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A Multi-Criteria Decision-Support Framework for Optimizing Digital Marketing Strategies in Indonesian SMEs Using Fuzzy AHP–TOPSIS

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ABSTRACT

Digital marketing has emerged as a critical determinant of competitiveness for small and medium enterprises (SMEs) operating within emerging economies. A comparable situation is observed in Indonesia, where the identification of suitable marketing strategies has become increasingly intricate due to multiple interacting constraints. These include limitations associated with financial resources, performance expectations, and other operational restrictions. Despite this complexity, a considerable proportion of SMEs continue to depend on intuition-based judgement rather than adopting systematic and model-driven approaches. To address this shortcoming, the present study develops a multi-criteria decision support framework integrating Fuzzy AHP and TOPSIS for the optimisation of digital marketing strategy selection among Indonesian SMEs. The proposed framework assesses alternative strategies using key evaluation dimensions, including economic outcomes such as return on investment (ROI) and conversion rates, levels of customer engagement, brand equity development, and associated operational expenditures. Empirical evidence was obtained from marketing professionals and SME practitioners located in major urban centres of Indonesia. The findings indicate that strategies centred on influencer-led content, when combined with performance-oriented advertising mechanisms, achieve the highest aggregated evaluation scores under the simultaneous consideration of financial and branding criteria. The developed model offers a systematic and data-oriented mechanism for prioritising marketing alternatives and determining an efficient portfolio under conditions of uncertainty, thereby minimising reliance on subjective judgement. This research advances the domain of decision science by presenting a structured analytical framework that supports improved allocation of strategic resources and strengthens the digital competitiveness of SMEs. Furthermore, it provides actionable insights for both SME managers and policymakers, highlighting the necessity of adopting analytically robust approaches in marketing decision-making processes.

1. Introduction

Digital marketing and are designednedgndedciated strategies may be conceptualised as

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organisational-level marketing initiatives designed to leverage digital technologies for integrated communication with diverse stakeholders, including customers and business partners. Such strategies facilitate multiple interaction channels that enable systematic customer data acquisition. Concurrently, enhancements in organisational market capabilities are closely linked with the adoption of digital marketing practices, allowing firms to anticipate evolving market trends and shifts in consumer preferences.

Within the Indonesian context, SMEs constitute a fundamental component of the national economy; however, their transition towards digital marketing adoption has been accompanied by significant constraints [65]. These enterprises frequently encounter financial limitations, insufficient technical knowledge, and a lack of specialised expertise required to effectively manage digital campaigns. Consequently, the capacity to make well-informed strategic decisions remains restricted [10]. Furthermore, the rapidly evolving nature of the digital environment intensifies these challenges, particularly for resource-constrained firms. Under such conditions, the availability of clear and systematic guidance becomes essential. Effective decision-making is therefore critical to enable SMEs to optimise their digital marketing initiatives and achieve sustainable growth. This situation underscores the necessity for a structured framework capable of supporting the evaluation and enhancement of digital marketing strategies among Indonesian SMEs.

A multi-criteria decision-support framework (MCDS) offers a rigorous and systematic mechanism for complex decision-making scenarios [66]. It enables organisations to assess and prioritise alternative strategies based on multiple evaluation dimensions. In the context of SME digital marketing, such a framework incorporates criteria including economic performance, customer engagement, brand equity, and operational costs. The integration of fuzzy AHP and TOPSIS further refines the analytical process by improving the handling of uncertainty, particularly in cases involving subjective expert evaluations. The fuzzy AHP technique is employed to establish the relative significance of criteria and sub-criteria, whereas TOPSIS facilitates the ranking of strategic alternatives according to their proximity to an ideal solution. The combined application of these methods provides a coherent and quantitative basis for evaluating digital marketing strategies, even when decision parameters are ambiguous or complex.

This study is centred on the development of a decision-support framework specifically designed for Indonesian SMEs to enhance the effectiveness of their digital marketing strategies. Through the application of fuzzy AHP and TOPSIS, the research seeks to identify optimal strategic options based on critical performance indicators such as ROI, customer retention, and brand awareness, which are essential for competitiveness in digital markets. This approach supports evidence-based decision-making and assists SMEs in overcoming structural barriers that limit their digital advancement. The remainder of the paper is structured as follows. Section 2 presents the literature review with its respective sub-sections. Section 3 outlines the research methodology. Section 4 provides the analysis and discusses the principal findings, while the final section offers the concluding remarks.

2. Literature Review

This literature review is intended to examine prior studies concerning digital marketing strategies, performance evaluation metrics, and decision-support systems, with particular emphasis on applications of MCDM techniques such as Fuzzy AHP and TOPSIS. The review is organised into three principal sections. The first section addresses the identification of key factors and sub-factors associated with digital marketing strategy formulation and the optimisation of marketing-related decisions. The second section evaluates various strategic approaches, which are analysed in detail in subsequent discussions. The final section concentrates on widely adopted MCDM methodologies as applied within the existing body of research.

2.1 Major Factors and Sub-Factors for Evaluating Digital Marketing Strategies

The concept of digital marketing originated during the 1990s, a period characterised by rapid advancements in information and communication technologies. As articulated by Pride et al. [43], digital marketing refers to the utilisation of diverse digital media, including internet-based platforms, mobile technologies, and interactive channels, to establish communication and engagement with customers. In the contemporary digital era, technological progress has enabled individuals to access information instantaneously, significantly expanding the availability of knowledge that was previously difficult to obtain.

