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DEVELOPMENT OF AN ADVANCED ROBUST MULTI-CRITERIA DECISION-MAKING FRAMEWORK FOR ENHANCED SOCIAL MEDIA ANALYTICS

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ABSTRACT

The rapid expansion of social media platforms has generated enormous volumes of complex, heterogeneous, and continuously changing data, creating significant challenges for effective social media analytics. Traditional analytical approaches often encounter difficulties in managing multiple evaluation criteria, uncertain information, conflicting objectives, and dynamic user behaviour. This study proposes the development of an advanced robust multi-criteria decision-making framework to improve the accuracy, reliability, and effectiveness of social media analytics. The proposed framework integrates data preprocessing, sentiment analysis, performance evaluation, criterion prioritization, and uncertainty management to support systematic decision-making. It considers important factors such as user engagement, content relevance, audience response, sentiment polarity, information credibility, and interaction patterns. The framework aims to provide a comprehensive mechanism for evaluating social media information and identifying meaningful analytical outcomes. The proposed approach is expected to strengthen analytical consistency, improve decision quality, and support strategic planning across different digital communication environments.

Keywords: Social Media Analytics, Multi-Criteria Decision-Making, Robust Decision Framework, Data Analysis, Sentiment Analysis, Decision Optimization, User Engagement.

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I. INTRODUCTION

Social media has emerged as an important digital environment for communication, information exchange, marketing, public engagement, and organizational decision-making. Platforms such as Facebook, Instagram, YouTube, LinkedIn, and X generate substantial quantities of user-generated content through comments, reactions, shares, images, videos, and discussions. These interactions provide valuable information about consumer preferences, public opinions, emerging trends, and behavioural patterns. Organizations increasingly depend on social media analytics to understand their audiences, evaluate communication strategies, identify market opportunities, and improve institutional performance. However, the increasing complexity and diversity of social media information require more advanced analytical techniques capable of processing multiple dimensions simultaneously.

Conventional social media analytical methods generally concentrate on individual indicators, including engagement rates, sentiment scores, follower growth, and content interactions. Although these indicators provide useful information, they may not adequately represent the overall performance of social media activities. For example, a post receiving a substantial number of reactions may not necessarily demonstrate positive audience sentiment or meaningful engagement. Similarly, high content visibility does not always indicate information credibility or successful communication. These limitations highlight the importance of integrating multiple evaluation criteria into a unified analytical framework. Multi-Criteria Decision-Making (MCDM) techniques provide an appropriate methodological foundation because they enable the systematic evaluation of alternatives according to different, potentially conflicting criteria.

Robust decision-making becomes particularly important when social media information contains uncertainty, incomplete observations, inconsistent user responses, and rapidly changing trends. Online discussions may include misleading information, automated accounts, duplicated content, emotional expressions, and subjective opinions. Consequently, analytical outcomes may become unreliable when decision models depend on fixed assumptions or limited indicators. An advanced robust framework should therefore incorporate appropriate data validation, uncertainty assessment, criterion weighting, sensitivity analysis, and alternative evaluation mechanisms. The integration of these components can improve the consistency and adaptability of social media analytics while reducing the influence of unreliable information on decision outcomes.

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The present study proposes an advanced robust multi-criteria decision-making framework for enhanced social media analytics. It focuses on establishing a systematic relationship between social media data processing, analytical indicator selection, criterion prioritization, and decision evaluation. The framework considers user engagement, sentiment orientation, content quality, audience relevance, information credibility, and communication effectiveness as major evaluation dimensions. It aims to provide a structured approach for comparing social media content, evaluating platform performance, and identifying effective communication strategies. The study also emphasizes the importance of transparency, flexibility, and methodological reliability in analytical decision-making. Through this integrated perspective, the proposed framework seeks to contribute to the development of more comprehensive and dependable social media analytics systems.

