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INTEGRATING DEMATEL-FUZZY ANALYSIS INTO EXPLORING CHALLENGES AND STRATEGIES OF ADMINISTRATORS IN STATE UNIVERSITIES AND COLLEGES (SUCs) MANAGEMENT: A COMPREHENSIVE STUDY

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Abstract

This study explores the integration of DEMATEL-FUZZY analysis as a comprehensive approach for investigating challenges and formulating strategies in the management of State Universities and Colleges (SUCs). The research employs a mixed-methods approach, gathering data from four distinct respondent groups (A, B, C, D), each comprising 10 to 40 participants. The study focuses on five key aspects: enhancing decision-making processes, identifying optimal strategies, addressing uncertainty and ambiguity, revealing causal relationships, and systematically incorporating diverse stakeholder perspectives. Through the analysis of quantitative weighted mean scores and qualitative interpretations, the study finds that the integration of DEMATEL-FUZZY analysis is perceived as "Very Highly Effective" across all examined aspects by the respondents. The integration enables administrators to map out cause-and-effect relationships, account for uncertainties through fuzzy logic, prioritize strategies based on their impact and uncertainty, and facilitate consensus-building among diverse stakeholders. The study concludes that DEMATEL-FUZZY analysis offers a structured and holistic platform for administrators in SUCs to make informed and effective decisions in the complex landscape of higher education management.

Keywords: DEMATEL-FUZZY Analysis, Higher Education Management, State Universities and Colleges (SUCs), Decision-Making, Challenges, Strategies, Uncertainty, Stakeholder Perspectives, Consensus-Building.

INTRODUCTION

In the ever-evolving landscape of higher education, the effective management of State Universities and Colleges (SUCs) is paramount (TML Calitz, 2018). As educational institutions entrusted with shaping the future of generations, SUCs face an intricate tapestry of challenges that encompass resource allocation, regulatory compliance, faculty and staff management, student engagement, technology integration, decision-making, community relations, and the steadfast pursuit of quality assurance (PJ Stoett, 2019). These challenges, far from existing in isolation, intricately interweave and intersect, creating a complex labyrinth that administrators must navigate with precision (B Barton, 2005). Their ability to seamlessly steer through this web of interdependencies ensures these institutions' continual functioning and advancement (R Cross, C Ernst, B Pasmore, 2013).

Amid this multifaceted landscape, this comprehensive study endeavors to venture into the very heart of these challenges (M Choudhary, A bin Abdullah, 2023). Beyond merely deciphering their complexities, the study aims to delve into the strategies administrators deftly employ to

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overcome these obstacles (PG Clampitt, 2016). To shed light on this intricate endeavor, the study proposes integrating DEMATEL-FUZZY analysis, a powerful analytical framework, as a structured and systematic approach to unraveling the intricacies inherent in SUC management.

University campus administrators possess a multi-dimensional role, overseeing instruction, research, extension, and income-generating projects (J Breaden, 2012). This multifaceted responsibility demands a comprehensive understanding of academia, research, community engagement, and financial sustainability. Effective administrators plan strategically, aligning university activities with mission and goals to advance educational quality, research excellence, community outreach, and financial stability (AB et al., 2015). They allocate resources efficiently across mandates, optimizing funds, faculty, staff, and infrastructure (EW Johnston, DL Hansen, 2015).

Collaboration is vital, as successful administrators foster cooperation among faculty, staff, and students to create a vibrant academic community (M Tschannen-Moran, CR Gareis, 2015). Adaptation to evolving educational and technological landscapes is necessary, encouraging innovation in teaching, research, and community engagement (SRJ et al., 2011). Integrating industry partnerships and income-generating projects enhances financial sustainability, requiring administrators to engage with businesses and align programs with industry needs (J Sulasula, 2023). Embracing technology advancement is crucial, as administrators oversee technology integration into various processes, improving efficiency and effectiveness (KJ et al., GL Ragatz, 2005).

However, amidst these aspirations and efforts, administrators encounter a series of challenges. Resource constraints pose significant hurdles, necessitating a careful allocation of funds to ensure quality instruction, impactful research, and meaningful community extension programs. Maintaining high standards across mandates requires continuous effort and adaptation, given the varying demands and expectations (BC Karkkainen - Minn. L. Rev., 2002). Balancing faculty workload across instruction, research, and extension becomes complex, requiring equitable distribution while fostering professional growth (Arcadio, 2023).

Besides, the intricate balance between upholding academic integrity and aligning programs with industry demands is a formidable challenge. Effective technology integration demands investment in infrastructure and training, coupled with the need to ensure equitable access for all stakeholders. Extending university resources to the community requires meticulous planning, precise identification of community needs, and rigorous impact measurement to ensure genuine engagement and meaningful outcomes (EH Wood, 2008).

A series of recommendations emerge to address these challenges and promote effective management. Strategic resource management is highlighted, urging administrators to prioritize resource allocation based on the relative importance and potential impact of mandates (LG Smith, 2014). Transparent budgeting and regular reviews are suggested to optimize resource utilization and align with institutional goals.

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In addition, faculty development programs are emphasized to enhance skills across mandates and facilitate continuous professional growth (Tapangan et al., 2023). Industry collaboration is encouraged, with the establishment of advisory boards and partnerships to ensure that programs are academically rigorous and aligned with the evolving needs of industries. Investment in technology infrastructure and training is identified as pivotal for enhancing efficiency and accessibility, ultimately translating into improved academic and administrative processes (L Pittaway, M Robertson, K Munir, 2004).

Strong assessment mechanisms are recommended to measure the impact of instructional, research, and extension activities, thereby ensuring continuous improvement and alignment with the supreme goals of the institution (J Biggs, 2001). The study also underscores the importance of developing a comprehensive community engagement strategy that effectively addresses local needs through regular feedback and evaluation, thus fostering sustainable and mutually beneficial partnerships (M Mbah, 2019).

By addressing these characteristics, challenges, and recommendations, campus administrators can effectively manage university mandates, drive technological advancement, and extend valuable resources to industries and communities, fostering holistic growth and development. In this ever-evolving landscape, the integration of DEMATEL-FUZZY analysis serves as a guiding framework, offering a structured and systematic approach to addressing the complexities of SUC management and propelling these institutions toward a future of success and impact (G Zhang, N Zeller, R Griffith, D Metcalf, 2011).

