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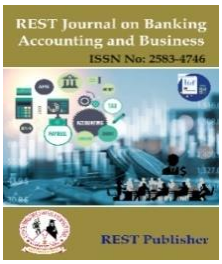

Management Model of Higher Education Using VIKOR Method

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Abstract: *Effective management of Higher education models play a key role in sustaining institutional performance, sustaining quality assurance, and promoting continuous improvement. As higher education systems grow more complex and dynamic, implementing effective management strategies becomes essential for long-term success and adaptability complex, the integration of strategic management approaches, quality assessment frameworks, and advanced technologies has become essential. This study examines different management models in higher education, emphasizing their influence on academic success, organizational performance, and overall efficiency. stakeholder engagement. Research Significance: The study of higher education management models and their influence on institutional performance, academic standards, and student achievement is essential. With the rise of globalization, rapid technological advancement, and changing educational demands, implementing effective management strategies is essential for long-term sustainability and growth. Methodology: This study uses a mixed-methods approach to examine higher education management models, incorporating both It is a combination of qualitative and quantitative research approaches supported by a comprehensive literature review is conducted to explore the management structures, best practices, and challenges within higher education institutions. Alternatives Precision: Refers to the extent to which repeated measurements produce consistent results. Accuracy: Precision is measured in terms of accuracy, while recall is measured in terms of positive predictions. The accuracy of a classification model refers to its overall correctness. Recall: Recall and precision are key metrics for evaluating the performance of a classifier in binary and multiclass classification tasks. Specificity: Sensitivity and specificity assess how accurately the true and false sets are predicted. Evolution Parameter (NTQ-BDT): The adoption of the Network-based teaching quality with big data technologies (NTQ-BDT) has facilitated a comprehensive evaluation of online education. AI: This study explores artificial intelligence (AI), fuzzy mathematics, and differential modeling after analyzing existing mathematical models and the "knowledge forgetting curve". (AHP): The study combines this study combines the Analytical Hierarchy Process (AHP) and the Elimination and Choice Expressing Reality (ELECTRE) method to improve patient flow and service quality. Conclusion: In summary, effective management of higher education models is crucial for maintaining institutional performance, achieving academic excellence, and meeting stakeholder expectations. This study emphasizes the need to integrate strategic planning, quality assurance mechanisms, and technological innovation to address emerging challenges in the field of higher education. Result: The results of the study highlight the effectiveness of various higher education management models improving institutional performance, academic standards, and student satisfaction. The results indicate that incorporating strategic planning, technological advancements, and data-driven decision-making enhances operational efficiency, promoting sustainable development and adaptability within higher education institutions.*

Key Words: *Higher education administration, institutional performance, academic excellence, strategic development, quality assurance, technology integration, evidence-based decision-making, learner satisfaction, faculty development, educational policy, operational optimization, sustainable improvement, higher education structures, institutional governance, and educational innovation.*

