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Research Article

# Optimizing Higher Education Performance Through Data Integration Using the Zachman Framework: A Case Study on LAM Infokom Accreditation Criteria

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**A B S T R A C T**

This study explores the application of the Zachman Framework to enhance data integration in higher education, specifically targeting the LAM Infokom accreditation criteria. The research addresses the challenges faced by educational institutions in managing fragmented data systems, which hinder their ability to meet comprehensive accreditation standards. Utilizing a multi-phase methodology, the research incorporates a literature review, case analysis, and prototype development to develop a cohesive data integration model aligned with accreditation requirements. The Zachman Framework provides a structured approach to system integration, covering perspectives such as data types, processes, storage locations, personnel, timelines, and objectives. The proposed integration strategy emphasizes using Application Programming Interfaces (APIs), middleware solutions, and a centralized data warehouse to unify disparate data sources. These integration methods facilitate seamless data exchange across academic, financial, and administrative systems, promoting data consistency and accessibility. A phased implementation plan is also recommended, outlining specific tasks, resource allocation, and monitoring measures to ensure systematic system improvement. Key performance indicators and evaluation metrics are established to monitor the effectiveness of the integrated system in meeting accreditation requirements. The study highlights the importance of a robust data governance framework and the role of stakeholder engagement in overcoming technical and resource-related challenges. Ultimately, this research contributes a practical data integration blueprint for higher education institutions, offering a replicable model for achieving and maintaining accreditation compliance through structured data management and governance practices.

## 1. INTRODUCTION

Data governance and information management have become critical components in higher education in the digital era. The rapid advancement of technology has significantly increased the volume and complexity of data generated by educational institutions. Properly managing this data is crucial for making informed decisions, optimizing operations, and enhancing the overall quality of education. Data governance encompasses the policies, procedures, and standards that ensure data integrity, security, and accessibility. Effective data governance enables institutions to maintain accurate records, protect sensitive information, and comply with regulatory requirements, thereby fostering a culture of transparency and accountability.

Furthermore, integrating information systems within higher education facilitates the seamless data flow across various departments and functions. This integration is essential for creating a holistic view of institutional performance, enabling administrators to identify trends, address challenges, and capitalize on opportunities. By leveraging integrated data, higher education institutions can improve student outcomes, streamline

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administrative processes, and support faculty research and development efforts. The importance of robust data governance and information management practices cannot be overstated, as they form the foundation for data-driven decision-making and continuous improvement in the educational sector.

Higher education institutions need help meeting the accreditation criteria set forth by LAM Infokom. One of the primary obstacles is the effective management and integration of vast amounts of data generated across various departments and functions. Institutions must comply with comprehensive standards encompassing academic quality, administrative efficiency, student outcomes, and faculty credentials. It requires a robust system to collect, manage, and report data accurately and consistently. However, many institutions struggle with fragmented data systems, outdated technology, and insufficient data governance practices, making it challenging to provide the necessary evidence for accreditation.

Additionally, the dynamic nature of accreditation standards necessitates continuous monitoring and updating of data practices. Institutions must be agile and responsive to changes in accreditation requirements, ensuring that all relevant data is up-to-date and accurately reflects institutional performance. This constant flux can strain existing resources and infrastructure, leading to data quality and completeness gaps. Moreover, the decentralized nature of data management in many institutions further complicates efforts to achieve a cohesive and comprehensive view of institutional performance. As a result, higher education institutions often need help aligning their data practices with LAM Infokom accreditation criteria, impacting their ability to achieve and maintain accredited status.

The Zachman Framework offers a promising solution to these challenges through its structured data integration and management approach. As an enterprise architecture framework, the Zachman Framework provides a logical and systematic method for organizing and analyzing complex data sets. It emphasizes the importance of creating a comprehensive architecture encompassing all aspects of an institution's operations, from data collection and storage to processing and reporting. By applying the Zachman Framework, higher education institutions can develop a cohesive data management strategy that aligns with accreditation requirements, ensuring that all necessary data is accurately captured, integrated, and accessible. Furthermore, the Zachman Framework facilitates better communication and collaboration among various stakeholders within the institution. By providing a common language and set of principles for data management, the framework helps bridge the gap between different departments and functions, promoting a more integrated and holistic approach to data governance. It enhances the institution's ability to meet accreditation criteria and supports overall effectiveness and efficiency. This paper explores how the Zachman Framework can be leveraged to optimize data integration and improve higher education performance, specifically in meeting LAM Infokom accreditation standards.