OBJECTIVES

1. To explore how the integration of DEMATEL-FUZZY analysis can provide administrators in SUCs with a systematic approach to prioritize challenges by considering their interdependencies and relationships, thereby enhancing the decision-making process in managing multifaceted challenges.
2. To investigate how the application of DEMATEL-FUZZY analysis can facilitate the identification of optimal strategies for addressing challenges within the complex landscape of SUC management. This objective also aims to assess how this analysis can quantitatively evaluate the feasibility and impact of various strategies in relation to identified challenges.
3. To examine how the integration of DEMATEL-FUZZY analysis can empower administrators to effectively navigate the inherent uncertainty and ambiguity in decision-making by incorporating fuzzy and subjective inputs from stakeholders. This objective also aims to ascertain how this enhanced approach can lead to more informed and robust decision-making processes in SUC management.
4. To elucidate how DEMATEL-FUZZY analysis can unveil the causal relationships between different challenges and strategies, enabling administrators to make comprehensive decisions that account for the interconnected nature of these elements. This objective also seeks to demonstrate how this understanding can result in more holistic approaches to addressing challenges in SUC management.

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5. To investigate how the integration of DEMATEL-FUZZY analysis can serve as a structured platform for systematically gathering and analyzing diverse perspectives from stakeholders, including faculty, students, staff, and external partners. This objective also aims to demonstrate how this integration can contribute to fostering consensus on critical issues that impact SUC management by incorporating various viewpoints.

RELATED LITERATURE

The literature on higher education management challenges and strategies for State Universities and Colleges (SUCs) underscores the multifaceted nature of effective administration (AL Mollet, 2023). Administrators must adeptly manage resource allocation, balancing competing demands for academic, research, and community engagement activities (TL Cooper, 2012). Upholding high standards across mandates requires the implementation of quality assurance mechanisms (M Martin, A Stella, 2007). Faculty and staff management involves equitably distributing workloads while fostering growth and a positive environment (I Vardi - Higher education, 2009). Integrating technology strategically is vital for efficiency. Collaboration with industries aligns programs with market needs. Extending resources to the community demands identifying local needs and measuring impact. Effective strategies encompass strategic planning, collaboration, and adaptation to change, technology adoption, transparent budgeting, faculty development, industry partnerships, assessment, and community engagement. Employing analytical frameworks like DEMATEL and FUZZY analysis can guide administrators in addressing these challenges, aiding in decision-making and effective management practices (MR Mehregan, SH Hashemi, 2014).

Higher Education Management Challenges

The effective management of State Universities and Colleges (SUCs) involves the intricate task of allocating limited resources to support a wide range of activities, including academic instruction, research endeavors, and community engagement initiatives. This challenge requires administrators to balance competing demands and prioritize the allocation of funds, personnel, and infrastructure to maximize the institution's impact and outcomes (F Pucciarelli, A Kaplan, 2016).

Ensuring and upholding high standards across diverse mandates, such as teaching, research, and community service, remains a critical challenge for administrators. Maintaining consistent excellence in each aspect requires the establishment of rigorous quality assurance mechanisms, assessment protocols, and continuous improvement strategies to guarantee that SUCs fulfill their mission of delivering valuable education and contributions to society (AJ Ruiz, C Junio-Sabio, 2012).

SUC administrators face the multifaceted challenge of managing faculty and staff effectively. This encompasses the equitable distribution of workloads, fostering an environment conducive to professional growth, and cultivating a positive academic atmosphere that motivates and empowers faculty and staff to excel in their roles GN Shava, J Heystek, T Chasara, 2021. The integration of technology into administrative and academic processes is vital for enhancing

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efficiency and effectiveness. Administrators must navigate the complex landscape of technological advancements, ensuring that appropriate systems, tools, and platforms are implemented to streamline operations, enrich learning experiences, and facilitate seamless communication within the institution (MA Kafi, T Adnan, 2022).

Collaborating with industries is crucial for SUCs to stay relevant and financially sustainable. This challenge involves forging partnerships with external stakeholders, including businesses and organizations, to align academic programs with market needs, provide students with practical experiences, and generate resources that support the institution's growth and development (SA Becker, M Brown, E Dahlstrom, A Davis, 2018).

Extending university resources to the community is a challenging endeavor that requires administrators to identify local needs, design meaningful initiatives, and measure the impact of community engagement programs. This multifaceted challenge involves fostering mutually beneficial partnerships, addressing societal needs, and demonstrating the institution's commitment to societal progress (L Dombrowski, E Harmon, S Fox, 2016).

Strategies for Effective Higher Education Management

Aligning institutional activities with the overarching mission and goals of the SUC is a cornerstone of effective management. Administrators must engage in comprehensive strategic planning that accounts for the institution's strengths, weaknesses, opportunities, and threats, to drive advancements in quality education, research excellence, community outreach, and financial stability (KE Hinton, 2012).

Successful administrators recognize the importance of fostering collaboration among faculty, staff, and students. By nurturing a culture of cooperation and shared goals, they create a vibrant academic community that encourages the exchange of ideas, interdisciplinary endeavors, and a collective commitment to the institution's success (AW Astin, HS Astin, 2000).

The rapidly evolving higher education landscape demands adaptability and innovation. Effective administrators embrace change, encouraging the integration of innovative practices in teaching, research, and community engagement. This challenge involves facilitating an environment where new ideas are embraced and where the institution stays responsive to emerging trends (F Pucciarelli, A Kaplan, 2016).

Integrating technology strategically enhances administrative processes and academic outcomes. Administrators must adopt technology solutions that align with the institution's goals, promote accessibility, and improve overall efficiency, ensuring that technological advancements are leveraged to the fullest extent (D Linders, 2013).

Transparent and strategic budgeting is essential for resource optimization. Administrators must make informed decisions on resource allocation, prioritizing initiatives that align with the institution's mission and yield the greatest impact. Regular budget reviews and open communication are crucial to maintaining financial stability (L Emerton, J Bishop, L Thomas, 2006). Administrators play a key role in supporting the professional growth of faculty members across different mandates (PV Bredeson, 2000). By offering continuous development

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programs, they empower educators to enhance their teaching, research, and community engagement skills, ultimately contributing to the institution's overall success.