1. INTRODUCTION

The underlying idea is that universities can improve their operational efficiency, accessibility, cost-effectiveness, and personalized learning experiences through this integration. However, before fully embracing this new educational model, it is important to assess the potential drawbacks. [1] The creation and access to new and existing knowledge pose significant challenges and opportunities for organizations striving to compete globally. Human resource managers must navigate the evolving demands of a technology-driven landscape, while educational institutions face both challenges in adapting to rapid changes in the global business environment and meeting increasing stakeholder accountability expectations. [2] For an organization to effectively leverage knowledge assets for competitive advantage, knowledge management (KM) requires a comprehensive approach that integrates business strategy, organizational structure, and human factors. Therefore, KM must work with business operations, organizational structures, and IT systems to continuously capture, preserve, and leverage critical information, ultimately managing strategic knowledge assets that improve business performance. [3] Quality initially emerged as a major concern in the business and industrial sectors, but gradually evolved into a broader social issue, affecting various aspects of society, especially in public services. This growing concern has initiated a debate about the best approaches to maintaining quality in public service delivery challenges in implementing a quality management (QM) framework originally designed for the business and manufacturing sectors. [4] As the 21st century progresses, higher education faces unparalleled challenges shaped by globalization growing importance of knowledge as a key factor for development, and rapid advances in information and communication technologies. [5] In recent years, higher education institutions (HEIs) have made various efforts to integrate sustainable development (SD) using various approaches. [6] Many universities have adopted Principles of Total Quality Management (TQM) drive continuous improvement in both educational offerings and learning outcomes. This approach also aims to improve employee performance, ensuring that graduates acquire the knowledge and skills necessary to compete effectively in the job market. In addition, many countries have established regulatory bodies to oversee TQM application in higher education. For example, Jordan established the Higher Education Accreditation and Quality Assurance Board to oversee quality standards in its universities. [7] Analysis of the history of education reveals an early connection between learning and formal schooling. As a result, most students today participate in traditional courses and programs that are designed for a broad audience, offering minimal customization to individual learning needs. However, education Continues to be an important component of assessment both individual success and social integration. [8] In many countries and cultures, quality a fundamental focus for higher education institutions (HEIs), especially with expansion higher education to accommodate a growing population and the growing need for accountability are often cited as key reasons for this heightened focus on quality. In addition, there are rising student expectations, increasing diversity among learners, the need for greater flexibility in educational offerings, and intensified competition at national and international levels. [9] Analyzing and understanding student satisfaction in higher education is essential, as universities can benefit significantly from developing long-term relationships with their students. Maintaining strong relationships with students can be a competitive advantage, especially by generating positive word of mouth among prospective, current, and future students. In addition, these relationships can lead to continued collaboration with the institution, especially after graduation, and can help recent graduates with job opportunities. [10] Understanding what constitutes effective Leadership within academic department's higher education is particularly relevant in today's economic climate. The sector continues to expand through globalization and the rise of new institutions in the higher education sector, as universities face increasing pressure to operate like businesses and remain competitive. In this evolving landscape, it is critical that universities explore ways to improve their performance. This includes strengthening departmental leadership and governance, as the overall the overall success of a company is determined by its performance individual academic departments. [11] The literature highlights many fields that have adopted this approach to address various challenges, including finance, medicine, marketing, stock market, telecommunications, manufacturing, healthcare, and customer relationship management.[12] Climate change is a critical global issue and one of the greatest challenges facing humanity. In recent years, companies have come under increasing pressure from stakeholders to reduce the environmental footprint of their operations. As a result, businesses are expected not only to integrate environmental values into their economic objectives, but also Adoption of an environmental management framework assesses their social performance. [13] The growing diversity of students introduces a new perspective to the quality debate. This aspect focuses on addressing the learning needs of "new learners" and transforming teaching methods in higher education, rather than emphasizing only quality assurance mechanisms designed to improve institutional processes and workflows. [14] The combined impact Existing financial structures, government regulations, and quasi-market dynamics has placed higher education staff under increasing pressure to manage a high workload with limited resources. This pressure stems from both external and internal sources. Externally, various regulatory bodies, Agencies responsible for higher education funding and quality assurance, agencies, influence institutions by

controlling resource allocation and quality rankings. [15] The effectiveness the success of an e-learning system depends on identifying key factors that influence student adoption and engagement of such platforms. This study examines current e-learning environments, their features, benefits, limitations, and the primary factors that influence their adoption. The findings suggest that a successful e-learning system must take into account individual, social, cultural, technological, organizational, and environmental aspects. [16] This study is particularly relevant as modern universities face significant mission ambiguity. Many institutions adopt similar goals while inefficiently deploying their limited human and physical resources. As universities increasingly engage with diverse traditional and emerging communities, there is a growing need for a well-defined strategy to effectively understand and manage stakeholder relationships. [17] Although it is assumed that nonprofits are not subject to restructuring pressures like other industries, this study indicates that changing environmental conditions may impose demands for restructuring that are comparable, if not greater, than those experienced by nonprofits. [18] Business process reengineering (BPR) efforts have failed to achieve the expected results. While improvements have been seen in specific areas—such as a 20% cost reduction, a 50% reduction in process time, and a 25% improvement in quality—these gains are often offset by rising business-unit costs and declining profits. [19] In recent decades, universities have undergone significant changes driven by technological advances and the broader societal shift towards digitalization. In higher education, the integration of technology represents a transformative change, establishing an interconnected ecosystem that enhances digital learning experiences as a result; the focus has shifted from technology to students and the learning experiences it enables [20].