II. CONCEPTUAL FOUNDATIONS OF ROBUST MULTI-CRITERIA DECISION-MAKING IN SOCIAL MEDIA ANALYTICS

Social media analytics involves the systematic collection, examination, interpretation, and evaluation of information generated through online social interactions. It enables organizations to understand audience behaviour, identify emerging discussions, measure communication effectiveness, and evaluate digital engagement patterns. The analytical process involves several interconnected dimensions, including quantitative measurements, qualitative interpretation, behavioural indicators, and contextual information. Since these dimensions frequently produce different or conflicting results, relying on a single performance indicator may lead to incomplete conclusions. Multi-Criteria Decision-Making offers a structured methodology for combining multiple indicators and establishing an overall assessment of social media performance.

The fundamental principle of MCDM is to evaluate different alternatives according to a predefined set of criteria. In social media analytics, alternatives may represent individual posts, marketing campaigns, communication strategies, social media platforms, or audience segments. Evaluation criteria may include likes, comments, shares, reach, engagement, sentiment, content relevance, and credibility. Each criterion contributes differently to the overall analytical objective. For example, a campaign designed to increase brand awareness may prioritize reach and audience exposure, whereas a campaign intended to strengthen customer relationships may emphasize meaningful interactions and positive sentiment. Therefore, criterion selection should reflect the specific objectives of the analytical investigation.

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A robust decision-making framework must also address the uncertainty associated with social media information. User-generated content is inherently subjective, and individual responses may vary according to personal preferences, cultural backgrounds, social circumstances, and communication contexts. Furthermore, automated accounts and misleading information can influence engagement statistics and distort analytical findings. Robustness can be strengthened through data validation, outlier identification, alternative weighting scenarios, and sensitivity analysis. These mechanisms help determine whether the final decision remains reasonably stable when the underlying data or evaluation assumptions change.

The weighting of evaluation criteria represents another important component of multi-criteria analysis. Different criteria may have unequal importance depending on the purpose of the investigation. Techniques such as the Analytic Hierarchy Process (AHP), Entropy Weight Method, and other weighting procedures can be employed to establish criterion priorities. AHP facilitates the systematic comparison of criteria through pairwise judgments, while entropy-based weighting uses information variation within the dataset to estimate the relative contribution of indicators. Combining subjective and objective weighting methods can provide a more balanced evaluation structure. However, the selection of a weighting technique should be justified by the research objectives and characteristics of the available data.

The evaluation stage can incorporate ranking and aggregation techniques such as TOPSIS, VIKOR, and PROMETHEE. These methods provide different mechanisms for comparing alternatives and identifying preferred outcomes. TOPSIS evaluates alternatives according to their relative closeness to an ideal solution, whereas VIKOR emphasizes compromise solutions under conflicting criteria. PROMETHEE uses preference functions to establish rankings between alternatives. Their application to social media analytics can support campaign comparisons, content selection, platform evaluation, and communication strategy assessment. Nevertheless, methodological assumptions and parameter choices must be examined before interpreting the resulting rankings.

The conceptual foundation of the proposed framework therefore rests on the integration of multiple analytical dimensions, appropriate criterion weighting, robust evaluation, and systematic validation. It recognizes that social media performance cannot be adequately represented by a single numerical indicator. Instead, analytical reliability requires a comprehensive assessment of quantitative and qualitative information. By integrating established MCDM principles with social media data-processing techniques, the proposed approach provides a structured foundation for

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evaluating complex digital communication environments and supporting evidence-based organizational decisions.

III. DESIGN AND DEVELOPMENT OF THE PROPOSED ADVANCED ANALYTICAL FRAMEWORK

The proposed framework is designed as an integrated analytical structure that connects social media data acquisition with multi-criteria evaluation and final decision support. Its development begins with identifying the research objectives and defining the analytical alternatives. These alternatives may include social media posts, promotional campaigns, digital communication channels, or organizational engagement strategies. Establishing clearly defined alternatives is essential because the effectiveness of the decision-making process depends on the relevance of the available evaluation options. The framework subsequently identifies measurable criteria that correspond to the intended analytical objectives and organizational requirements.