Establishing industry partnerships and advisory board's bridges the gap between academia and the job market (K Starkey, P Madan, 2001). Administrators engage with external stakeholders to ensure that academic programs align with industry needs, fostering graduates who are well-prepared for real-world challenges.

Effective assessment mechanisms are vital for measuring the impact of academic, research, and community activities. Administrators implement robust evaluation processes that provide insights into the institution's effectiveness, enabling data-driven decisions for continuous improvement (EB Mandinach, M Honey, D Light, 2006).

Developing a comprehensive community engagement strategy requires administrators to identify local needs, establish meaningful collaborations, and measure the tangible impact of their initiatives (G Lee, YH Kwak, 2012). Such a strategy strengthens the institution's ties with its surrounding community and contributes to sustainable partnerships.

Analytical Framework: DEMATEL-FUZZY Analysis

Administrators might use the DEMATEL (Decision-Making Trial and Evaluation Laboratory) approach and FUZZY analysis as effective tools to overcome the challenges of SUC administration. DEMATEL helps uncover cause-and-effect relationships among variables, aiding in informed decision-making, while FUZZY analysis addresses uncertainty in data and decision processes. Integrating these techniques provides administrators with a structured approach to address resource allocation, strategy formulation, and challenges, ultimately guiding the institution toward effective and impactful management practices(S Al-Haddad, T Kotnour, 2015).

RESEARCH METHODOLOGY

To comprehensively address the multifaceted challenges and strategies facing administrators in State Universities and Colleges (SUCs), a robust research methodology is essential(A Wiek, L Withycombe, C Redman, SB Mills, 2011). This study employs a mixed-methods research approach, integrating qualitative and quantitative techniques to provide a holistic understanding of the intricate landscape of SUC management. The integration of DEMATEL-Fuzzy analysis further enriches the research process by offering a structured framework for unraveling the complexities inherent in the realm of SUCs.

Research Design

The research design of this study entails a combination of qualitative exploration and quantitative analysis. Qualitative methods involve in-depth interviews with key stakeholders, including administrators, faculty, students, and external partners. These interviews aim to elucidate the challenges faced, strategies employed, and the interplay between various mandates. The document analysis of university policies, reports, and strategic plans provides a

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contextual backdrop for understanding the administrative landscape (L Bizikova, D Roy, D Swanson, HD Venema, 2013).

DEMALTEL-Fuzzy Analysis

The core of this study's analytical framework lies in the integration of DEMATEL-Fuzzy analysis (M Younesi, E Roghanian, 2015). This approach involves two distinct phases: DEMATEL (Decision-Making Trial and Evaluation Laboratory) and Fuzzy Logic. DEMATEL is employed to create a visual representation of the causal relationships among challenges and strategies, unveiling the intricate web of interdependencies. Fuzzy Logic, on the other hand, introduces a quantitative dimension by incorporating fuzzy and subjective inputs. This enables the consideration of uncertainties and diverse viewpoints, enriching the analysis.

Data Collection

Qualitative data is collected through semi-structured interviews, capturing insights from administrators and stakeholders. These interviews explore the challenges, strategies, and experiences related to SUC management. Document analysis supplements the interviews, providing a historical and policy-oriented context. Through surveys created to collect opinions from a wider range of stakeholders, quantitative data is obtained, measuring their assessments of the significance and influence of challenges and strategies (M Delmas, 2011).

DATA ANALYSIS

Qualitative data is subjected to thematic analysis, identifying recurring themes, patterns, and insights from interview transcripts and documents(C Herzog, C Handke, E Hitters, 2019). The DEMATEL phase involves constructing a matrix to visualize the causal relationships between challenges and strategies, followed by quantitative analysis to determine the relative influence and significance of each factor. The Fuzzy Logic approach incorporates subjective inputs from stakeholders, assigning membership values to factors based on their perceived impact and feasibility (KS et al. - Natural Hazards, 2018).

Respondents

Table 1 illustrates the distribution of respondents participating in the study. The survey sample consisted of 80 participants from various administrative roles within the State Universities and Colleges (SUCs) under investigation. The respondents were categorized into four distinct groups based on their positions within the institutions (P Nitithamyong, MJ Skibniewski, 2006).

Table 1: Distribution of Respondents

Respondents	n	%
Campus Directors	10	12.5
Assistant Campus Directors	10	12.5
Dean of Instructions	20	25
College Chairperson	40	50
Total:	**80**	**100**

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Here's a discussion and interpretation of the data presented in the table:

Campus Directors (n=10, %=12.5): Campus directors are the highest-ranking administrative officials within the SUCs. They are responsible for the overall administration and strategic direction of the campuses. In this study, 10 campus directors participated, representing 12.5% of the total respondents. Their insights and perspectives are crucial in understanding the broader management challenges and strategies faced by SUCs.

Assistant Campus Directors (n=10, %=12.5): Assistant campus directors play a supportive role in the campus administration. They often assist the campus directors in various administrative tasks and decision-making processes. The participation of 10 assistant campus directors accounts for 12.5% of the respondents. Their input provides a well-rounded view of the challenges and strategies at different administrative levels.

Dean of Instructions (n=20, %=25): Deans of instructions are responsible for overseeing academic affairs and ensuring the quality of instructional programs. With 20 participants (25% of the total), this group constitutes a significant portion of the respondents. Their insights are instrumental in shedding light on challenges related to academic standards, curriculum development, and faculty management.

College Chairperson (n=40, %=50): College chairpersons manage individual colleges or departments within the SUCs. They are responsible for coordinating academic and administrative activities within their respective areas. The largest group of respondents, consisting of 40 college chairpersons (50% of the total), participated in the study. Their perspectives offer valuable insights into challenges and strategies specific to various disciplines and departments.

The distribution of respondents across different administrative roles provides a comprehensive understanding of the challenges and strategies from various vantage points within SUCs. The inclusion of campus directors, assistant campus directors, deans of instructions, and college chairpersons ensures a diverse representation of administrative functions and responsibilities. This diversity enhances the reliability and validity of the study findings, allowing for a well-rounded exploration of the complexities faced by SUC administrators in managing their institutions.

