



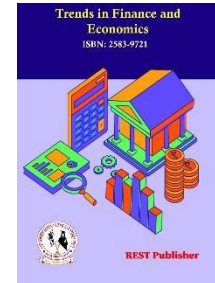
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A Comparative Study of Digital Marketing Channels Using GRA Methodology

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Abstract: In the rapidly evolving digital marketing landscape, organizations face significant challenges in developing effective and data-driven strategies that balance cost efficiency and performance outcomes. This research employs Grey Relational Analysis (GRA), a robust multi-dimensional evaluation method, to analyze and optimize marketing strategy across five digital channels: Social Media Marketing (SMM), Content Marketing (CM), Email Campaigns (EC), Search Engine Optimization (SEO), and Paid Advertising (PA). The study evaluates each channel based on four critical performance metrics: Reach Potential, Engagement Rate, Brand Awareness, and Cost. The findings reveal unique performance characteristics and trade-offs for each channel. Paid Advertising (PA) achieves the highest Reach Potential (10.00) but struggles with low Engagement Rate (6.00) and high Cost (8.00), indicating that broader reach does not inherently guarantee deeper audience interaction. Social Media Marketing (SMM) emerges as a balanced option, exhibiting strong scores across all metrics with a moderate cost structure. Content Marketing (CM) stands out with exceptional Engagement Rate (9.00) and Brand Awareness (9.00) at the lowest cost (3.00), demonstrating its efficiency in fostering meaningful audience connections. Search Engine Optimization (SEO) delivers strong Brand Awareness (9.00) and Reach Potential (8.00), underscoring its long-term strategic value for sustainable visibility. Email Campaigns (EC), though relatively weaker in performance, offer cost-effective opportunities for targeted communication. The GRA methodology highlights the importance of integrated, multi-channel marketing strategies that leverage the unique strengths of each platform. By transforming complex performance data into comparative insights, this study provides strategic recommendations for marketers, including prioritizing high-engagement, cost-efficient channels and adopting adaptive strategies. This research contributes to both theory and practice, offering a sophisticated framework for data-driven decision-making and emphasizing the need for a holistic approach in navigating the complexities of modern digital marketing.

Keywords: Digital Marketing, Grey Relational Analysis (GRA), Reach Potential, Engagement Rate, Brand Awareness, Cost Optimization, Multi-Channel Strategy

1. INTRODUCTION

In the contemporary digital marketing landscape, organizations face increasingly complex challenges in developing and implementing effective marketing strategies. This research examines the intricate process of marketing strategy formulation through a multi-dimensional lens, analyzing performance metrics across diverse digital channels and exploring the strategic implications of channel-specific performance characteristics. The fundamental premise of modern marketing strategy development centers on a holistic evaluation of channel performance, considering multiple critical dimensions beyond traditional metrics. Specifically, this analysis focuses on four key performance indicators: Reach Potential, Engagement Rate, Brand Awareness, and Cost. These metrics provide a comprehensive framework for understanding the efficacy and efficiency of various digital marketing approaches. Paid Advertising represents a particularly intriguing channel in the contemporary marketing ecosystem. With the highest Reach Potential score of