2. MATERIALS

Effective management of higher education materials is critical to enhancing learning experiences and improving institutional operations. This includes properly organizing, storing, and distributing resources such as textbooks, digital content, research materials, and administrative records. Adopting digital repositories and learning management systems (LMS) ensures seamless access and real-time updates. It is also essential to protect academic and student data through advanced security measures. Collaboration between faculty, students, and administrators ensures the relevance and accuracy of educational resources. Regular audits and feedback mechanisms help refine content, address gaps, and optimize resource allocation. In addition, standard practices, such as digitizing materials and reducing paper use, improve cost efficiency and environmental responsibility. By strategically integrating technology with resource management, universities can streamline administrative processes, improve access to educational materials, and support academic success in the evolving higher education landscape.

Alternatives

Precision: Precision measures the consistency of repeated measurements, indicating how closely they agree with each other. It is affected by factors such as noise and short-term drift, which can affect the reliability of an instrument. The level of precision is often reflected in the number of decimal places a value can have. Ensuring high accuracy is essential to maintaining reliability in any measurement process. In contrast, accuracy refers to how closely a measured value matches the true or true value, emphasizing correctness over consistency.

Accuracy: Precision is measured in terms of accuracy, whereas recall is measured in terms of the number of positive cases correctly identified. Precision refers to the overall correctness of a classification model, while accuracy refers to how effectively it identifies the target class. Recall, on the other hand, measures the model's ability to detect all relevant cases, highlighting its effectiveness in capturing essential data.

Recall: Recall and precision are essential metrics for evaluating the performance of a classifier in binary and multiclass in categorization tasks, precision assesses the correctness of positive predictions, while recall measures the ability to identify all relevant events classifier's ability to identify all relevant events, ensuring comprehensive and effective predictions.

Specificity: Sensitivity and specificity assess the accuracy of true and false predictions. Recall measures the amount of relevant information obtained, while precision assesses the quality of predictions. An algorithm with high recall and precision effectively identifies the most relevant results, even if some irrelevant ones are included.

Evolution Parameter

(NTQ-BDT): Implementing Network Teaching Quality Enhanced by Big Data Technologies (NTQ-BDT) enables a holistic assessment of online education. As high-speed internet continues to expand, online learning has become a common practice in vocational and technical universities. This change improves teaching methods, fosters student engagement, and provides valuable insights for educators.

AI: This study explores artificial intelligence (AI), fuzzy mathematics, and differential modeling by analyzing existing mathematical models and the "knowledge-forgetting curve". The research aims to develop an advanced mathematical model and algorithm to improve software intelligence. In addition, it proposes a new approach to evaluating the effectiveness of the college education system.

(AHP): This study combines the Analytical Hierarchy Process (AHP) combined with Elimination and Choice Expressing Reality (ELECTRE) method. By providing an adaptive method applicable to various healthcare settings, the approach improves emergency department (ED) operations and supports the pursuit of operational excellence in healthcare.

(FSQCA): This study uses fuzzy-set qualitative comparative analysis (fsQCA) to explore the complex relationship between founder management and innovation, and advances the concept of planned behavior. Using the planned behavior framework, it categorizes founders' behavioral intentions into three main dimensions: attitude, subjective norms, and perceived behavioral control.