Consequently, there has been a substantial shift towards the Internet as a primary source of information. This transformation has compelled organisations to adjust to an increasingly digital environment, where maintaining an online presence has become indispensable for sustaining competitiveness. Furthermore, digital marketing serves as a critical instrument for information-oriented organisations, supporting the promotion of services and the development of long-term relationships with both existing and potential users [69], thereby ensuring continued relevance in dynamic market conditions. A range of determinants has been identified as influential in shaping effective digital marketing strategies [3; 8; 9; 19; 38; 39; 71]. As outlined in Table 1, these determinants encompass key performance indicators such as return on investment, conversion rate, customer acquisition cost, customer lifetime value, social media engagement, click-through rate, brand awareness, customer trust, customer retention rate, lead conversion rate, brand perception, and net promoter score.

More recently, digitalisation and technological innovation have been recognised as central drivers of SME growth and organisational success [45]. Concurrently, existing literature has examined both the opportunities and challenges associated with SME digital transformation [26]. For organisations seeking to capitalise on technological progress and achieve strategic objectives, continuous enhancement of digital infrastructure and platforms is essential [64]. This is particularly evident in the domain of digital marketing, which has facilitated more efficient customer interaction for SMEs [53]. Rizvanović et al. [47] highlight that digital marketing represents one of the most rapidly expanding and influential dimensions of modern business, evolving beyond traditional promotional functions towards a relationship-oriented mechanism that enables advanced forms of digital engagement. In addition, Li et al. [30] identify four principal social media marketing strategies, namely social selling, content marketing, risk management, and relationship management, each underscoring the strategic importance of digital platforms in enhancing international business expansion. Table 1 summarises the primary factors and sub-factors identified within this context.

Table 1
 Major Factors and Sub-Factors Influencing Digital Marketing Performance and their Corresponding Literature References

Major Factors	Sub-Factors	Assigned Code	Literature References
1. Economic Performance (MF1)	Return on Investment (ROI)	MF11	[42]
	Conversion Rate	MF12	[35]
	Customer Acquisition Cost (CAC)	MF13	[1]
	Customer Lifetime Value (CLTV)	MF14	[13]
	Cost per Click (CPC)	MF15	[21]
	Cost per Acquisition (CPA)	MF16	[62]
	Lead-to-Customer Conversion Rate	MF17	[23]
	Sales Growth Rate	MF18	[15]
	Average Revenue per User (ARPU)	MF19	[9]
	Marketing ROI	MF20	[36]

Table 1 (continued)

Major Factors and Sub-Factors Influencing Digital Marketing Performance and their Corresponding Literature References

Major Factors	Sub-Factors	Assigned Code	Literature References
2. Customer Engagement (MF2)	Sub-Factor	Assigned Code	Literature References
	Social Media Engagement (likes, shares, comments)	MF21	[19]
	Email Open Rate	MF22	[41]
	Click-Through Rate (CTR)	MF23	[68]
	Content Interaction (e.g., video views, time on page)	MF24	[67]
	Feedback and Sentiment Analysis	MF25	[27]
	Influencer Endorsement and Interaction	MF26	[55]
	Loyalty Program Participation	MF27	[61]
	Net Promoter Score (NPS)	MF28	[6]
	Customer Retention Rate	MF29	[12]
3. Brand Equity (MF3)	Sub-Factor	Assigned Code	Literature References
	Brand Awareness	MF31	[71]
	Brand Perception	MF32	[39]
	Brand Recall and Recognition	MF33	[8]
	Customer Trust	MF34	[3]
	Customer Satisfaction	MF35	[38]
	Emotional Connection with the Brand	MF36	[33]
	Brand Differentiation	MF37	[48]
	Brand Consistency	MF38	[37]
	Online Reviews and Reputation	MF39	[44]
4. Operational Cost (MF4)	Sub-Factor	Assigned Code	Literature References
	Budget Allocation	MF41	[56]
	Cost-Effectiveness of Digital Channels	MF42	[29]
	Technology and Tool Costs (analytics platforms, CRM)	MF43	[32]
	Content Creation Costs	MF44	[46]
	Cost of Distribution and Ad Placement	MF45	[46]
	Advertising Spend vs Revenue Generated	MF46	[34]
	Outsourcing vs In-House Operations	MF47	[25]
	Campaign Management Costs	MF48	Kumar, 2012 #30}
	Cost of Customer Acquisition (CAC)	MF49	[1]
Return on Marketing Investment (ROMI)	MF50	[14]	

2.2 Identification of the Strategies (S1 to S10)

Following the identification of relevant factors and sub-factors associated with digital marketing and decision optimisation, it becomes necessary to determine appropriate strategies that effectively address these dimensions. In this context, prior studies offer valuable insights into strategic approaches aligned with the identified criteria. Table 2 presents a comprehensive set of alternatives, where strategies labelled from S1 to S10 have been derived through an extensive review of the literature based on the established factors and sub-factors. A concise explanation of each proposed strategy is also included in Table 2.

Table 2
 Identified Strategies Codes and their References

Strategy Code	Strategies	Source
S1	Leverage Social Media Advertising	[52]
S2	Implement Influencer Marketing	[49]
S3	Develop Customer Loyalty Program	[60]
S4	Enhance Website Optimization and SEO	[59]
S5	Use Data Analytics for Targeted Marketing	[4]
S6	Personalized Email Marketing Campaigns	[17]
S7	Improve Content Marketing and Blogging	[40]
S8	Invest in Mobile Marketing	[57]
S9	Implement E-Commerce Sales Channels	[24]
S10	Adopt Marketing Automation Tools	[16]

2.3 Literature Gaps as Observed

Following an extensive examination of prior research, this study identifies several critical gaps within the existing literature. In particular, a significant limitation is the insufficient emphasis on effective resource allocation and optimisation, especially in contexts characterised by financial constraints.