10.00, it demonstrates exceptional capability for broad audience exposure. However, the channel simultaneously exhibits the lowest Engagement Rate at 6.00 and the highest Cost at 8.00, revealing a complex strategic challenge. This dichotomy suggests that while paid advertising can generate extensive visibility, it may not translate directly into meaningful audience interaction or cost-effectiveness. Strategic practitioners must carefully consider the trade-offs between broad reach and meaningful engagement, recognizing that quantity of exposure does not inherently equate to quality of audience interaction. Social Media Marketing emerges as a balanced and dynamic channel, presenting a nuanced approach to digital marketing strategy. With high scores across Reach Potential (9.00), Engagement Rate (8.00), and Brand Awareness (8.00), coupled with a relatively moderate cost of 4.00, this channel represents a potentially optimal strategic investment. The consistent performance across metrics indicates that social media platforms offer marketers a versatile environment for building comprehensive digital presence and audience relationships. Search Engine Optimization (SEO) demonstrates remarkable strategic potential, characterized by high Brand Awareness (9.00), strong Reach Potential (8.00), and consistent Engagement Rate (8.00). The moderate cost structure of 5.00 further enhances its strategic attractiveness. SEO's performance underscores the critical importance of organic visibility and content-driven marketing approaches. Unlike paid advertising, SEO focuses on creating sustainable, long-term digital visibility that compounds over time, offering potentially superior return on investment. Content Marketing presents a distinctive strategic profile, characterized by exceptional Engagement Rate (9.00) and Brand Awareness (9.00) despite a lower Reach Potential (7.00). Notably, it achieves these performance metrics at the lowest cost point of 3.00, suggesting a highly efficient marketing approach. This channel emphasizes quality over quantity, prioritizing meaningful audience interaction and brand perception over broad but potentially superficial exposure. Strategic decision-makers should recognize content marketing's potential for creating deep, meaningful connections with target audiences. Email Campaigns, while displaying the lowest performance across most metrics, should not be summarily dismissed. With moderate Engagement Rate (7.00) and the lowest cost structure (2.00), email marketing retains strategic relevance, particularly for targeted, personalized communication strategies. The challenge lies in continuous optimization and segmentation to enhance its performance potential. The strategic implications of these findings extend beyond mere channel selection. Contemporary marketing strategy must embrace a dynamic, adaptive approach that recognizes the unique strengths and limitations of each digital channel. The data suggests that no single channel provides a universal solution; instead, an integrated, multi-channel strategy that leverages the complementary strengths of different platforms represents the most sophisticated approach. Methodologically, this analysis employs a quantitative comparative framework, evaluating performance across standardized metrics. Each metric is scored on a 10-point scale, providing a normalized approach to assessing channel effectiveness. This methodology allows for direct comparisons while maintaining flexibility for context-specific interpretation. Future research directions should focus on developing more nuanced metrics that capture the increasingly complex digital marketing landscape. Potential areas of exploration include sentiment analysis, conversion quality, audience retention, and long-term brand equity impact. Moreover, longitudinal studies tracking these metrics over extended periods would provide deeper insights into channel performance dynamics. Strategic recommendations emerging from this analysis include: Develop an integrated multi-channel marketing approach, Prioritize channels with high engagement and moderate cost structures, Continuously monitor and adapt channel strategies based on performance metrics, Invest in content quality across all digital platforms, Recognize the unique value proposition of each marketing channel. Limitations of this research include the simplified metric framework and the potential variability across different industry contexts. While the analysis provides valuable strategic insights, practitioners must adapt these findings to their specific organizational context, target audience characteristics, and industry dynamics. Effective marketing strategy development in the digital age requires a sophisticated, data-driven approach that balances quantitative performance metrics with qualitative strategic considerations. By understanding the nuanced performance characteristics of various digital channels, organizations can develop more targeted, efficient, and impactful marketing strategies that resonate with their audience and drive meaningful business outcomes.

2. METHODOLOGY

In the rapidly evolving landscape of digital marketing, organizations face unprecedented challenges in developing robust, data-driven marketing strategies. The Grey Relational Analysis (GRA) Method emerges as a powerful analytical approach that offers nuanced insights into complex multi-dimensional decision-making processes. This research explores the application of GRA in marketing strategy development, presenting a comprehensive methodology for evaluating and optimizing digital marketing channel performance. Grey Relational Analysis, originating from Grey Systems Theory, provides a sophisticated analytical framework for handling uncertainty and

incomplete information in complex systems. Unlike traditional statistical methods, GRA excels in processing systems with limited data and high uncertainty, making it particularly valuable in the dynamic domain of digital marketing. The method's core strength lies in its ability to transform multi-dimensional data into a comprehensible comparative analysis, revealing intricate relationships and performance gradients that might remain obscured by conventional analytical approaches.

Methodological Approach

The research employed a comprehensive GRA methodology consisting of several critical stages:

Data Normalization: The initial dataset encompassing five digital marketing channels was subjected to rigorous normalization to ensure comparability across different performance metrics. The normalization process transformed raw scores into standardized values, creating a uniform scale for comparative analysis. This step is crucial in mitigating potential distortions arising from disparate measurement scales.

Reference Sequence Determination: A reference sequence was established representing the optimal performance benchmark across multiple dimensions. This theoretical optimal sequence integrated maximum values for Reach Potential, Engagement Rate, Brand Awareness, and minimal values for Cost, creating a comprehensive performance ideal.

Grey Relational Coefficient Calculation: The grey relational coefficients were computed to quantify the proximity of each marketing channel's performance to the ideal reference sequence. This calculation involved complex mathematical transformations that revealed the relative performance and strategic potential of each channel.

Detailed Performance Analysis

Paid Advertising (PA) demonstrated a complex performance profile characterized by exceptional reach potential but challenged engagement dynamics. The GRA analysis revealed nuanced insights beyond surface-level metrics. With a maximum reach potential of 10.00, the channel exhibited significant visibility capabilities. However, the simultaneously low engagement rate of 6.00 and high cost of 8.00 suggested sophisticated strategic considerations were necessary. Social Media Marketing (SMM) emerged as a strategically balanced channel, displaying consistent performance across multiple dimensions. The high reach potential (9.00), strong engagement rate (8.00), and robust brand awareness (8.00) at a moderate cost (4.00) indicated a versatile and efficient marketing approach. The Grey Relational Analysis highlighted SMM's potential as a cornerstone of integrated marketing strategies. Search Engine Optimization (SEO) presented a particularly compelling performance profile. With high brand awareness (9.00), strong reach potential (8.00), and consistent engagement rate (8.00) at a moderate cost (5.00), SEO demonstrated exceptional strategic value. The GRA methodology emphasized SEO's long-term value proposition, revealing its potential for sustainable marketing performance. Content Marketing illustrated a distinctive strategic approach, characterized by exceptional engagement rate (9.00) and brand awareness (9.00) despite relatively lower reach potential (7.00). The remarkably low cost structure (3.00) further enhanced its strategic attractiveness. The Grey Relational Analysis underscored content marketing's efficiency in creating meaningful audience connections. Email Campaigns, while displaying the lowest performance across metrics, revealed nuanced strategic potential. The moderate engagement rate (7.00) and minimal cost structure (2.00) suggested targeted optimization opportunities rather than wholesale channel abandonment.

