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Journal of Information Systems Engineering and Management
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