Table 3
 Key Findings and the Gaps as Observed

S.No.	Authors (Year)	Scope	Major Findings	Gaps Identified
1	[54]	The impact of digital marketing on the performance of SMEs	The research found that digital marketing is essential for SME performance, enhancing economic results, market presence, and customer engagement. Digital transformation acts as a mediator.	The study lacks a focus on specific strategies for resource allocation and optimization under budget constraints. It also misses detailed decision-support models for SMEs.
2	[2]	Analysing digital marketing strategies for SMEs using machine learning	Machine learning models predict successful digital marketing campaigns for SMEs with 90% accuracy. Key predictors include engagement metrics, conversion rates, ad spend, and audience reach.	The model struggles with class imbalance, affecting its ability to predict unsuccessful campaigns accurately. More advanced techniques like synthetic data generation are needed for better predictions.
3	[51]	Digital marketing in SMEs via data-driven strategies	SMEs are increasingly using data science to enhance their online marketing strategies.	The study doesn't provide specific guidance on how SMEs can integrate these strategies effectively, nor does it focus on actionable frameworks for adopting data-driven marketing.
4	[28]	Optimizing business performance in Jakarta SMEs through digital marketing channel utilization.	SMEs in Jakarta mainly rely on social media marketing, search engine marketing, and affiliate marketing for business performance. Email marketing had a negligible impact.	Limited scope as focus is only on the SMEs in Jakarta, without comparing effectiveness across different regions. It doesn't explore how SMEs can allocate resources across these channels for optimal performance.

To facilitate the prioritisation of the proposed strategies, Figure 1 illustrates the structure of the decision-making hierarchy, incorporating the identified primary factors and sub-factors in alignment

with the central objective of the study.



Fig. 1: Decision Hierarchy for Prioritization of Strategies

3. Research Methodology

The research process commenced with a comprehensive review of the relevant literature, followed by the collection of expert opinions to identify a total of 55 sub-factors. A panel comprising four academic specialists and two industry practitioners was engaged to evaluate these sub-factors, ranking them according to their significance for Indonesian SMEs in the context of digital marketing strategy optimisation. The average value for each sub-factor was computed using a five-point Likert scale, and those with mean scores below three were subsequently excluded. As a result, 50 sub-factors were retained and considered sufficiently important for further investigation. In the subsequent stage, an additional literature assessment, combined with expert consultation, facilitated the categorisation of these sub-factors into four overarching factors. Concurrently, ten strategic alternatives were identified from the literature, each aligned with the selected factors and sub-factors. The overall research framework is illustrated in Figure 2.

A structured questionnaire was then administered to five experts to conduct pairwise comparisons of factors and to evaluate the identified strategies using a 1–9 Likert scale. The analytical procedure incorporated two MCDM techniques, namely Fuzzy AHP and Fuzzy TOPSIS, with the objective of determining factor weights and assessing the relative performance of strategies. Specifically, Fuzzy AHP was employed to derive the weights of the factors, whereas Fuzzy TOPSIS was utilised to compute the closeness coefficients and rank the strategic alternatives. The integration of these methods enables a comprehensive assessment of both factor influence and strategic effectiveness. MCDM approaches are widely recognised for addressing complex decision-making problems, and their application across various practical contexts has been extensively documented. Table 4 provides a comparative overview of several MCDM techniques, including TOPSIS, AHP, ELECTRE III, PROMETHEE II, Grey Relational Analysis, Fuzzy TOPSIS, MOORA, WASPAS, VIKOR, and FAHP, highlighting their operational mechanisms, capacity to handle multiple criteria,

and relative strengths and limitations in dealing with complex datasets and subjective evaluations during the ranking of alternatives.

Table 4

MCDM Methods from the Literature

MCDM Method	Application	Authors
Fuzzy TOPSIS	Nuclear decommissioning risk management	[5]
AHP	Evaluation of tram routes in a city	[18]
ELECTRE III	Strategic Environmental Assessment	[7]
PROMETHEE II	Evaluation of irrigation methods	[11]
Gray Relational Analysis	Assessment of water quality	[58]
TOPSIS	Evaluation of regions for geothermal energy	[31]

The selection of Fuzzy AHP and Fuzzy TOPSIS in this study is justified by their comparative advantages over other MCDM techniques. These approaches are particularly effective in handling uncertainty and imprecision, offering greater analytical robustness in contrast to methods that rely on precise and deterministic data inputs. Both techniques demonstrate considerable flexibility in modelling ambiguous decision environments. Specifically, Fuzzy AHP enables the incorporation of uncertainty inherent in expert judgements, while Fuzzy TOPSIS effectively addresses incomplete information and subjective evaluations. Moreover, the combined application of these methods produces clear and interpretable rankings of alternatives, which is comparatively more straightforward than the interpretation of results generated through methods such as AHP and ELECTRE III. Further theoretical elaboration on fuzzy theory, Fuzzy AHP, and Fuzzy TOPSIS is presented in the subsequent sections.