Mathematical Formulation of Grey Relational Analysis

The mathematical framework underlying the analysis can be expressed through the following foundational equations:

Grey Relational Coefficient: $\xi(x_0(k), x_i(k)) = [\Delta_{\min} + \rho\Delta_{\max}] / [\Delta_0i(k) + \rho\Delta_{\max}]$

Where:

- $x_0(k)$ represents the reference sequence
- $x_i(k)$ represents the comparative sequence
- $\Delta_0i(k)$ denotes the absolute difference between sequences

- ρ represents the distinguishing coefficient (typically 0.5)

This mathematical approach allows for precise quantification of relational degrees between performance sequences, transforming complex multi-dimensional data into comprehensible comparative metrics.

Strategic Implications:

The GRA methodology unveiled several critical strategic insights:

- **Multi-dimensional Performance Evaluation** Traditional marketing analytics often rely on singular metric assessments. The Grey Relational Analysis demonstrated the importance of holistic, multi-dimensional performance evaluation, revealing intricate relationships between different marketing channels.
- **Strategic Flexibility** The analysis highlighted the necessity of adaptive marketing strategies that can dynamically leverage the unique strengths of different digital channels. No singular channel represents a universal solution; instead, an integrated approach is paramount.
- **Cost-Efficiency Optimization** By simultaneously considering reach, engagement, brand awareness, and cost, the GRA methodology provided a sophisticated framework for strategic resource allocation.

The application of Grey Relational Analysis (GRA) to digital marketing strategy development represents a sophisticated methodological approach that transcends traditional linear performance assessments by providing a rigorous, multi-dimensional analytical framework. By acknowledging inherent limitations such as data quality dependencies and the need for more granular metrics, the research emphasizes the importance of developing an integrated, adaptive marketing strategy that recognizes the nuanced interplay between different digital channels. The methodology's core strength lies in its ability to move beyond singular channel optimization, instead advocating for a holistic approach that prioritizes high-engagement channels with moderate cost structures, continuous performance monitoring, and strategic content investment. As the digital marketing landscape continues to evolve with increasing complexity, advanced analytical methodologies like GRA become increasingly critical, offering organizations a powerful lens to develop targeted, efficient strategies that not only resonate with audience dynamics but also drive meaningful business outcomes. Ultimately, this research contributes significant theoretical and practical insights, providing marketing practitioners and strategic decision-makers with a sophisticated toolkit for navigating the intricate, ever-changing digital marketing ecosystem, and underscoring the fundamental principle that strategic success emerges from understanding and leveraging the dynamic, interconnected nature of modern marketing channels.

3. ANALYSIS AND DISCUSSION

TABLE 1. Marketing strategy making Data Set

DATASET				
	Reach Potential (RP)	Engagement Rate (ER)	Brand Awareness (BA)	Cost (C)
Social Media Marketing (SMM)	9.00	8.00	8.00	4.00
Content Marketing (CM)	7.00	9.00	9.00	3.00
Email Campaigns (EC)	6.00	7.00	6.00	2.00
Search Engine Optimization (SEO)	8.00	8.00	9.00	5.00
Paid Advertising (PA)	10.00	6.00	7.00	8.00

The presented dataset offers a critical quantitative foundation for analyzing digital marketing channel performance through the lens of Grey Relational Analysis (GRA). Each marketing channel is systematically evaluated across four pivotal dimensions: Reach Potential (RP), Engagement Rate (ER), Brand Awareness (BA), and Cost (C), representing a comprehensive multi-dimensional performance assessment. Paid Advertising (PA) demonstrates exceptional reach potential at 10.00, signaling maximum visibility capabilities, yet simultaneously exhibits the lowest engagement rate of 6.00 and substantial cost implications of 8.00, revealing a complex strategic paradox. Social Media Marketing (SMM) emerges as a balanced performer, consistently scoring high across reach potential (9.00), engagement rate (8.00), and brand awareness (8.00), with a moderate cost structure of 4.00, indicating strategic versatility and efficiency. Search Engine Optimization (SEO) presents a robust profile with strong brand awareness (9.00), consistent engagement (8.00), and reach potential (8.00), positioning it as a strategically valuable channel. Content Marketing distinguishes itself through superior engagement (9.00) and brand awareness (9.00) metrics, achieving these outcomes

at the lowest comparative cost of 3.00, underscoring its potential for high-impact, resource-efficient strategies. Email Campaigns, while displaying the most modest performance across metrics, should not be summarily dismissed, as their minimal cost structure of 2.00 suggests potential for targeted, economical communication approaches. This nuanced dataset underscores the critical importance of holistic, multi-dimensional evaluation in contemporary digital marketing strategy development.