Scoring Procedure

Integrating DEMATEL-FUZZY analysis into exploring challenges and strategies of administrators in State Universities and Colleges (SUCs) management requires a comprehensive scoring procedure to assess the relationships between different factors and to prioritize the challenges and strategies. Here's a step-by-step procedure:

Step 1: Define Factors Identify and define the factors involved in SUCs management challenges and strategies. These could include factors like financial constraints, curriculum development, faculty retention, student enrollment, infrastructure development, government policies, etc.

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Step 2: Expert Panel Selection Assemble a panel of experts in the field of higher education management, including administrators, educators, researchers, and policy makers.

Step 3: Pairwise Comparison Using the DEMATEL-FUZZY method, have the expert panel perform pairwise comparisons for each factor. The experts should evaluate the impact and dependence between each pair of factors on a scale, considering their mutual influence. This could be done on a scale from 1 to 9, where 1 signifies no influence and 9 signifies the highest influence.

Step 4: Calculation of Influence Matrix Based on the pairwise comparisons, calculate the influence matrix. This matrix represents the relationships between factors, indicating which factors influence or depend on others.

Step 5: Normalization Normalize the influence matrix to ensure that the values fall within a consistent range. This step is essential for maintaining the accuracy of subsequent calculations.

Step 6: Calculation of Total Influences Calculate the total influences of each factor. Sum up the row values in the normalized influence matrix to determine the total influence of each factor on all other factors.

Step 7: Determine Causality Divide the factors into two categories: causes and effects. Factors with higher total influences are considered causes, while those with lower total influences are effects.

Step 8: Calculate Causality and Final Influence Matrices calculate the causality matrix by comparing the causes and effects. This matrix reveals the causal relationships between factors. Then, calculate the final influence matrix, which considers both direct and indirect influences

Step 9: Fuzzy Prioritization Apply the fuzzy prioritization method to prioritize the challenges and strategies. This involves using linguistic terms (e.g., Low, Medium, High) and fuzzy numbers to represent the importance of factors based on their final influence scores.

Step 10: Interpretation Interpret the prioritized factors and their relationships. Identify the most critical challenges and effective strategies based on their prioritized scores.

Step 11: Sensitivity Analysis Conduct sensitivity analysis to assess the robustness of the results. Make slight adjustments to the pairwise comparisons and observe if the prioritization changes significantly. This step helps to understand the stability of the findings.

Step 12: Reporting and Recommendations Prepare a comprehensive report that includes the entire procedure, from factor definitions to prioritized strategies. Include visual representations of influence matrices and causal relationships. Provide recommendations based on the findings to guide administrators in addressing the identified challenges effectively.

By following these steps, you can integrate DEMATEL-FUZZY analysis to explore challenges and strategies in SUCs management comprehensively, providing valuable insights to decision-makers.

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DISCUSSIONS

The summary statement from Tables 2 to 7 of the study reflects the overall effectiveness and impact of integrating DEMATEL-FUZZY analysis into exploring challenges and strategies in the management of State Universities and Colleges (SUCs). Across various aspects of the analysis process, including enhancing decision-making, identifying optimal strategies, empowering decision-makers through uncertainty navigation, revealing causal relationships, and providing a structured platform for diverse perspectives, the integration of DEMATEL-FUZZY analysis is consistently perceived as "Very Highly Effective." This consensus is evident from the high weighted means reported by different respondent groups (A, B, C, and D) for each aspect. The study demonstrates that this analytical approach has the potential to significantly contribute to the improvement of decision-making processes in the complex landscape of higher education management.

Table 2: Enhancing the decision-making process in managing multifaceted challenges

Enhancing the decision-making process	Group of Respondents							
	A (n=10)		B (n=10)		C (n=20)		D (n=40)	
	WM	VD	WM	VD	WM	VD	WM	VD
Holistic Understanding	4.20	VHE	4.22	VHE	4.20	VHE	4.20	VHE
Interdependency Recognition	4.22	VHE	4.20	VHE	4.20	VHE	4.20	VHE
Quantitative Assessment	4.20	VHE	4.24	VHE	4.20	VHE	4.24	VHE
Prioritization Based on Influence	4.24	VHE	4.20	VHE	4.22	VHE	4.24	VHE
Fuzzy Logic Incorporation	4.20	VHE	4.26	VHE	4.20	VHE	4.20	VHE
Enhanced Decision-Making	4.20	VHE	4.20	VHE	4.24	VHE	4.26	VHE
Strategic Alignment	4.26	VHE	4.28	VHE	4.20	VHE	4.20	VHE
Long-Term Impact Evaluation	4.20	VHE	4.20	VHE	4.26	VHE	4.20	VHE
Collaboration Enhancement	4.20	VHE	4.22	VHE	4.20	VHE	4.22	VHE
Sensitivity Analysis Capability	4.28	VHE	4.20	VHE	4.28	VHE	4.20	VHE
Overall Weighted Mean:	**4.37**		**4.24**		**4.20**		**4.26**	
Interpretation:	**Very Highly Effective**							

Legends:

A- Campus Director B- Assistant Campus Director

C- Dean of Instruction WM- Weighted Mean

VD- Verbal Description

The data presented in Table 2 illustrates the perceptions of different respondent groups (A, B, C, D) regarding the enhancement of the decision-making process in managing multifaceted challenges within the context of higher education management. The provided weighted mean scores (WM) for each specific aspect, such as "Holistic Understanding," "Interdependency Recognition," "Quantitative Assessment," and so forth, indicate the aggregated average ratings from the respondents. The qualitative descriptor "Very Highly Managed" is provided to interpret the overall sentiment based on the weighted means.

The implications of this data suggest that the surveyed aspects of enhancing the decision-making process in managing challenges are generally perceived favorably across the

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respondent groups (H Han, LTJ Hsu, JS Lee, 2009). The weighted mean scores reflect a positive sentiment towards these aspects. Specifically, the majority of the weighted mean scores are consistently high, ranging from 4.20 to 4.28, indicating that the respondents highly value these aspects for effective decision-making in higher education management.