3.1 Fuzzy Set Theory

Fuzzy set theory forms the foundational basis of both Fuzzy AHP and Fuzzy TOPSIS, enabling the management of imprecise or uncertain information. Originally proposed by Zadeh [70], fuzzy set theory addresses the ambiguity inherent in human language by allowing elements to possess varying degrees of membership within the interval of 0 to 1, rather than a strict binary classification. A commonly employed representation is the triangular fuzzy set, defined by three parameters, a , b , and c , which collectively capture uncertainty in a flexible manner. This allows decision-makers to model a spectrum of values, offering a more realistic representation of ambiguity. Triangular fuzzy numbers (TFNs) are frequently used to quantify uncertain numerical values, enhancing the practical applicability of fuzzy models in decision-making contexts. Analytic Hierarchy Process (AHP), introduced by Saaty in 1971, is a well-established MCDM method for evaluating and ranking alternatives across multiple criteria. While AHP provides a structured framework for decision-making, it is limited in handling subjectivity, particularly when dealing with qualitative criteria, making precise numerical assignment challenging. To overcome these limitations, Fuzzy AHP integrates fuzzy set theory with AHP, reducing uncertainty in the evaluation of criteria by incorporating vagueness in expert judgements. The method commonly utilises the geometric mean approach proposed by Saaty and Kearns. Fuzzy AHP has been applied to a wide range of practical problems, including prioritising factors in agile software development, evaluating site selection using sustainability criteria, and assessing operational barriers. The process involves pairwise comparisons of items using a nine-point scale, with the results processed through triangular fuzzy numbers to introduce fuzziness, thereby supporting more reliable decision-making under uncertainty. The implementation of Fuzzy AHP in this study follows a systematic procedure:

Step 1: Development of a fuzzy comparison matrix by establishing a linguistic scale based on

TFNs, ranging from 1 to 9. The membership functions corresponding to this scale are defined in Table 5.

Table 5
 Linguistic Variables and Membership Functions for Fuzzy AHP in Digital Marketing Strategy Optimization

Importance Level	Linguistic Terms	Membership Function (TFN)
One	Equal Importance	(1,1,1)
Three	Equal Importance	(1,3,5)
Five	Moderately Important	(3,5,7)
Seven	Highly Important	(5,7,9)
Nine	Critically Important	(7,9,11)

The next step involves employing TFNs to construct a pairwise comparison matrix for both the main criteria and sub-criteria, as illustrated in Equation 1.

$$\tilde{A} = [1 \dots \tilde{a}_{m1} : \dots : \tilde{a}_{n1} \dots 1] \quad \text{Equation 1}$$

The Fuzzy Geometric Mean is computed according to the formulation presented in Equation 2.

$$\tilde{r}_i = (\tilde{a}_1 * \tilde{a}_2 \dots \tilde{a}_n)^{1/n} \quad \text{Equation 2}$$

Where the term \tilde{a}_i determines the value of the fuzzy comparison matrix from criteria 1 to n.

The subsequent step involves determining the global fuzzy number for each evaluation criterion, which is calculated using the Equation 3 provided.

$$\tilde{W} = \tilde{r}_1 * (\tilde{r}_1 * \tilde{r}_1 \dots \tilde{r}_1)^{-1} \quad \text{Equation 3}$$

The following step entails identifying the optimal non-fuzzy performance. This is achieved by converting the global fuzzy numbers into crisp weights, calculated as the mean of the fuzzy weights for each criterion using Equation 4.

$$BNP_{wi} = \frac{[lw_i + mw_i + uw_i]}{3} \quad \text{Equation 4}$$

After calculating the weight assigned by each expert, the average is computed to obtain the final optimal weight for each criterion. The subsequent step involves assessing the consistency of the pairwise comparisons by calculating the consistency index (CI) and the consistency ratio (CRI), as defined in the following formulas.

$$\lambda_{max} = \frac{1}{n} \sum_{j=1}^n \frac{AW_j}{W} \quad \text{Equation 5}$$

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad \text{Equation 6}$$

$$CR = CI / CRI \quad \text{Equation 7}$$

A consistency ratio (CR) value of ≤ 0.1 is generally considered acceptable, indicating that the pairwise comparisons are sufficiently consistent. If the CR exceeds this threshold, the decision-maker is advised to revise the elements of matrix A to improve consistency. Table 5 presents the CRI values corresponding to different matrix sizes (n). Meanwhile, Table 6 displays the fuzzy pairwise comparison matrix for the main factors (MF1 to MF4), which was used to compute their respective weights. Similarly, pairwise matrices were constructed for the sub-factors within each main category for every expert.

Table 6
 Fuzzy Representative Matrix for Major Factors (MF1-MF4) for An Expert

	MF1 (Economic Performance)			MF2 (Customer Engagement)			MF3 (Brand Equity)			MF4 (Operational Cost)		
MF1 (Economic Performance)	1	1	1	5	7	9	5	7	9	5	7	9
MF2 (Customer Engagement)	0.111	0.134	0.300	1	1	1	5	7	9	5	7	9
MF3 (Brand Equity)	0.111	0.134	0.300	0.117	0.134	0.300	1	1	1	5	7	9
MF4 (Operational Cost)	0.111	0.134	0.300	0.117	0.134	0.300	0.117	0.134	0.300	1	1	1

3.2 Fuzzy TOPSIS Approach

TOPSIS, introduced by Hwang and Yoon [22], is a widely recognised MCDM technique that facilitates group decision-making, particularly in situations where there is disagreement regarding the relative importance of criteria. The method operates by identifying the shortest distance to the ideal solution, which maximises benefits and minimises costs, and the farthest distance from the negative-ideal solution, which minimises benefits and maximises costs. Fuzzy TOPSIS extends this approach by integrating fuzzy logic to manage preferences and reduce ambiguity [50]. While traditional TOPSIS has been applied to determine weights and ranks for criteria, the incorporation of fuzzy logic allows for a more accurate representation of human judgement, recognising that numerical values alone may not fully capture subjective perceptions. The procedure for applying Fuzzy AHP-TOPSIS to derive criterion weights involves the following steps:

Step 1: Construction of a fuzzy comparison matrix using fuzzy values, based on the membership functions presented in Table 7.