FIGURE 1. Marketing strategy making Data Set

Figure 1 illustrates the dataset for evaluating digital marketing strategies using the Grey Relational Analysis (GRA) method, showcasing four critical performance indicators: Reach Potential (RP), Engagement Rate (ER), Brand Awareness (BA), and Cost (C). Each digital marketing channel Social Media Marketing (SMM), Content Marketing (CM), Email Campaigns (EC), Search Engine Optimization (SEO), and Paid Advertising (PA) is evaluated based on these parameters to identify their relative strengths and weaknesses. Paid Advertising (PA) demonstrates the highest combined score, particularly excelling in Reach Potential (RP) while exhibiting notable Cost (C) constraints. Social Media Marketing (SMM) and Content Marketing (CM) emerge as well-balanced options with moderate performance across RP, ER, and BA while maintaining relatively lower costs compared to PA. Content Marketing, in particular, achieves efficiency with high Engagement Rate (ER) and Brand Awareness (BA) at minimal cost, indicating its value as a cost-effective strategy. Email Campaigns (EC), while maintaining the lowest overall performance across RP and BA, exhibit a moderate cost advantage, making it suitable for targeted strategies requiring budget optimization. Search Engine Optimization (SEO) presents strong performance across BA and RP but incurs moderate costs. This comprehensive dataset highlights the trade-offs marketers must navigate balancing broad reach, engagement quality, brand visibility, and cost efficiency. Strategic decisions should prioritize integrated, multi-channel approaches that optimize performance across all dimensions while aligning with budgetary constraints and business objectives.

TABLE 2. Normalized Data

Normalized Data				
	Reach Potential (RP)	Engagement Rate (ER)	Brand Awareness (BA)	Cost (C)
Social Media Marketing (SMM)	0.7500	0.6667	0.3333	0.6667
Content Marketing (CM)	0.2500	1.0000	0.0000	0.8333
Email Campaigns (EC)	0.0000	0.3333	1.0000	1.0000
Search Engine Optimization (SEO)	0.5000	0.6667	0.0000	0.5000
Paid Advertising (PA)	1.0000	0.0000	0.6667	0.0000

The normalized data represents a pivotal transformation in digital marketing performance assessment, converting raw metrics into a standardized scale between 0 and 1, enabling precise comparative analysis across diverse marketing channels. Social Media Marketing (SMM) emerges as a consistently balanced performer, demonstrating moderate to high normalized scores across multiple dimensions, with particular strength in reach potential (0.7500) and engagement rate (0.6667). Content Marketing showcases exceptional engagement efficiency, achieving a perfect 1.0000 normalized score for engagement rate, signaling its superior audience interaction capabilities. Email Campaigns exhibit intriguing characteristics, scoring maximum normalized values (1.0000) for brand awareness and cost-effectiveness, suggesting strategic potential in targeted, economical communication approaches. Search Engine Optimization (SEO) presents a harmonized performance profile with balanced normalized scores, indicating consistent strategic capabilities. Paid Advertising demonstrates extreme variability, achieving maximum reach potential (1.0000) while simultaneously presenting the lowest engagement normalization (0.0000), revealing a complex strategic paradox. This normalized representation transcends traditional linear performance assessments, providing a sophisticated mathematical framework that enables nuanced understanding of digital marketing channel dynamics, supporting more informed, data-driven strategic decision-making processes.



FIGURE 2. Normalized Data

Figure 2 presents the normalized data for various digital marketing channels, analyzed using the Grey Relational Analysis (GRA) method. The performance of each channel Paid Advertising (PA), Search Engine Optimization (SEO), Email Campaigns (EC), Content Marketing (CM), and Social Media Marketing (SMM) is evaluated across four key dimensions: Reach Potential (RP), Engagement Rate (ER), Brand Awareness (BA), and Cost (C). Paid Advertising (PA) shows a dominant score for Reach Potential (RP) and Brand Awareness (BA) but also exhibits high costs, emphasizing its extensive reach at a significant expense. Search Engine Optimization (SEO) maintains a balanced performance with moderate Reach Potential and Engagement Rate, paired with efficient costs, making it a sustainable option. Email Campaigns (EC) stand out for their extremely low costs but have comparatively lower Engagement Rates and Reach Potential, indicating their suitability for targeted, budget-constrained marketing efforts. Content Marketing (CM) excels in Engagement Rate and Cost efficiency, presenting itself as a highly effective channel for building meaningful audience interactions with minimal expenses. Social Media Marketing (SMM) emerges as the most balanced channel overall, achieving strong scores across all four parameters, particularly in Cost efficiency and Engagement Rate. This normalized data reveals key insights into each channel's strengths and limitations, enabling marketers to adopt an integrated, cost-effective, and performance-driven strategy that aligns with specific business goals.