VIKOR Method: The education system plays a vital role in the development of a country performance directly affects national development. A well-organized system fosters a knowledgeable and skilled society. In Malaysia, blended learning is widely adopted in educational institutions. Recently, undergraduate students have gained access to alternative learning approaches, including online education and distance learning, which improves their educational opportunities. [1] In response to the demands of a globalized world, universities have increasingly adopted modern approaches to improve their educational and research services. To achieve a prestigious position among top performing institutions, it is essential to assess the quality of service and effectively monitor performance improvements. Identifying strengths and weaknesses, strategic planning and its successful implementation play a key role in organizational progress. Therefore, it is crucial for universities to continuously assess their national and international standing to measure growth and maintain competitiveness. [2] To improve the development of fuzzy sets (FSs), intuitive fuzzy sets (IFSs) were introduced. Over time, FSs and their extensions have been widely used in various decision analysis fields. Su et al. proposed a dynamic and interactive method for intuitive fuzzy multi-attribute group decision making (IF-MAGDM). Their research introduced an intuitive fuzzy super-performance slack-based measure and investigated the partial derivatives and absolute differences of binary intuitive fuzzy mathematical functions. [3] Ensuring the quality of modern library services is a multifaceted process involves identifying alternatives, selecting evaluation criteria, and implementing strategies for improvement. This study examines the applicability of the use of Multi-Criteria Analysis (MCA), especially the VIKOR method, in evaluating faculty library services. services. Effective service quality management requires assessing current service levels and ranking them to guide improvement efforts. [4] Scholarships provide financial assistance without the need to repay, supporting deserving and financially disadvantaged students by covering essential Expenses including accommodation, food, transportation and education. Various institutions and organizations evaluate applicants based on a number of criteria, usually assessed by a designated committee. Since scholarships are limited, selecting the most suitable recipients is a complex challenge. The selection process involves evaluating many factors simultaneously, which Multiple criteria are approached as a decision-making challenge. [6] The quality assurance system, built around the content, objectives and structure of educational management, facilitates a comprehensive evaluation process. By using scientific and systematic approaches, it enhances the effective implementation of educational management tasks while maintaining high standards and efficiency. As higher education continues to expand, this system improves management structures and teaching methods, ensuring that universities are aligned with the evolving socio-economic landscape. [7] Scholarships provide important financial support to students, covering Expenses including housing, food, travel, and tuition fees. Various institutions and organizations establish specific evaluation criteria to determine recipients, and applications are usually reviewed by a dedicated committee. Since scholarships are limited, selecting the most deserving applicants is a complex process. Considering Selecting scholarship recipients is a complex multi-criteria decision-making process. challenge ensures a fair, transparent and comprehensive evaluation of applicants, as many factors must be assessed simultaneously. [8] Most research in this area has primarily examined student-level factors, while this study emphasizes e-learning. While digital learning offers convenient access to extensive stored

information, students must independently select their study materials, which can sometimes be overwhelming. The rapid expansion of online educational resources has surpassed pace at which educators can adopt innovative e-learning strategies, as some programs cannot always be effectively aligned with specific teaching materials. [9] The progress of nations and the global community depends heavily on educational institutions, which are instrumental in developing skilled professionals and driving research for sustainable progress. In recent years, universities have adopted a renewed vision by incorporating contemporary strategies to improve the quality of education and research services. [10]

3. ANALYSIS AND DISCUSSION

TABLE 1. Management of Model Higher Education

Alternatives	NTQ-BDT	AI	AHP	fsQCA
Precision	53.3	69.5	44.2	99.4
Accuracy	54.5	62.7	55.4	90.4
Recall	31.2	53.8	91.3	97.5
Specificity	51.9	68.7	86.4	93.9

The table provides a comparative evaluation of the four methods, NTQ-BDT, AI, AHP and fsQCA, using key performance indicators: precision, accuracy, recall and specificity. Of these, fsQCA exhibits the best performance, achieving the highest values in precision (99.4%), accuracy (90.4%), recall (97.5%) and specificity (93.9%). These findings suggest that fsQCA is a highly efficient method for ensuring accurate and reliable results classification and model evaluation. AI follows with 69.5% precision and 62.7% accuracy, which provides a balanced but lower performance than fsQCA. Although AI shows strong specificity (68.7%), its recall (53.8%) is relatively weak, indicating limitations in detecting true positive cases. AHP performs exceptionally well in recall, reaching 91.3%, which makes it valuable in applications where capturing true positives is important. However, its precision (44.2%) is very low, indicating potential problems with false positives. NTQ-BDT, on the other hand, exhibits low recall (31.2%) and moderate precision (53.3%), reflecting its limited classification performance. Although its accuracy (54.5%) and specificity (51.9%) are reasonable, they are underperforming compared to other methods. In summary, fsQCA emerges as a very reliable method, excelling in particular in precision and recall, making it a more suitable approach for applications that demand high precision and reliability.