Table 7
 Membership Functions for Intensity of Importance in Fuzzy Comparison Matrix

Intensity of Importance	Membership Function (TFN)/Linguistic Variable
1	(1, 1, 3), Does Not Overcome
3	(1, 3, 5), Insufficiently Overcome
5	(3, 5, 7), Sufficiently Overcome
7	(5, 7, 9), Greatly Overcome
9	(7, 9, 11), Absolute Overcome

Step 2 involves aggregating the decision matrices from all decision-makers, which is performed using Equation 8.

$$I_{ij} = \{I_{ij}^k\}, m_j = 1 / k \sum_{k=1}^k m_{ij}^k, u_j = \min\{u_{ij}^k\} \quad \text{Equation 8}$$

Step 3 involves normalising the values in the decision matrix, which is carried out using Equation 9.

$$I_{ij} = \left(\frac{I_{ij}}{u_j}, \frac{m_{ij}}{u_j}, \frac{u_{ij}}{u_j} \right) \quad \text{Equation 9}$$

Step 4 involves weighting the normalised matrix. Each element is multiplied by its corresponding normalized weight vector, $w = (w_1, w_2, w_3, \dots, w_n)$, to form the weighted matrix V . The elements of V are calculated using the formula $V_{ij} = w_{ij} * r_{ij}$, where $i = 1, \dots, m$ and $j = 1, \dots, n$.

$$\tilde{V}_{ij} = \tilde{\omega}_j \tilde{r}_{ij}, i=1,2,\dots,m; j=1,2,\dots,n \quad \text{Equation 10}$$

In Step 5, the fuzzy positive ideal solution (FPIS) and the fuzzy negative ideal solution (FNIS) are

identified. The corresponding calculations are performed using the equations provided below.

$$A^+ = \{v_1^+, v_2^+, \dots, v_j^+, \dots, v_m^+\} \text{ Equation 11}$$

$$A^- = \{v_1^-, v_2^-, \dots, v_j^-, \dots, v_m^-\} \text{ Equation 12}$$

$$v_j^+ = (1,1,1) \tilde{w}_j \text{ and } v_j^- = (0,0,0), j=1,2,\dots,m \text{ Equation 13}$$

Step 6 focuses on calculating the distance of each alternative from the FPIS and FNIS, using Equations 14 and 15.

$$d_i^+ = \left\{ \sum_{j=1}^n (v_{ij} + v_j^+)^2 \right\}^{1/2}, i=1,2,\dots,m \text{ Equation 14}$$

$$d_i^- = \left\{ \sum_{j=1}^n (v_{ij} + v_j^-)^2 \right\}^{1/2}, i=1,2,\dots,m \text{ Equation 15}$$

In Step 7, the relative closeness of each alternative to the ideal solution is calculated using the equation provided.

The Step 8, involves establishing the ranking of alternatives, where the strategy with the highest closeness coefficient (Ci) is identified as the most preferred.

Tables 8 to 11 present the combined fuzzy decision matrix for the ten selected strategies.

Table 8

Combined Fuzzy Decision Matrix for Strategies for Major Factor Which is Economic Performance or MF1

MF	MF11			MF12			MF13			MF14			MF15			MF16			MF17			MF18			MF19			MF20					
Weight	0.0	0.2	0.7	0.0	0.2	0.4	0.0	0.3	0.	0.0	0.3	0.	0.02	0.3	0.6	0.01	0.	0.	0.01	0.3	0.	0.0	0.	0.	0.01	0.	0.	0.01	0.	0.	0.0	0.	0.
s	5	0	5	1	5	5	8	5	6	4	5	8	2	5	5	1	5	9	5	2	7	2	3	8	7	5	7	3	5	7	3	5	8
S1	7	1	7	3	1	9	5	7	5	3	5	3	3	5	1	3	5	3	5	9	1	3	5	1	3	7	3	3	7	3	3	1	5
S2	1	5	9	5	1	9	3	5	1	5	7	1	1	1	7	5	1	9	1	9	5	3	3	7	3	7	7	9	7	9	9	9	9
S3	3	7	9	5	1	7	9	7	9	1	5	5	7	1	7	9	1	1	1	1	3	3	1	5	1	7	3	1	7	3	1	9	1
S4	5	9	7	9	5	5	7	3	3	1	3	7	7	5	5	1	7	7	7	9	1	1	9	7	7	9	5	7	9	5	7	1	9
S5	1	9	7	7	7	7	7	5	3	7	5	1	1	5	1	7	5	1	7	5	3	1	7	3	3	7	1	9	9	9	7	9	7
S6	1	1	1	1	5	1	7	9	1	5	5	1	3	5	5	1	5	9	9	7	3	1	3	3	5	9	5	1	9	9	9	9	9
S7	5	1	9	1	5	3	7	5	1	9	7	3	1	7	1	7	9	7	9	1	5	5	1	5	7	7	7	3	9	1	9	1	1
S8	1	1	3	7	7	3	5	1	9	5	7	3	7	1	9	1	5	9	5	7	3	9	7	1	9	5	3	3	5	7	5	7	5
S9	1	5	1	3	3	7	9	1	1	7	1	5	9	7	3	9	5	5	7	9	3	3	9	3	1	7	3	1	7	9	7	9	9
S10	3	9	7	3	7	5	5	1	9	7	1	7	9	5	3	7	5	7	1	9	5	3	7	9	9	9	9	9	9	3	3	7	7