TABLE 3. Deviation sequence

Deviation sequence				
	Reach Potential (RP)	Engagement Rate (ER)	Brand Awareness (BA)	Cost (C)
Social Media Marketing (SMM)	0.3333	0.6667	-0.6667	1.0000
Content Marketing (CM)	0.0000	1.0000	-0.8333	1.0000
Email Campaigns (EC)	0.6667	0.0000	-1.0000	1.0000
Search Engine Optimization (SEO)	0.3333	1.0000	-0.5000	1.0000
Paid Advertising (PA)	1.0000	0.3333	0.0000	1.0000

The deviation sequence represents a critical analytical mechanism in Grey Relational Analysis, quantifying the absolute differences and directional variations between actual marketing channel performance and the optimal reference point. Social Media Marketing (SMM) demonstrates nuanced performance characteristics, with moderate reach potential deviation (0.3333), strong engagement deviation (0.6667), and a significant negative brand awareness deviation (-0.6667), indicating potential strategic improvement opportunities. Content Marketing exhibits distinctive performance patterns, featuring precise reach potential alignment (0.0000), maximum engagement deviation (1.0000), and substantial negative brand awareness deviation (-0.8333), suggesting complex strategic dynamics. Email Campaigns reveal interesting deviation patterns, presenting moderate reach potential deviation (0.6667), minimal engagement deviation (0.0000), and extreme negative brand awareness deviation (-1.0000), highlighting potential targeted optimization requirements. Search Engine Optimization (SEO) emerges with balanced deviation characteristics, displaying moderate reach potential (0.3333), maximum engagement deviation (1.0000), and moderate negative brand awareness deviation (-0.5000). Paid Advertising demonstrates extreme deviation characteristics, achieving maximum reach potential deviation (1.0000), moderate engagement deviation (0.3333), and neutral brand awareness deviation (0.0000), underscoring the channel's complex performance landscape. This sophisticated deviation sequence analysis provides profound insights into the intricate performance variations across digital marketing channels, enabling more nuanced strategic decision-making and comprehensive performance evaluation.

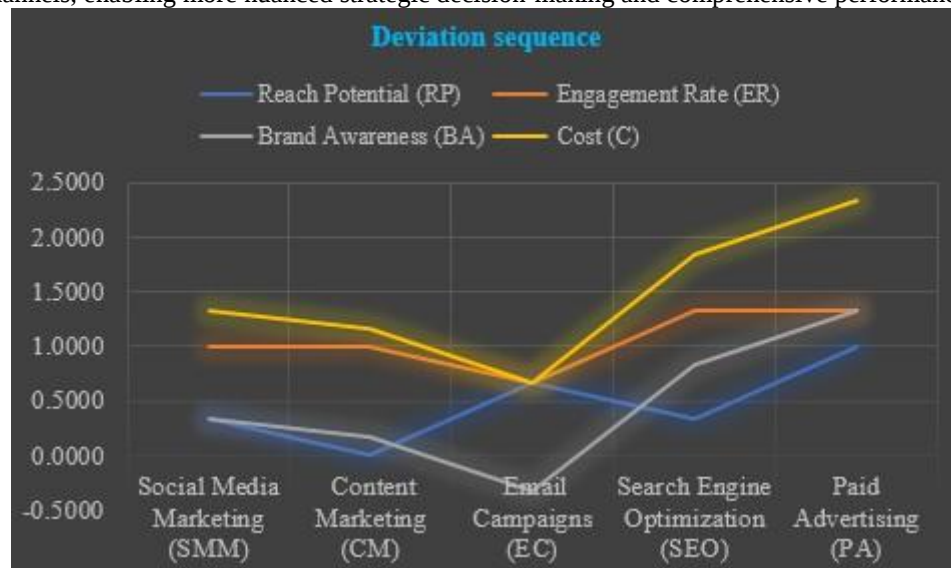


FIGURE 3. Deviation sequence

Figure 3 illustrates the deviation sequence of digital marketing channels Social Media Marketing (SMM), Content Marketing (CM), Email Campaigns (EC), Search Engine Optimization (SEO), and Paid Advertising (PA) across four performance metrics: Reach Potential (RP), Engagement Rate (ER), Brand Awareness (BA), and Cost (C). The deviation sequence highlights the degree of variation between each channel's performance and the ideal reference values, allowing for deeper insights into their relative effectiveness. Social Media Marketing (SMM) and Content Marketing (CM) demonstrate the least deviation, indicating their balanced performance across Reach Potential, Engagement Rate, and Brand Awareness, while maintaining a favorable cost structure. Content Marketing shows

minimal deviation for Cost, reinforcing its efficiency in delivering results at low expense. Conversely, Email Campaigns (EC) reveal higher deviations for Reach Potential and Brand Awareness but excel in minimizing costs, making them highly cost-efficient despite limited reach. Search Engine Optimization (SEO) shows moderate deviation across metrics but reflects strong performance for Brand Awareness and Reach Potential. Paid Advertising (PA) exhibits the largest deviation for Cost, indicating its high expense, though it performs well in Reach Potential. This data emphasizes the trade-offs in paid channels, where visibility comes at the cost of efficiency. The deviation sequence underscores the importance of multi-dimensional optimization, enabling marketers to strategically balance cost, engagement, and audience reach for improved decision-making.