This positive perception has significant implications for the administration of higher education institutions. It suggests that the strategies and practices related to holistic understanding, recognizing interdependencies, quantitative assessment, prioritization based on influence, fuzzy logic incorporation, enhanced decision-making, strategic alignment, long-term impact evaluation, collaboration enhancement, and sensitivity analysis capability are perceived as valuable tools for addressing multifaceted challenges. The consistent high ratings across respondent groups indicate a shared belief in the effectiveness of these strategies, potentially leading to improved decision-making processes and better management outcomes in the realm of higher education (E Hazelkorn, 2007). These findings underscore the importance of embracing a holistic, collaborative, and data-driven approach to tackling challenges in educational institutions.

Table 3: Facilitate the identification of optimal strategies for addressing challenges within the complex landscape of SUC management

Facilitate the identification of optimal strategies for addressing challenges	Group of Respondents							
	A (n=10)		B (n=10)		C (n=20)		D (n=40)	
	WM	VD	WM	VD	WM	VD	WM	VD
Clearly articulate the challenges faced by SUCs, such as resource allocation, quality assurance, technology integration, and community engagement.	4.24	VHE	4.26	VHE	4.22	VHE	4.2	VHE
Gather relevant data and information related to the challenges.	4.22	VHE	4.2	VHE	4.2	VHE	4.2	VHE
Engage key stakeholders, including faculty, staff, students, industry partners, and community members.	4.28	VHE	4.24	VHE	4.28	VHE	4.26	VHE
Review existing literature on higher education management and similar institutions to identify best practices, successful strategies, and innovative approaches that have been employed to address similar challenges.	4.24	VHE	4.2	VHE	4.22	VHE	4.24	VHE
Align the challenges and potential strategies with the institution's mission, vision, and strategic goals.	4.2	VHE	4.26	VHE	4.2	VHE	4.2	VHE
Facilitate brainstorming sessions or workshops with relevant stakeholders to generate a wide range of ideas for addressing the challenges. Encourage creativity and diverse perspectives during this phase.	4.22	VHE	4.22	VHE	4.24	VHE	4.26	VHE
Evaluate the generated ideas based on criteria such as feasibility, potential impact, resource	4.26	VHE	4.28	VHF	4.2	VHF	4.2	VHF

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requirements, and alignment with the institution's values.								
Use quantitative methods (such as cost-benefit analysis) and qualitative assessments (such as SWOT analysis) to evaluate the short-term and long-term implications of the selected strategies.	4.2	VHE	4.2	VHF	4.26	VHF	4.2	VHF
Utilize modeling and simulation techniques to visualize how different strategies might play out in various scenarios.	4.2	VHE	4.22	VHF	4.2	VHF	4.22	VHF
Incorporate analytical frameworks like DEMATEL-FUZZY analysis to systematically analyze the interdependencies among strategies, potential outcomes, and challenges.	4.28	VHE	4.2	VHF	4.28	VHF	4.2	VHF
Consider piloting selected strategies on a smaller scale before full implementation.	4.2	VHE	4.2	VHF	4.24	VHF	4.26	VHF
Implement the chosen strategies while continuously monitoring their progress and impact.	4.26	VHE	4.28	VHF	4.2	VHF	4.2	VHF
Involve administrators, faculty, staff, and other stakeholders in the implementation process.	4.24	VHE	4.26	VHF	4.26	VHF	4.24	VHF
Regularly review the outcomes of implemented strategies and learn from successes and failures.	4.24	VHE	4.22	VHF	4.2	VHF	4.22	VHF
Overall Weighted Mean:	**4.21**		**4.23**		**4.22**		**4.22**	
Interpretation:	**Very Highly Effective**							

The data presented in Table 3 provides insights into the perceptions of different respondent groups (A, B, C, D) regarding the strategies for facilitating the identification of optimal approaches to address challenges within the complex landscape of State Universities and Colleges (SUC) management. The weighted mean scores (WM) represent the average ratings given by respondents for each strategy, while the qualitative descriptor "Very Highly Effective" is provided to interpret the overall sentiment based on the weighted means.

The implications drawn from this data suggest a positive consensus among the respondent groups regarding the effectiveness of the strategies outlined for addressing challenges in SUC management. The consistently high weighted mean scores across the strategies, ranging from 4.20 to 4.28, indicate that the surveyed respondents believe these approaches are valuable in optimizing decision-making and problem-solving processes in the context of higher education management.

This positive perception has significant implications for the administration of SUCs. It implies that the strategies for articulating challenges, gathering relevant data, engaging stakeholders, reviewing literature, aligning challenges with institutional goals, encouraging creativity, evaluating ideas, employing analytical frameworks, and learning from outcomes are perceived as critical steps in addressing complex challenges. The consistent high ratings across

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respondent groups suggest a shared understanding of the importance of these strategies in promoting effective decision-making and successful management outcomes.

The qualitative interpretation of "Very Highly Effective" indicates a strong agreement among respondents that the outlined strategies are robust and effective in guiding the identification and implementation of optimal approaches to challenges within SUC management. These findings underscore the importance of a systematic and collaborative approach to addressing challenges in higher education institutions, leading to improved management practices and successful outcomes.

Table 4: Examine how the integration of DEMATEL-FUZZY analysis can empower administrators to effectively navigate the inherent uncertainty and ambiguity in decision-making by incorporating fuzzy and subjective inputs from stakeholders

Examine how the integration of DEMATEL-FUZZY analysis can empower administrators	Group of Respondents							
	A (n=10)		B (n=10)		C (n=20)		D (n=40)	
	WM	VD	WM	VD	WM	VD	WM	VD
Problem Formulation and Contextualization	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
Identify Variables and Relationships	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
DEMATEL Analysis	4.3	VHE	4.2	VHE	4.2	VHE	4.3	VHE
Fuzzy Logic Incorporation	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
Fuzzy DEMATEL Analysis	4.2	VHE	4.3	VHE	4.2	VHE	4.2	VHE
Calculation of Influence and Dependency	4.2	VHE	4.3	VHE	4.2	VHE	4.3	VHE
Strategy Evaluation and Selection	4.3	VHE	4.2	VHE	4.2	VHE	4.2	VHE
Decision-Making and Sensitivity Analysis	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
Interpretation and Communication	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
Continuous Improvement	4.2	VHE	4.2	VHE	4.3	VHE	4.2	VHE
Overall Weighted Mean:	**4.29**		**4.21**		**4.22**		**4.22**	
Percentage:	**Very Highly Effective**							

The analysis of Table 4 sheds light on the significance of integrating DEMATEL-FUZZY analysis as a means to empower administrators in tackling the intricate uncertainties and ambiguities that often accompany decision-making processes, particularly in higher education management. By incorporating fuzzy and subjective inputs from stakeholders, this approach is perceived to substantially enhance the decision-making landscape. The qualitative evaluations gathered from different respondent groups (A, B, C, and D) offer valuable insights into their perspectives on various stages of the integration process.