Table 9

Combined Fuzzy Decision Matrix for Strategies for Major Factor 2 or MF2

MF2	MF21			MF22			MF23			MF24			MF25			MF26			MF27			MF28			MF29			MF30		
Weight	0.0	0.2	0.	0.2	0.	0.6	0.	0.3	0.6	0.0	0.3	0.6	0.0	0.4	0.	0.02	0.	0.8	0.01	0.3	0.7	0.3	0.4	0.7	0.02	0.2	0.6	0.0	0.6	0.
s	1	5	8	6	4	8	1	5	5	5	2	5	1	5	8	6	5	5	7	9	5	1	5	8	1	5	5	1	2	9
S1	9	3	5	1	5	5	1	1	3	1	7	5	5	5	9	7	5	1	1	7	7	5	5	7	1	5	7	1	5	5
S2	9	1	9	9	3	1	5	5	3	1	3	9	5	5	9	7	7	9	3	3	9	3	5	3	7	1	9	5	7	7
S3	7	7	9	5	5	7	1	1	5	3	7	9	1	5	7	9	3	1	7	3	3	7	3	1	7	7	1	3	7	7
S4	9	7	9	1	3	1	9	9	3	5	1	7	9	5	9	3	1	7	5	9	7	9	3	7	5	9	3	7	5	3
S5	5	3	1	1	5	1	9	5	3	7	3	9	1	3	5	7	5	9	5	1	9	7	1	9	1	5	3	3	3	5
S6	7	7	9	1	7	1	1	5	9	1	1	9	5	7	7	7	7	9	7	1	5	7	9	3	7	3	3	7	3	3
S7	3	3	1	9	3	1	5	9	9	5	1	3	7	9	5	7	5	5	9	1	3	5	1	1	1	3	9	5	9	9
S8	9	9	5	7	7	1	9	7	1	3	1	5	3	9	1	7	1	5	5	1	1	7	1	9	5	1	5	5	5	9
S9	1	9	3	1	1	7	1	3	5	1	7	1	1	3	3	3	1	3	5	7	9	7	5	9	3	5	3	9	5	3
S10	1	7	9	9	3	7	1	9	7	5	9	3	9	1	9	3	7	5	1	7	9	3	1	7	7	3	3	7	5	9

Table 10
 Combined Fuzzy Decision Matrix for Strategies for Major Factor 3 or MF3

MF3	MF31	MF32	MF33	MF34	MF35	MF36	MF37	MF38	MF39	MF40
Weight	0.4	0.6	0.1	0.5	0.1	0.4	0.9	0.1	0.5	0.8
S1	2	5	9	7	9	6	9	1	2	9
S2	1	1	3	1	9	3	9	9	3	3
S3	7	1	5	1	3	9	7	1	3	1
S4	1	5	1	7	7	1	1	1	1	5
S5	7	1	9	1	7	5	1	9	7	1
S6	1	9	7	3	9	1	3	9	5	9
S7	1	1	3	3	9	5	5	7	5	9
S8	1	7	9	5	3	5	1	5	7	1
S9	7	9	1	9	9	5	5	7	1	7
S10	1	1	9	5	9	3	7	3	7	9

Table 11
 Combined Fuzzy Decision Matrix for Strategies for Major Factor 4 or MF4

MF4	MF41	MF42	MF43	MF44	MF45	MF46	MF47	MF48	MF49	MF50
Weight	0.3	0.6	0.7	0.4	0.6	0.9	0.3	0.6	10.4	0.5
S1	6	3	7	8	2	3	9	2	5	4
S2	7	1	1	5	1	1	9	93	5	7
S3	9	1	7	9	3	5	3	5	97	1
S4	5	7	3	1	9	7	5	3	91	7
S5	3	5	9	7	9	3	1	5	19	9
S6	1	7	5	1	3	9	3	1	11	7
S7	9	1	9	3	3	7	7	5	11	5
S8	5	3	9	9	5	3	7	9	11	3
S9	3	7	3	9	1	7	5	3	77	7
S10	3	1	5	9	1	7	9	3	31	7

4. Key Findings

In this study, four major factors were selected: economic performance, customer engagement, brand equity, and brand awareness. Five experts participated in the evaluation, using a 1–9 Likert scale to perform pairwise comparisons of the key categories, which were then compiled into a comparison matrix and analysed using Fuzzy AHP. The final step involved calculating the average of the ideal weights for each factor based on expert assessments. The results, presented in Table 12, indicate that brand awareness is the most influential factor, followed by brand equity, customer engagement, and economic performance, in that order.

Table 12
 Relative Weight and Ranking of Major Factors

Major Factor	Weight	Ranking
MF4 (Brand Awareness)	0.616	1st
MF3 (Brand Equity)	0.483	2nd
MF2 (Customer Engagement)	0.410	3rd
MF1 (Economic Performance)	0.374	4th
Consistency Ratio	0.0412	

Each sub-factor was compared against the others by the experts to establish their relative priorities. A comparison matrix was constructed from the questionnaire data and subsequently analysed using Fuzzy AHP. The weights of the sub-factors were calculated for each expert and then

normalised. The arithmetic mean of these ideal weights was determined to obtain consensus values. Sub-factors were ranked according to their relative weights, with the highest weight assigned the top rank. To calculate the global weight of each sub-factor, its relative weight was multiplied by the optimal weight of the corresponding main factor. Global ranks were then assigned based on these values, as presented in Table 13, with a graphical illustration provided in Figure 2.