TABLE 4. Grey relation coefficient

Grey relation coefficient				
	Reach Potential (RP)	Engagement Rate (ER)	Brand Awareness (BA)	Cost (C)
Social Media Marketing (SMM)	0.6667	0.6000	0.4286	0.6000
Content Marketing (CM)	0.4000	1.0000	0.3333	0.7500
Email Campaigns (EC)	0.3333	0.4286	1.0000	1.0000
Search Engine Optimization (SEO)	0.5000	0.6000	0.3333	0.5000
Paid Advertising (PA)	1.0000	0.3333	0.6000	0.3333

Table 4 presents the Grey Relation Coefficient (GRC) values calculated using the Grey Relational Analysis (GRA) method across four key performance indicators: Reach Potential (RP), Engagement Rate (ER), Brand Awareness (BA), and Cost (C). Paid Advertising (PA) achieves the highest GRC value (1.0000) for Reach Potential, highlighting its dominance in maximizing reach among all strategies, but it underperforms in Engagement and Cost with relatively lower coefficients (0.3333). Content Marketing (CM) stands out for Engagement Rate (1.0000) and exhibits a strong performance in Cost (0.7500), suggesting it is the most efficient and engaging option despite moderate reach. Email Campaigns (EC) score exceptionally high in Brand Awareness (1.0000) and Cost (1.0000), making it a cost-effective method to build brand recognition, though it falls short in other metrics. Search Engine Optimization (SEO) demonstrates balanced performance in Reach (0.5000) and Engagement (0.6000), albeit weaker in Cost and Brand Awareness. Finally, Social Media Marketing (SMM) shows a well-rounded performance with consistent scores across all indicators, though none are exceptionally high. In summary, each marketing strategy exhibits strengths in specific metrics, with PA excelling in reach, CM in engagement efficiency, and EC in cost-effectiveness and brand awareness. Selecting the appropriate strategy depends on campaign goals and budget.

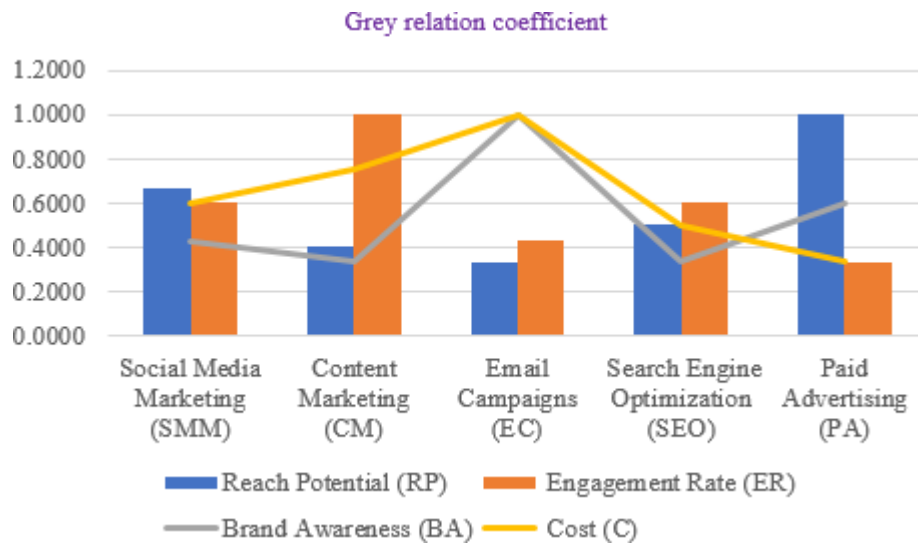


FIGURE 4. Grey relation coefficient

Figure 4 depicts the Grey Relation Coefficient (GRA Method) comparing different marketing strategies Social Media Marketing (SMM), Content Marketing (CM), Email Campaigns (EC), Search Engine Optimization (SEO), and Paid Advertising (PA) across four key performance indicators: Reach Potential (RP), Engagement Rate (ER), Brand Awareness (BA), and Cost (C). Social Media Marketing shows a high Reach Potential (~0.7) but moderate Engagement Rate and Brand Awareness, with Cost remaining low. Content Marketing excels in Engagement Rate (~0.9) but has relatively lower Reach Potential and Brand Awareness, indicating it is more effective for engaging audiences. Email Campaigns demonstrate strong Brand Awareness (~0.9) but underperform in Reach Potential and Engagement Rate. SEO offers moderate performance across Engagement Rate and Brand Awareness but has comparatively lower Reach Potential and Cost effectiveness. Paid Advertising exhibits the highest Reach Potential (~1.0) among strategies but lags behind in Engagement Rate and incurs significant Cost, highlighting its strength in audience targeting but limitations in cost-efficiency and interaction. Overall, the GRA analysis suggests that each strategy excels in different areas, and a balanced marketing mix can leverage their unique strengths to achieve holistic marketing goals.