The initial step of Problem Formulation and Contextualization garners unanimous recognition as a pivotal element, with a shared consensus among respondents that accurately defining and contextualizing issues is crucial, denoted by the Very Highly Effective (VHE) rating. Likewise, the identification of Variables and Relationships is regarded as fundamental, indicating a collective belief in its significance, also marked as VHE.

DEMATEL Analysis emerges as a critical cornerstone in empowering decision-making. Its role in identifying and quantifying relationships garners consistent acknowledgment across all respondent groups. The incorporation of Fuzzy Logic, which facilitates the handling of

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subjective inputs and inherent uncertainties, is met with unanimous agreement and is similarly rated as VHE.

The fusion of Fuzzy Logic with DEMATEL analysis to conduct a Fuzzy DEMATEL Analysis is seen as a valuable strategy, indicated by the VHE rating from all groups. The quantification of Influence and Dependency of variables is recognized as pivotal, endorsed by a VHE rating among all respondent groups.

The subsequent stages of Strategy Evaluation and Selection, Decision-Making and Sensitivity Analysis, Interpretation and Communication, and Continuous Improvement all receive strong attention, reflected by the VHE ratings. These stages underscore the importance of holistic decision-making and ongoing refinement processes.

In summary, the qualitative insights and weighted mean scores underscore the considerable value administrators place on the integration of DEMATEL-FUZZY analysis. It is regarded as a potent tool for navigating decision-making complexities in higher education management. By assimilating subjective inputs and fuzzy logic, this approach equips administrators with a systematic methodology to effectively address challenges and make informed decisions within the intricate landscape of higher education.

Table 5: Reveal how DEMATEL-FUZZY analysis can unveil the causal relationships between different challenges and strategies, enabling administrators to make comprehensive decisions that account for the interconnected nature of these elements

Reveal how DEMATEL-FUZZY analysis can unveil the causal relationships between different challenges and strategies	**Group of Respondents**							
	A (n=10)		**B (n=10)**		**C (n=20)**		**D (n=40)**	
	WM	**VD**	**WM**	**VD**	**WM**	**VD**	**WM**	**VD**
DEMATEL allows administrators to map out cause-and-effect relationships, while FUZZY analysis accounts for uncertainties and subjective inputs, resulting in a more holistic and nuanced understanding.	4.24	VHE	4.2	VHE	4.2	VHE	4.2	VHE
It provides a visual representation of how different factors are interconnected and how changes in one area might ripple through the system, aiding administrators in identifying both direct and indirect impacts.	4.24	VHE	4.2	VHE	4.2	VHE	4.2	VHE
Administrators can consider the broader context and potential repercussions of their choices, ensuring that decisions address multiple challenges and contribute to overall system enhancement.	4.26	VHE	4.24	VHE	4.24	VHE	4.26	VHE
This characteristic allows administrators to incorporate imprecise data and subjective judgments, making the analysis more adaptable to the complexities of the decision environment.	4.24	VHE	4.2	VHE	4.22	VHE	4.24	VHE

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DEMATEL-FUZZY analysis aids administrators in prioritizing strategies by considering their potential impact and the uncertainty associated with them.	4.26	VHE	4.24	VHE	4.2	VHE	4.2	VHE
Administrators can foresee the consequences of different strategies on multiple challenges, allowing them to anticipate both intended and unintended effects, thus enabling proactive planning.	4.22	VHE	4.26	VHE	4.24	VHE	4.26	VHE
This fusion enhances the rigor of decision-making by incorporating both numerical assessments and expert judgments.	4.26	VHE	4.24	VHE	4.2	VHE	4.2	VHE
They can develop multi-faceted approaches that tackle interconnected challenges, optimizing resource allocation and generating more sustainable outcomes.	4.2	VHE	4.2	VHE	4.24	VHE	4.2	VHE
Overall Weighted Mean:	**4.24**		**4.22**		**4.21**		**4.22**	
Interpretation:	**Very Highly Effective**							

Table 5 showcases how the integration of DEMATEL-FUZZY analysis can reveal the causal relationships between challenges and strategies, allowing administrators to make comprehensive decisions that account for the intricate interconnections within these elements. The qualitative insights from respondent groups A, B, C, and D elucidate the characteristics and implications of this analytical approach.

DEMATEL-FUZZY analysis offers administrators a powerful toolset for mapping out cause-and-effect relationships while accommodating uncertainties through subjective inputs. This combination results in a more nuanced understanding of complex issues, and all groups collectively emphasize its significance. By providing a visual representation of interconnected factors and their ripple effects, the analysis helps administrators recognize both direct and indirect impacts, thereby aiding their decision-making processes. The groups concur that this aspect is very highly effective.

The integration of DEMATEL-FUZZY analysis empowers administrators to make decisions within a broader context, accounting for potential consequences and system enhancement. Respondents highlight how this approach enables proactive planning and the anticipation of both intended and unintended effects, contributing to effectiveness. The fusion of these techniques allows administrators to incorporate imprecise data and expert judgments, adapting to the complexities of decision-making environments. Respondents across the groups value this adaptability as it enhances the analysis's rigor.

The ability to prioritize strategies by considering their impact and associated uncertainty is another critical characteristic of DEMATEL-FUZZY analysis. Respondents concur that this attribute aids administrators in making informed decisions and aligning strategies with the institution's goals.

The incorporation of both numerical assessments and expert judgments enhances the decision-making process's robustness, providing a comprehensive basis for evaluating options.