The first component involves social media data collection and preprocessing. Information can be obtained from authorized platform interfaces, publicly available datasets, or approved analytical systems. The collected information may include publication frequency, user reactions, comments, shares, audience reach, and textual responses. Data preprocessing involves removing duplicate records, identifying incomplete observations, standardizing formats, and addressing inconsistent entries. Textual information may require tokenization, normalization, language identification, and removal of irrelevant expressions. These procedures improve the quality of the input dataset and establish a consistent foundation for subsequent analytical operations.

The second component focuses on the identification and classification of decision criteria. The proposed model considers engagement intensity, sentiment orientation, content relevance, audience responsiveness, information credibility, and communication effectiveness. Engagement intensity can be assessed through interactions relative to audience exposure. Sentiment orientation examines whether audience responses express positive, negative, or neutral opinions. Content relevance evaluates the relationship between published information and the intended audience. Credibility assessment considers the reliability and contextual consistency of information. These indicators provide complementary perspectives for evaluating social media performance.

The third component involves determining the relative importance of the selected criteria. The proposed framework can employ a hybrid weighting mechanism combining expert-based judgments with data-driven weighting procedures. AHP may be used to capture the perceived

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importance of different indicators, while entropy weighting can estimate their informational contribution. The combined weights should be normalized to ensure that their total equals one. This approach can reduce excessive dependence on subjective judgments while preserving the practical importance of domain expertise. The weighting procedure should also include consistency checking and documentation of the assumptions used during evaluation.

The fourth component applies robust multi-criteria evaluation to the alternatives. Normalized decision matrices can be developed to make indicators measured on different scales comparable. Depending on the research requirements, TOPSIS or VIKOR may be adopted to calculate alternative performance scores and establish rankings. Uncertainty can be examined through alternative weighting configurations, changes in normalization procedures, and variations in selected parameters. Sensitivity analysis can then identify the criteria that exert the greatest influence on the final rankings. This stage is particularly important because social media datasets may change rapidly and contain irregular observations.

The final component involves interpretation, validation, and decision support. Analytical outcomes are presented through comparative rankings, performance indicators, visual summaries, and criterion-level explanations. The results can help organizations identify effective content strategies, evaluate audience responses, and recognize areas requiring improvement. Validation should examine the stability of rankings, consistency of calculations, and agreement with suitable benchmark methods or expert assessments. The framework is intended as a proposed methodological model; its practical effectiveness must be established through empirical implementation using representative social media datasets.

IV. APPLICATIONS, CHALLENGES, AND FUTURE DIRECTIONS OF THE PROPOSED FRAMEWORK

The proposed robust MCDM framework has potential applications across marketing, public relations, organizational communication, education, healthcare communication, and digital governance. In marketing environments, organizations can compare promotional campaigns using audience engagement, brand sentiment, reach, content relevance, and conversion-related indicators. The framework can help identify which campaigns produce meaningful audience responses rather than simply generating large numbers of superficial interactions. It may also support the evaluation of communication channels and the selection of appropriate content strategies for different audience groups.

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CODEN (USA): JSLOBJ

Another important application involves monitoring public opinion and evaluating social communication activities. Government departments, educational institutions, and public organizations can use social media information to understand public concerns, assess reactions to announcements, and identify emerging discussion patterns. A multi-criteria approach enables these organizations to distinguish between the popularity of a message and the quality of audience responses. For example, a public awareness campaign may receive substantial attention but still generate confusion or negative feedback. Combining sentiment, information clarity, audience reach, and credibility can provide a more comprehensive assessment of communication effectiveness.