Table 13
 Relative and Global Weights/Ranking of the Sub Factors

Sub-Factor	Relative Weight	Relative Rank	Global Weight	Global Rank
ROI (MF11)	0.0155	3	0.0047	30
Conversion Rate (MF12)	0.0119	4	0.0036	31
CAC (MF13)	0.0095	5	0.0029	19
CLTV (MF14)	0.0155	7	0.0046	28
CPC (MF15)	0.0447	7	0.0134	22
CPA (MF16)	0.0071	7	0.0021	32
Lead-to-Customer Conversion Rate (MF17)	0.0095	1	0.0029	6
Sales Growth Rate (MF18)	0.0080	1	0.0024	8
ARPU (MF19)	0.0083	2	0.0025	9
Marketing ROI (MF20)	0.0142	7	0.0043	37
Social Media Engagement (MF21)	0.0286	4	0.0072	25
Email Open Rate (MF22)	0.0875	3	0.0219	7
CTR (MF23)	0.0137	5	0.0034	3
Content Interaction (MF24)	0.0488	7	0.0122	29
Feedback and Sentiment Analysis (MF25)	0.0360	1	0.0090	27
Influencer Endorsement (MF26)	0.0195	4	0.0049	13
Loyalty Program (MF27)	0.0149	1	0.0037	23
NPS (MF28)	0.0744	6	0.0186	2
Customer Retention Rate (MF29)	0.0009	2	0.0002	17
Brand Advocacy (MF30)	0.0559	3	0.0140	40
Brand Awareness (MF31)	0.0378	6	0.0076	26
Brand Perception (MF32)	0.0050	1	0.0010	10
Brand Recall (MF33)	0.0175	5	0.0035	4
Customer Trust (MF34)	0.0813	6	0.0163	1
Customer Satisfaction (MF35)	0.0129	2	0.0026	16
Emotional Connection (MF36)	0.0208	6	0.0042	34
Brand Differentiation (MF37)	0.0167	5	0.0033	38
Brand Consistency (MF38)	0.0020	2	0.0004	11
Online Reviews (MF39)	0.0150	3	0.0030	21
Social Proof (MF40)	0.0007	1	0.0001	36
Budget Allocation (MF41)	0.0006	2	0.0001	15
Digital Channel Effectiveness (MF42)	0.0059	4	0.0015	39
Tech and Tool Costs (MF43)	0.0425	5	0.0106	33
Content Creation Costs (MF44)	0.0230	2	0.0058	14
Ad Placement Costs (MF45)	0.0734	1	0.0184	5
Advertising Spend (MF46)	0.0317	1	0.0079	20
Outsourcing vs In-House (MF47)	0.0103	3	0.0026	24
Campaign Management Costs (MF48)	0.0255	1	0.0064	35
Customer Acquisition Cost (MF49)	0.0369	5	0.0092	18
Return on Marketing Investment (ROMI) (MF50)	0.0163	6	0.0041	12

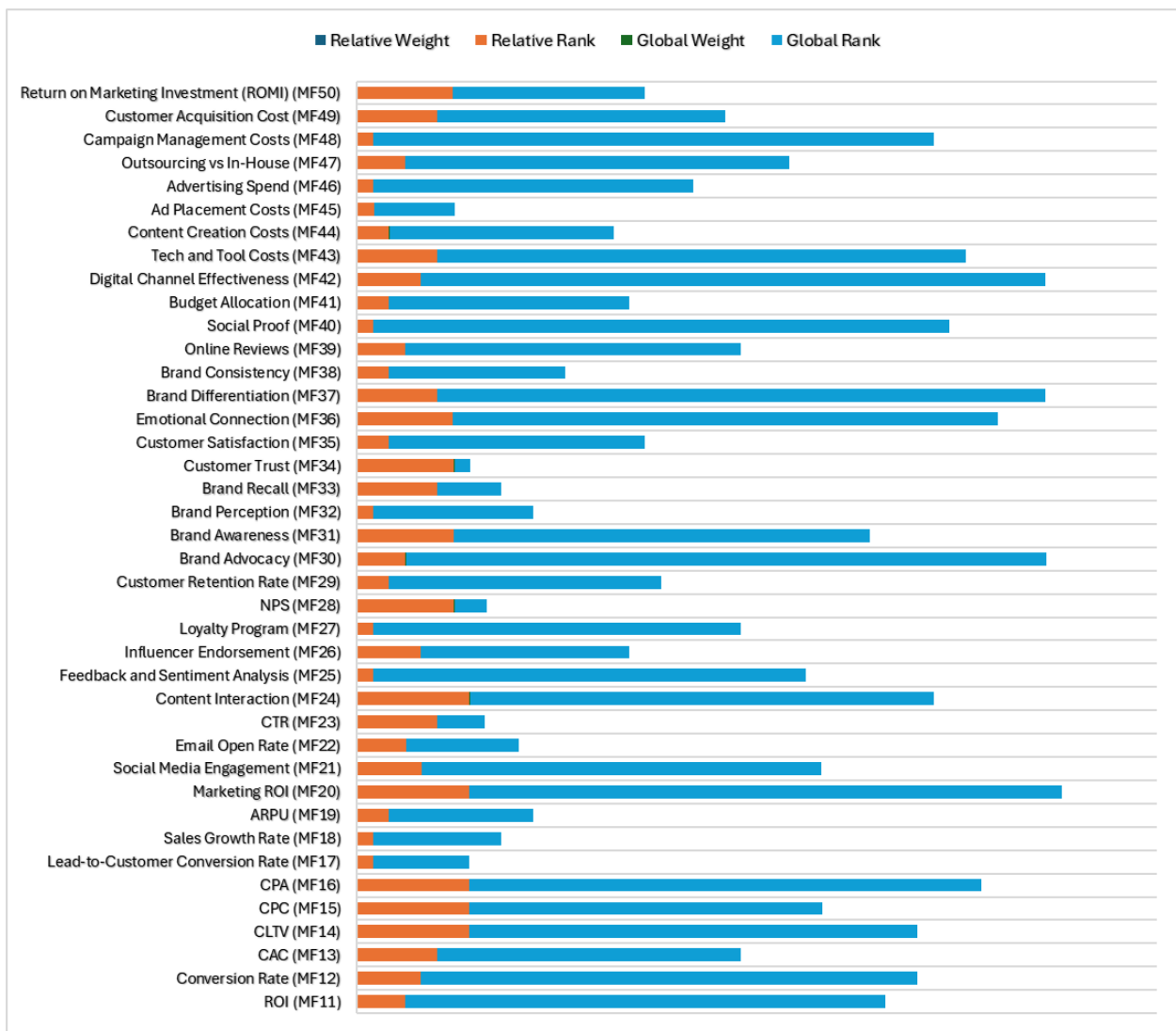


Fig.2: Relative and Global Weights/Ranks of Sub Factors

To prioritise the ten strategies, Fuzzy TOPSIS was employed to calculate the closeness coefficient for each alternative. Five experts assessed the effectiveness of each strategy in addressing the identified barriers using a 1–9 Likert scale. Their responses were aggregated into a fuzzy decision matrix and analysed using the Fuzzy TOPSIS approach.