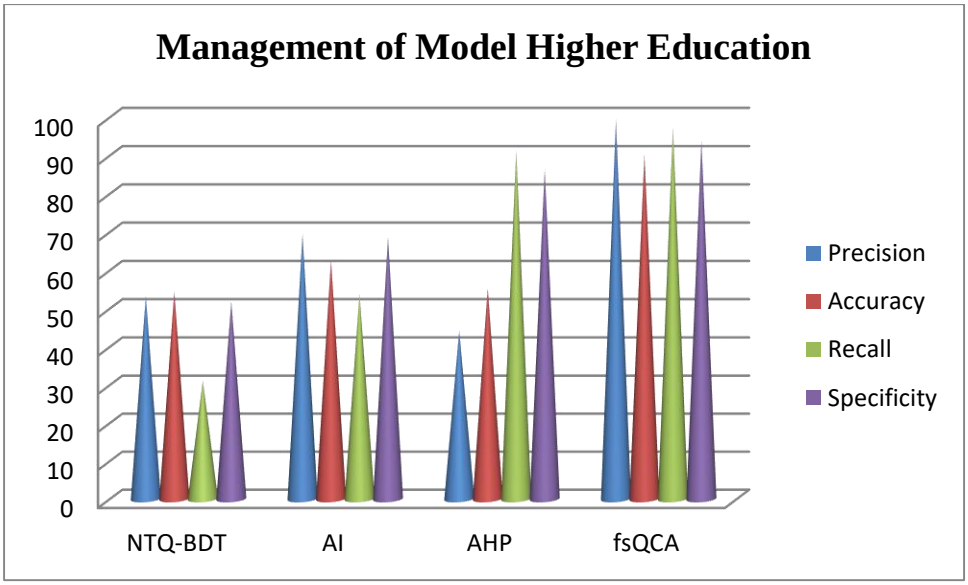

FIGURE 1. Higher Education Model Management

Figure 1 Management Model Higher Education provides a comparative assessment of four methods – NTQ-BDT, AI, AHP and fsQCA – evaluated in terms of precision, accuracy, recall and specificity. FsQCA achieves the highest

performance across all metrics, with significant strengths in precision (99.4%) and recall (97.5%). AHP demonstrates high recall (91.3%) and specificity (86.4%), while AI performs better in precision (69.5%) and specificity (68.7%). NTQ-BDT shows moderate performance across all parameters. This analysis identifies fsQCA as the most effective method, especially for improving precision and recall.

TABLE 2. Calculation of SJ and RJ

Alternatives	Calculation of SJ and RJ			
Precision	0.266908	0.263423	2.403061	0.13194
Accuracy	0.281401	0.149329	1.831633	0.493056
Recall	0	0	0	0
Specificity	0.25	0.25	0.25	0.25

The table shows the calculated SJ and RJ values for various methods, considering precision, accuracy, recall, and specificity. Precision varies significantly across alternatives, ranging from 0.13194 to 2.403061, while accuracy also fluctuates, reaching a maximum of 1.831633. Recall remains constant at 0 for all alternatives, while specificity maintains a constant value of 0.25. These calculations provide insights into the relative performance and efficiency of each method.

TABLE 3. SJ and RJ

Alternatives	SJ	RJ
Precision	2.801448	2.403061
Accuracy	2.755418	1.831633
Recall	0	0
Specificity	1	0.25

The table shows the SJ and RJ values for various methods, considering precision, accuracy, recall and specificity. Precision exhibits the highest Sj (2.801448) and RJ (2.403061) scores, followed by precision at Sj 2.755418 and Rj 1.831633. Recall remains constant at 0 for both metrics, whereas specificity maintains a constant Sj value of 1 and RJ value of 0.25. These results provide a numerical assessment of the performance of the methods on different performance metrics.

TABLE 4. QJ

Alternatives	QJ
Precision	11.01297
Accuracy	8.70424
Recall	0
Specificity	1.5

The table outlines the QJ values for the key performance measures – precision, accuracy, recall and specificity – highlighting their importance in assessing methodological performance. Precision has the highest QJ value at 11.01297, underscoring its important role in performance assessment. Precision follows with a QJ value of 8.70424, underscoring its importance in assessing overall correctness. Specificity, with a QJ value of 1.5, indicates a moderate influence on the assessment process. Meanwhile, recall records a QJ value of 0, indicating its minimal contribution in this context. These findings provide valuable insights into the relative impact of each measure within the analytical framework.