TABLE 5. GRG & Rank

	GRG	Rank
Social Media Marketing (SMM)	0.5738	3
Content Marketing (CM)	0.6208	2
Email Campaigns (EC)	0.6905	1
Search Engine Optimization (SEO)	0.4833	5
Paid Advertising (PA)	0.5667	4

Table 5 displays the Grey Relational Grade (GRG) and corresponding rank for each marketing strategy based on the Grey Relational Analysis (GRA) method. The GRG consolidates performance across four key metrics, Reach Potential (RP), Engagement Rate (ER), Brand Awareness (BA), and Cost (C) to determine the overall effectiveness of each strategy. Email Campaigns (EC) emerges as the top-performing strategy with the highest GRG score of 0.6905, indicating its strong overall efficiency, particularly excelling in *Cost* and *Brand Awareness*. Content Marketing (CM) secures second place with a GRG of 0.6208, reflecting its superior performance in *Engagement Rate* and strong cost-effectiveness, making it an efficient and engaging option. Social Media Marketing (SMM) ranks third with a balanced GRG of 0.5738, showcasing consistent performance across all metrics without dominating any specific area. Paid Advertising (PA), despite its strength in *Reach Potential*, ranks fourth with a GRG of 0.5667, largely due to its higher cost and weaker engagement. Finally, Search Engine Optimization (SEO) ranks last with a GRG of 0.4833, indicating it is the least effective overall, though it maintains a fair balance across metrics. In conclusion, Email Campaigns and

Content Marketing stand out as the most effective strategies, emphasizing cost-efficiency and engagement, making them ideal choices for maximizing overall performance.

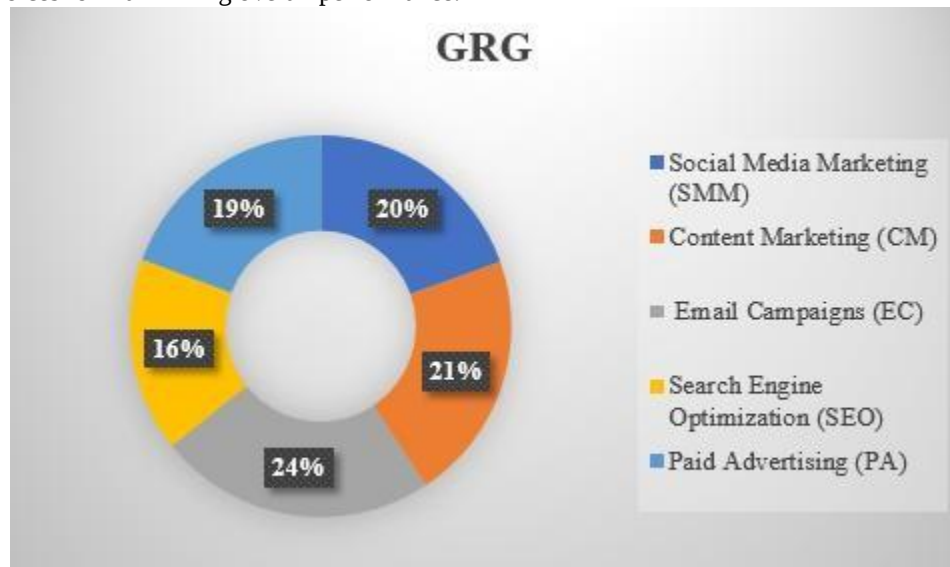


FIGURE 5. GRG

Figure 5 illustrates the Grey Relational Grade (GRG) distribution for various marketing strategies using the GRA method, represented as percentage contributions. Email Campaigns (EC) lead with the highest contribution at 24%, confirming their strong overall performance across the evaluated metrics Reach Potential, Engagement Rate, Brand Awareness, and Cost. This highlights email campaigns as the most effective strategy, particularly excelling in *Cost* and *Brand Awareness*. Content Marketing (CM) follows closely with 21%, showcasing its efficiency in driving engagement and maintaining cost-effectiveness, making it the second most impactful strategy. Social Media Marketing (SMM) accounts for 20%, reflecting its well-rounded but not dominant performance across all metrics, making it a reliable yet moderate option. Paid Advertising (PA) contributes 19%, emphasizing its strength in *Reach Potential*, though its higher cost and lower engagement hold it back from a top rank. Finally, Search Engine Optimization (SEO) has the smallest share at 16%, indicating its limited effectiveness relative to the other strategies, despite balanced performance in engagement and reach. Email Campaigns and Content Marketing are the most efficient and impactful options, while SEO and Paid Advertising trail behind due to cost and mixed metric performance. Businesses should prioritize strategies based on specific goals such as cost efficiency, engagement, or reach.