Table 14
 Closeness Coefficient and Strategies’ Ranking

Strategy Code	Strategies as Selected	di+	di-	Cci	Ranking Order
S1	Leverage Social Media Advertising	1.85	2.9	0.611	2
S2	Implement Influencer Marketing	2.4	2.1	0.467	7
S3	Develop Customer Loyalty Program	2.1	2.95	0.584	3
S4	Enhance Website Optimization and SEO	2.75	1.8	0.395	10
S5	Use Data Analytics for Targeted Marketing	1.95	2.6	0.571	4
S6	Personalized Email Marketing Campaigns	2.3	2.4	0.511	6
S7	Improve Content Marketing and Blogging	2.6	2.2	0.458	8
S8	Invest in Mobile Marketing	1.7	3	0.638	1
S9	Implement E-Commerce Sales Channels	2.05	2.7	0.568	5
S10	Adopt Marketing Automation Tools	2.45	2.05	0.456	9

The resulting rankings and closeness coefficients are presented in Table 14 and illustrated in Figure 3.

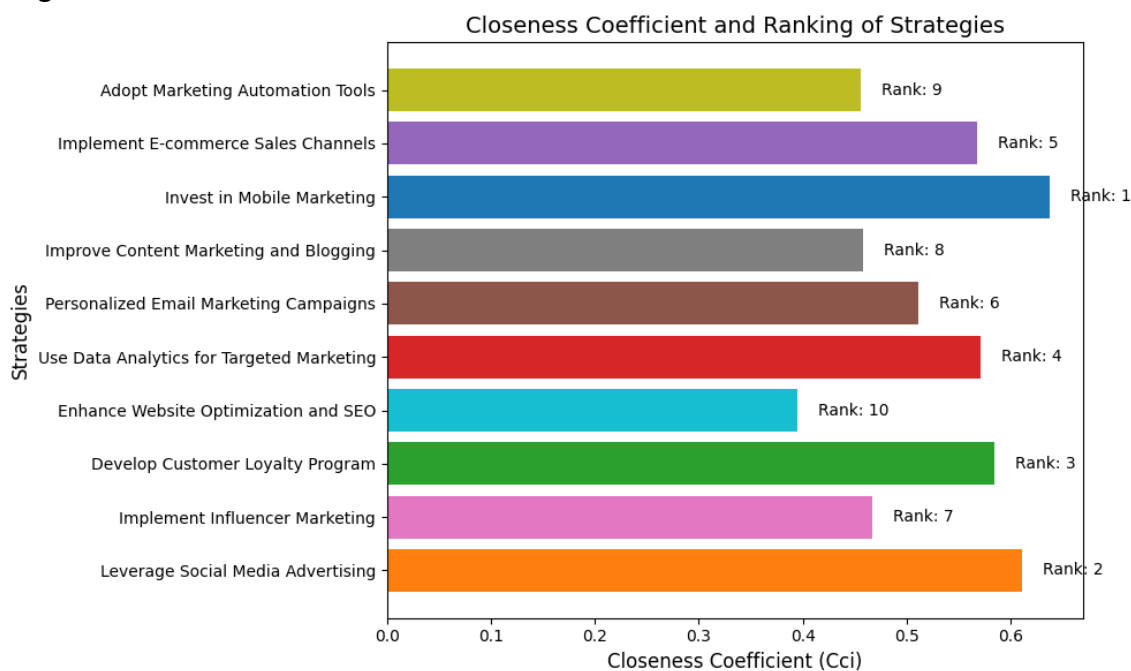


Fig.3: Graphical Presentation of Strategies with Ranking

5. Conclusion

In a dynamic and competitive market environment, strategic decision-making is critical for SMEs, as it directly affects their competitiveness. Effective marketing strategies enable SMEs to optimise resource utilisation, enhance market share, strengthen brand equity, and increase customer engagement. In line with this, the present study applied a multi-criteria decision-support framework using Fuzzy AHP and TOPSIS to evaluate ten digital marketing strategies among Indonesian SMEs. Four major factors were considered—economic performance, customer engagement, brand equity, and operational cost—each further divided into ten sub-factors, including ROI, customer acquisition cost, conversion rate, and customer retention. The results indicate that mobile marketing (Strategy S8) and social media advertising (Strategy S1) achieved the highest rankings based on closeness coefficients, demonstrating their effectiveness in improving customer engagement and economic performance for the sampled SMEs. Specifically, mobile marketing, which attained the highest closeness coefficient, proved particularly effective in boosting lead-to-lead conversion rates and sales growth. Based on these findings, the study offers the following practical recommendations for decision-makers in similar contexts:

Firstly, Indonesian SMEs should prioritise mobile marketing, given its significant impact on customer conversion and sales growth. Secondly, social media advertising should be maintained as a key strategy for enhancing customer engagement and expanding reach to potential customers. Thirdly, SMEs are advised to regularly monitor key performance indicators, such as ROI, customer acquisition cost, and conversion rates, to assess the effectiveness of their marketing initiatives.

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