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Incorporating DEMATEL-FUZZY analysis facilitates administrators in developing multi-faceted approaches that address interconnected challenges. This aspect supports optimal resource allocation and sustainable outcomes, and respondents collectively recognize its value.

The overall weighted mean scores and qualitative interpretations illustrate the high effectiveness of DEMATEL-FUZZY analysis in unveiling causal relationships between challenges and strategies. This approach enables administrators to make comprehensive decisions that consider uncertainties, prioritize strategies, and foster a holistic understanding of complex issues, ultimately leading to more effective decision-making in the realm of higher education management.

Table 6. The integration of DEMATEL-FUZZY analysis can serve as a structured platform for systematically gathering and analyzing diverse perspectives

Integration of DEMATEL-FUZZY analysis can serve as a structured platform	Group of Respondents							
	A (n=10)		B (n=10)		C (n=20)		D (n=40)	
	WM	VD	WM	VD	WM	VD	WM	VD
DEMATEL-FUZZY analysis provides a well-defined framework that guides the systematic gathering of information and viewpoints.	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
The methodology encourages the inclusion of a wide range of perspectives from stakeholders with different backgrounds, expertise, and roles.	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
FUZZY logic's incorporation allows for the integration of subjective inputs, reflecting stakeholders' opinions, judgments, and experiences.	4.3	VHE	4.2	VHE	4.2	VHE	4.3	VHE
Through DEMATEL, the analysis translates subjective inputs into quantifiable relationships, assigning numerical values to causal links and interdependencies.	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
DEMATEL-FUZZY analysis accommodates multiple criteria and parameters that represent different perspectives.	4.3	VHE	4.2	VHE	4.2	VHE	4.2	VHE
The analysis often employs visual representations, such as matrices or graphs, to display the relationships and interactions between different perspectives.	4.2	VHE	4.3	VHE	4.2	VHE	4.3	VHE
By systematically aggregating and evaluating diverse viewpoints, DEMATEL-FUZZY analysis can facilitate consensus building among stakeholders.	4.3	VHE	4.2	VHE	4.2	VHE	4.2	VHE
The methodology can help identify areas of divergence or conflicting perspectives.	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
The combination of qualitative and quantitative elements in DEMATEL-FUZZY analysis enables administrators to gain a holistic insight into the decision problem.	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE

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The structured platform fosters a systematic approach to decision-making by taking into account a wide range of inputs and systematically analyzing their implications.	4.2	VHE	4.2	VHE	4.2	VHE	4.2	VHE
Overall Weighted Mean:	**4.24**		**4.21**		**4.21**		**4.22**	
Interpretation:	**Very Highly Effective**							

Table 6 underscores how the integration of DEMATEL-FUZZY analysis functions as a structured platform for systematically gathering and analyzing diverse perspectives. Respondent groups A, B, C, and D provide qualitative insights into the characteristics and implications of this approach. DEMATEL-FUZZY analysis provides administrators with a well-defined framework that guides the systematic collection of information and viewpoints. This feature aids administrators in obtaining a comprehensive understanding of complex issues, as indicated by the very highly effective ratings from all respondent groups.

The methodology encourages the inclusion of diverse perspectives from stakeholders with varying backgrounds, expertise, and roles. This characteristic enhances the comprehensiveness and depth of analysis, contributing to informed decision-making. All groups consistently rate this aspect as very highly effective.

The incorporation of FUZZY logic allows administrators to integrate subjective inputs, reflecting stakeholders' opinions, judgments, and experiences. Through the translation of subjective inputs into quantifiable relationships using DEMATEL, the analysis assigns numerical values to causal links and interdependencies. This characteristic provides a structured means of incorporating qualitative viewpoints into the analysis, and respondents across all groups recognize its effectiveness.

DEMATEL-FUZZY analysis accommodates multiple criteria and parameters representing different perspectives. This attribute allows administrators to capture the diverse range of viewpoints that stakeholders bring to the decision-making process. Respondents collectively highlight the significance of this aspect as very highly effective.

Visual representations, such as matrices or graphs, are often employed to depict the relationships and interactions between different perspectives. This visual approach aids administrators in comprehending complex interdependencies and relationships. Respondents concur that this feature is very highly effective.

By systematically aggregating and evaluating diverse viewpoints, DEMATEL-FUZZY analysis can facilitate consensus building among stakeholders. The methodology also helps identify areas of divergence or conflicting perspectives, enabling administrators to address potential challenges. Respondent groups consistently rate these aspects as very highly effective.

The combination of qualitative and quantitative elements in DEMATEL-FUZZY analysis allows administrators to gain holistic insights into decision problems. This fusion provides a well-rounded perspective that takes into account both subjective inputs and quantifiable relationships, contributing to overall effectiveness.

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In sum, the overall weighted mean scores and qualitative interpretations affirm that the integration of DEMATEL-FUZZY analysis serves as a structured platform for systematically gathering and analyzing diverse perspectives. This approach enhances the comprehensiveness, inclusivity, and effectiveness of decision-making processes, particularly in the context of higher education management.

Table 7: Summary of Integrating DEMATEL-FUZZY Analysis into Exploring Challenges and Strategies of Administrators in State Universities and Colleges (SUCs) Management

Summary of Integrating DEMATEL-FUZZY Analysis into Exploring Challenges and Strategies of Administrators in State Universities and Colleges (SUCs) Management	Identified Respondent Groups			
	A (n=10)	B (n=10)	C (n=20)	D (n=40)
	WM	WM	WM	WM
Enhancing the decision-making process in managing multifaceted challenges.	4.37	4.24	4.20	4.26
Facilitate the identification of optimal strategies for addressing challenges within the complex landscape of SUC management.	4.21	4.23	4.22	4.22
Examine how the integration of DEMATEL-FUZZY analysis can empower administrators to effectively navigate the inherent uncertainty and ambiguity in decision-making by incorporating fuzzy and subjective inputs from stakeholders.	4.29	4.21	4.22	4.22
Reveal how DEMATEL-FUZZY analysis can unveil the causal relationships between different challenges and strategies, enabling administrators to make comprehensive decisions that account for the interconnected nature of these elements.	4.24	4.22	4.21	4.22
The integration of DEMATEL-FUZZY analysis can serve as a structured platform for systematically gathering and analyzing diverse perspectives.	4.24	4.21	4.21	4.22
Overall Weighted Mean:	**4.29**	**4.22**	**4.21**	**4.23**
Interpretation:	**Very Highly Effective**			

The integration of DEMATEL-FUZZY analysis into examining the difficulties and solutions used by managers in State Universities and Colleges (SUCs) management is fully summarized in Table 7. The analysis encompasses insights from respondent groups A, B, C, and D and highlights the weighted means for each aspect:

Enhancing the Decision-Making Process: The integration of DEMATEL-FUZZY analysis is perceived as very highly effective in enhancing the decision-making process to manage multifaceted challenges. This approach garnered consistently high weighted means across all respondent groups, indicating its substantial impact on decision-making effectiveness.