TABLE 5: Rank

Alternatives	Rank
Precision	1
Accuracy	2
Recall	4
Specificity	3

The table provides a ranking of the essential performance measures – precision, accuracy, recall, and specificity – based on their effectiveness. Precision has the highest rank (1), indicating its central role in performance assessment. Accuracy follows at rank 2, highlighting its importance in measuring overall correctness. Specificity is in third place, emphasizing its function in identifying true negatives, while recall has the lowest rank (4), indicating its relatively

minor impact on this assessment. These rankings provide insights into the relative importance of each measure in assessing performance.

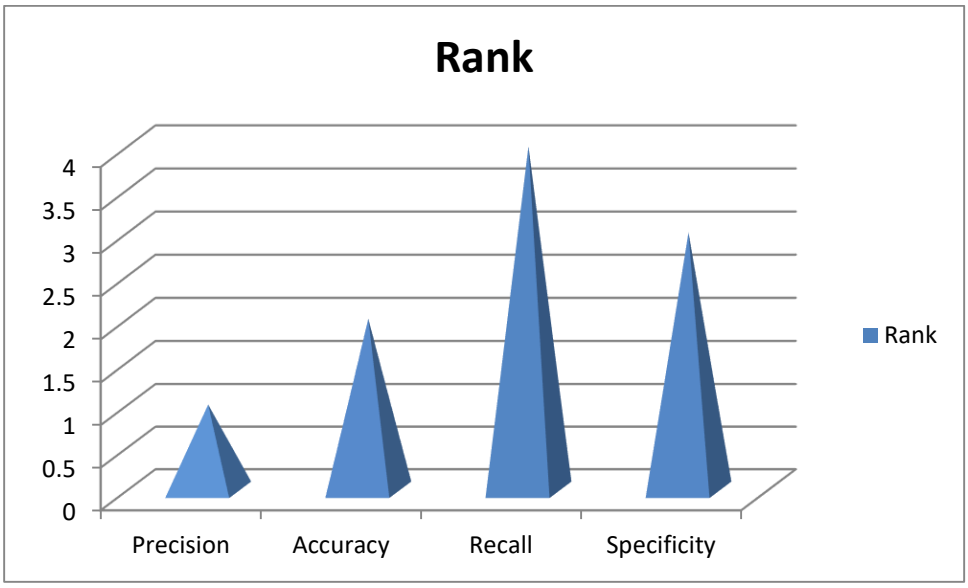

FIGURE 2. Rank

Figure 2 the chart provides a ranking of various performance metrics, namely precision, accuracy, recall, and specificity. Precision ranks highest at 1, followed by accuracy at 2. Specificity ranks third, while recall ranks lowest at 4. This ranking emphasizes the importance of each metric in assessing the performance of different methods.

4. CONCLUSION

A fuzzy logic system is developed to manage uncertainty, ambiguity, and imprecision in language acquisition and natural language processing tasks. Using input from an HE-based learning environment, the system is trained to improve decision-making through a dual-deep Q-learning network. While conventional classification metrics such as precision, accuracy, and recall are useful for normally distributed data, alternative methods such as ROC/AUC provide more reliable estimates for classification models that deal with unbalanced datasets. Furthermore, game-based learning fosters a positive mindset among students, enhancing their engagement and participation in the learning process. Both education and business organizations need to focus on creating a skilled knowledge workforce capable of succeeding in a highly competitive global environment. As a result, human resource management (HRM) strategies, along with curriculum and program development, should prioritize the development, assessment, and continuous improvement of individuals' knowledge, skills, and abilities. This study seeks establishing a basis for assessing the construct validity of empirical studies that use the key information approach method to assess organizational characteristics within collaborative groups. While previous studies have introduced advanced methods for individual-level analysis, limited attention has been paid to testing hypotheses in more complex contexts such as manufacturing units. This paper bridges this gap By providing a framework for assessing the validity of organizational asset metrics within industry groups using a key information approach. The literature underscores the need for a comprehensive quality management (QM) framework that integrates multiple quality dimensions for comprehensive analysis. However, while some approaches are called 'comprehensive', many are 'partial' or 'limited' when considering the full scope of levels and dimensions applicable to higher education institutions (HEIs).

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