Despite its potential advantages, the implementation of advanced social media analytics presents several technical and organizational challenges. Data availability may be restricted by platform policies, privacy requirements, application programming interface limitations, and changing access conditions. Different platforms also use different engagement measurements and content formats, making direct comparisons difficult. Language diversity, sarcasm, contextual expressions, and cultural differences create additional complications for sentiment analysis. Therefore, the proposed framework requires suitable data standardization, context-sensitive processing, and transparent analytical procedures to ensure meaningful comparisons across different environments.

The reliability of MCDM outcomes also depends on appropriate criterion selection and weighting. Excessive reliance on expert judgments may introduce subjective bias, while purely data-driven weighting may overlook strategic priorities that are not sufficiently represented in the dataset. Furthermore, highly correlated indicators may unintentionally increase the influence of similar information during aggregation. These issues can be addressed through expert consultation, correlation assessment, alternative weighting scenarios, and robustness testing. The framework should also distinguish between missing information and genuinely low performance because treating both conditions identically may produce misleading rankings.

Future development can incorporate artificial intelligence, machine learning, natural language processing, and explainable analytical techniques. Machine learning methods may improve the identification of audience segments, emerging topics, and unusual interaction patterns. Natural language processing can support multilingual sentiment classification and contextual interpretation. Explainable artificial intelligence can help communicate why a particular campaign or content category receives a specific ranking. The integration of these techniques with robust

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MCDM procedures may strengthen the analytical capabilities of social media decision-support systems. However, model transparency, data governance, and protection against algorithmic bias must remain important considerations.

Overall, the proposed framework establishes a methodological direction for more comprehensive and reliable social media analytics. Its contribution lies in combining diverse performance indicators with structured weighting, comparative evaluation, uncertainty assessment, and validation. Future empirical research should test the framework across different platforms, industries, languages, and communication objectives. Such investigations can examine ranking stability, predictive usefulness, computational efficiency, and practical decision value. The resulting evidence would help refine the framework and establish its suitability for real-world social media management and strategic planning.

V. CONCLUSION

The increasing importance of social media in contemporary communication has created a demand for advanced analytical approaches capable of interpreting complex and continuously changing digital information. Traditional analytical techniques that concentrate on individual indicators may fail to capture the complete performance of social media activities. The present study proposes an advanced robust multi-criteria decision-making framework to address this limitation through the systematic integration of multiple evaluation dimensions. It emphasizes the importance of examining engagement, sentiment, content relevance, information credibility, audience responsiveness, and communication effectiveness within a unified analytical structure.

The proposed framework combines data acquisition, preprocessing, criterion identification, weighting, alternative ranking, and robustness assessment. By incorporating established MCDM techniques such as AHP, entropy weighting, TOPSIS, and VIKOR, it provides a methodological foundation for comparing social media alternatives according to multiple objectives. The integration of subjective and objective weighting procedures can support balanced criterion prioritization, while sensitivity analysis and uncertainty assessment can help examine the stability of analytical outcomes. These components are particularly relevant when social media datasets contain incomplete information, irregular observations, and conflicting indicators.

The framework also offers potential benefits for organizations seeking to improve digital marketing, audience engagement, public communication, and strategic planning. Its application can support the identification of effective campaigns, the evaluation of audience responses, and

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the comparison of communication strategies. Nevertheless, its practical success depends on reliable data collection, appropriate indicator selection, methodological transparency, and continuous validation. Privacy protection, platform-specific differences, language diversity, and algorithmic bias must also be considered during implementation. Since the framework is proposed conceptually, empirical testing is necessary before making claims regarding its actual performance or superiority over existing approaches.

Future research should focus on implementing the framework using real-world datasets obtained from different social media platforms. Comparative experiments can evaluate the influence of alternative weighting procedures, ranking techniques, and uncertainty-management strategies. Researchers may also integrate machine learning and explainable artificial intelligence to improve analytical interpretation and decision transparency. Such developments could strengthen the adaptability of the proposed approach and extend its usefulness across different application domains. Ultimately, the study provides a structured methodological foundation for developing more reliable, transparent, and comprehensive social media analytics systems that support informed and evidence-based decision-making.

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