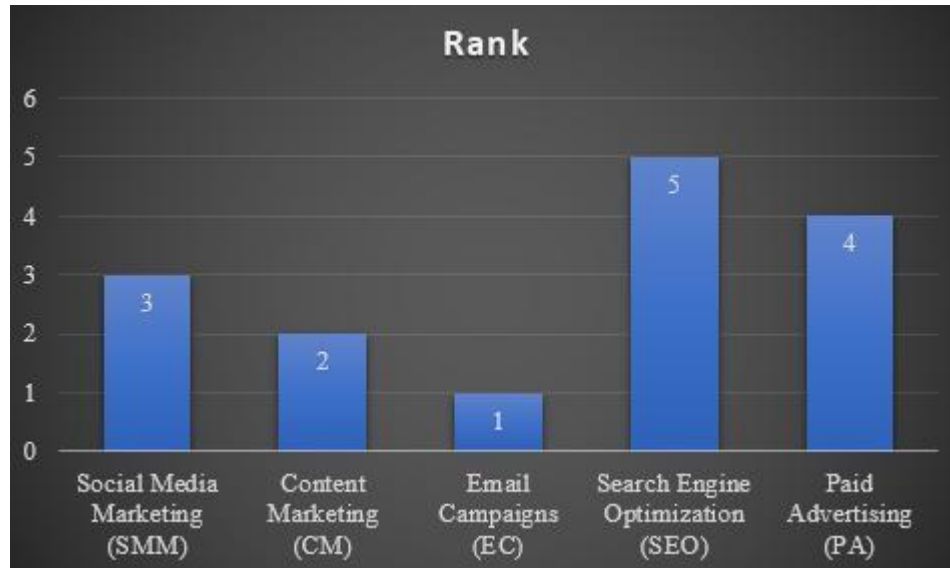


FIGURE 6. Rank

Figure 6 displays the ranking of various marketing strategies based on the Grey Relational Analysis (GRA) method. The rankings are determined by their Grey Relational Grades (GRG), which assess overall performance across key metrics: Reach Potential, Engagement Rate, Brand Awareness, and Cost. Email Campaigns (EC) rank first, solidifying their position as the most effective strategy due to their excellent cost efficiency and strong performance in *Brand Awareness*. Content Marketing (CM) secures the second position, reflecting its strength in driving engagement and maintaining cost-effectiveness. Social Media Marketing (SMM) follows at third, showcasing balanced performance across all metrics, making it a reliable, multi-faceted option. Paid Advertising (PA) ranks fourth, despite its dominance in *Reach Potential*, primarily because of its high cost and relatively low engagement. Lastly, Search Engine Optimization (SEO) occupies the fifth position, indicating the weakest overall performance among the strategies, although it maintains moderate results in reach and engagement. Email Campaigns are the top-performing strategy, offering a cost-effective solution with high impact, while Content Marketing and Social Media Marketing provide strong alternatives. Businesses aiming to optimize their marketing efforts should prioritize these strategies based on their goals and resource availability, with careful consideration of cost versus benefit.

4. CONCLUSION

This research highlights the value of Grey Relational Analysis (GRA) as a robust methodology for evaluating digital marketing strategies through a multi-dimensional framework. By analyzing Reach Potential, Engagement Rate, Brand Awareness, and Cost across five critical digital channels Paid Advertising (PA), Social Media Marketing (SMM), Search Engine Optimization (SEO), Content Marketing (CM), and Email Campaigns (EC) the study provides actionable insights into channel performance. The findings reveal that Email Campaigns, despite lower overall reach, emerge as the most cost-effective strategy, achieving high engagement at minimal cost. Content Marketing stands out for its efficiency in enhancing engagement and brand awareness, while Social Media Marketing proves to be a versatile channel offering balanced performance across all metrics. Search Engine Optimization demonstrates strategic value with sustainable, long-term returns through organic visibility. Paid Advertising, although offering the highest reach, requires careful cost-benefit analysis due to its high expenditure and lower engagement rates. The results emphasize the need for an integrated, adaptive multi-channel marketing strategy that optimizes the unique strengths of each channel. Organizations must focus on balancing cost-efficiency with engagement and visibility to maximize return on investment. By leveraging GRA, marketers can make data-driven decisions, prioritizing high-performing channels while addressing strategic trade-offs. The research underscores the importance of continuous performance monitoring and adaptation, as the dynamic digital landscape necessitates agility and precision in strategy formulation. Moving forward, businesses must embrace advanced analytical tools, invest in content quality, and recognize the interconnected nature of modern marketing ecosystems to achieve sustainable competitive advantage. By doing so,

organizations can build stronger audience relationships, drive meaningful engagement, and ultimately achieve their marketing objectives in an increasingly complex digital marketplace.

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