Facilitate the Identification of Optimal Strategies: Administrators find that integrating DEMATEL-FUZZY analysis facilitates the identification of optimal strategies to address challenges within the complex landscape of SUC management. The relatively consistent weighted means from respondent groups further affirm the approach's efficacy in strategy

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formulation.

Empowerment through Uncertainty Navigation: The analysis indicates that the integration of DEMATEL-FUZZY analysis empowers administrators to navigate uncertainty and ambiguity in decision-making by incorporating fuzzy and subjective inputs from stakeholders. The overall positive response from respondent groups demonstrates the perceived value of this approach in addressing inherent uncertainties.

Revealing Causal Relationships: The analysis reveals that DEMATEL-FUZZY analysis unveils causal relationships between different challenges and strategies. This characteristic enables administrators to make comprehensive decisions that consider the interconnected nature of these elements. The consistent weighted means across respondent groups emphasize the effectiveness of this aspect.

Structured Platform for Diverse Perspectives: The integration of DEMATEL-FUZZY analysis is viewed as a structured platform for systematically gathering and analyzing diverse perspectives. This approach provides a well-rounded understanding of decision problems. The positive response from respondent groups underscores its effectiveness in capturing various viewpoints.

The overall weighted mean of the summary table is calculated for each aspect, and it suggests that the integration of DEMATEL-FUZZY analysis into exploring challenges and strategies in SUCs management is perceived as very highly effective. This indicates a strong consensus among administrators across different respondent groups about the value and impact of this approach on decision-making processes. The high levels of effectiveness reported for various aspects of the analysis demonstrate its potential to contribute significantly to the enhancement of decision-making practices in the complex context of higher education management.

SUMMARY

The study aimed to explore the integration of DEMATEL-FUZZY analysis for investigating challenges and strategies in the management of State Universities and Colleges (SUCs). The study employed a mixed-methods approach, gathering data from four respondent groups (A, B, C, D) and analyzing their perspectives on various aspects of the integration. The study focused on enhancing decision-making, identifying optimal strategies, addressing uncertainty, unveiling causal relationships, and incorporating diverse perspectives.

FINDINGS

The findings revealed that the integration of DEMATEL-FUZZY analysis is highly effective in addressing the challenges faced by SUC administrators. Respondents consistently rated the integration as "Very Highly Effective" across all aspects examined. The analysis aids in mapping cause-and-effect relationships, accounting for uncertainties and subjective inputs, enhancing decision-making by prioritizing strategies, and facilitating comprehensive planning by considering interconnected challenges. Additionally, the study highlighted the structured platform provided by DEMATEL-FUZZY analysis for systematically gathering and analyzing

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diverse stakeholder perspectives, contributing to consensus-building and holistic decision-making.

CONCLUSION

In conclusion, the integration of DEMATEL-FUZZY analysis offers a powerful tool for administrators in SUCs to navigate the complexities of higher education management. It provides a systematic and structured approach for addressing challenges and formulating strategies that account for uncertainties, interdependencies, and diverse viewpoints. The study's findings underscore the potential of this analytical approach to empower administrators in making informed and effective decisions in a rapidly changing educational landscape.

RECOMMENDATIONS

Based on the study's results, several recommendations can be made:

Incorporate DEMATEL-FUZZY Analysis: SUCs are encouraged to adopt the DEMATEL-FUZZY analysis as a part of their decision-making processes to enhance strategic planning, prioritize strategies, and address complex challenges.

Training and Skill Development. Offer training to administrators on the application of DEMATEL-FUZZY analysis to ensure its proper implementation and interpretation.

Stakeholder Engagement. Actively involve stakeholders, including faculty, staff, students, industry partners, and community members, in the analysis process to gather diverse perspectives.

Continuous Improvement. Encourage continuous learning and improvement by regularly reviewing the outcomes of implemented strategies and refining the analysis process.

Incorporating the integration of DEMATEL-FUZZY analysis can empower SUC administrators to navigate uncertainties, make well-informed decisions, and foster a more effective and responsive higher education management system.

TECHNICAL TERMS

Accessibility: Ensuring equal opportunities and easy access to education, resources, and services.

Administrators: Individuals responsible for managing and leading activities within State Universities and Colleges.

Aligning institutional activities: Ensuring that the actions of an institution correspond with its goals and mission.

Challenges: Complex issues and obstacles faced by administrators in State Universities and Colleges.

DEMATEL-FUZZY Analysis: A structured approach combining DEMATEL's cause-and-

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effect mapping with FUZZY logic to address uncertainty and subjective inputs.

Efficiency: The ability to achieve desired outcomes with minimum resources and waste.

Elucidate: To clarify or explain a concept, idea, or situation in detail.

Enhancing: Improving or making something more effective or efficient.

Higher Education: Education beyond secondary school, typically provided by colleges and universities.

Integration: Bringing different components or systems together to function as a unified whole.

Integration of technology: Incorporating technological tools and systems into various processes.

Investigation: The systematic process of exploring and gathering information to understand a topic.

Management: The method of arranging, managing, and planning activities to accomplish organizational goals.

Rapidly evolving: Undergoing quick and significant changes over a short period.

Related Literature: Previous research and scholarly works relevant to the study's topic.

Research Methodology: The systematic approach used to gather and analyze data in a study.

State Universities and Colleges: Educational institutions funded by the government, providing tertiary education.

Strategies: Well-defined plans or actions designed to address challenges and achieve specific goals.

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