Despite the concerted efforts of higher education institutions to enhance their performance and meet accreditation standards, significant gaps still exist between their actual performance and the criteria set forth by LAM Infokom. These gaps often manifest in various aspects, such as the quality and comprehensiveness of academic programs, administrative efficiency, student outcomes, and faculty qualifications. One of the core reasons for these discrepancies is the fragmented and inconsistent data management practices prevalent across many institutions. Data silos, lack of standardized data collection processes, and inadequate data governance frameworks contribute to the difficulty in achieving a holistic and accurate view of institutional performance. Moreover, the dynamic nature of higher education and the evolving accreditation standards further exacerbate these challenges. Institutions must continuously adapt their data management practices to align with the latest accreditation criteria, which can be resource-intensive and complex. A unified and integrated approach to data management is necessary for institutions to provide the evidence needed to meet all accreditation requirements comprehensively. This impacts their accreditation status and hinders their ability to make informed decisions, improve operational efficiency, and enhance the overall quality of education. To bridge these gaps, there is a critical need for an integrated data management model that can streamline and standardize data collection, storage, processing, and reporting processes across higher education institutions. Such a model would enable institutions to systematically capture and manage data relevant to accreditation standards, ensuring accuracy, consistency, and accessibility. With its structured and holistic approach to enterprise architecture, the Zachman Framework offers a viable solution to this problem. By adopting the Zachman Framework, institutions can develop a comprehensive data architecture that aligns with accreditation requirements, facilitates better data integration, and supports continuous improvement in institutional performance. This paper aims to explore the development and implementation of such a model to optimize data integration and enhance the ability of higher education institutions to meet LAM Infokom accreditation standards.

The primary objective of this research is to identify and analyze the data gaps between the actual performance of higher education institutions and the standards set by LAM Infokom. This involves thoroughly examining the various data points required for accreditation assessing their availability, accuracy, and completeness within these institutions' current data management systems. The research aims to clearly understand the specific areas that need improvement by pinpointing where these gaps lie. This step is crucial as it sets the foundation for developing effective strategies to enhance data governance and ensure compliance with accreditation criteria. Understanding these gaps also helps highlight the challenges institutions face regarding data integration and management. The secondary objective is to propose a comprehensive data integration model using the Zachman Framework. The Zachman Framework is a well-established enterprise architecture framework that provides a structured approach to organizing and managing complex information systems. By applying this framework, the research aims to design a model that addresses the identified data gaps, ensuring that all necessary data is systematically captured, organized, and accessible. This model will facilitate better data integration and promote a more cohesive and efficient approach to data management. The proposed model will be tailored to align with the specific requirements of LAM Infokom accreditation,


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ensuring that higher education institutions can meet and even exceed these standards.

The significance of this study lies in its potential to substantially benefit higher education institutions by enhancing their data management practices and ensuring compliance with accreditation standards. By adopting the Zachman Framework, institutions can achieve a more structured and integrated approach to managing their data, which is crucial for meeting the comprehensive criteria set by LAM Infokom. Improved data management facilitates accurate and timely reporting, streamlines administrative processes, and enhances decision-making capabilities. It, in turn, leads to better resource allocation, improved student services, and more effective academic program management. Ultimately, these improvements can result in higher accreditation ratings, critical for maintaining institutional credibility and attracting students and funding.

Moreover, a robust data integration model can help institutions proactively identify and address potential issues before they escalate into significant problems. By having a comprehensive and real-time view of their data, institutions can make more informed decisions, respond more quickly to changes in accreditation standards, and continuously improve their processes. This proactive approach helps maintain compliance and fosters a culture of continuous improvement and innovation within the institution. Managing and utilizing data can enhance the institution's overall performance and competitiveness in higher education. Beyond the direct benefits to higher education institutions, this study has broader educational quality and accountability implications. Effective data governance and management are essential for ensuring transparency and accountability in academic institutions. Institutions can build trust with stakeholders, including students, parents, faculty, and regulatory bodies, by demonstrating compliance with accreditation standards and continuously improving their data practices. This trust is crucial for maintaining the institution's reputation and ensuring students receive a high-quality education that meets or exceeds national and international standards.

Furthermore, the findings and methodologies developed through this research can serve as a valuable resource for other institutions looking to improve their data management practices. By providing a detailed case study and a replicable model, this study contributes to the broader educational technology and management field, offering practical insights and solutions that can be applied in various contexts. This can lead to widespread educational quality and accountability improvements, ultimately benefiting students and society. The study's emphasis on data integration and governance also aligns with broader trends in the digital transformation of education, highlighting the importance of leveraging technology to enhance educational outcomes.

## 2. LITERATURE REVIEW

### *2.1. Data Governance in Higher Education*

Data governance in higher education emerged as a critical focus area as institutions navigated the challenges of managing vast information while adhering to privacy regulations and ethical standards. The increasing digitalization and datafication of educational processes required institutions to adopt structured approaches for handling sensitive and operational data. Central to this effort was establishing a governance framework that aligned with the institution's data strategies and addressed the complexities of managing diverse types of information. As [1] suggested, integrating data governance principles with information science was vital for institutions looking to enhance their governance structures. They argued that an adaptable governance framework should consider the institutional culture and operational contexts to effectively address each educational entity's unique needs.

Various researchers also underscored the importance of involving data subjects and stakeholders in governance practices to ensure accountability and ethical data use. [2] emphasized the need for institutions to involve individuals whose data was being processed in the governance process, reducing the risks associated with data misuse and ensuring transparency. This approach complemented the idea of higher education institutions serving as "information fiduciaries," as [3] described, highlighting their obligation to protect student and stakeholder data from misuse and over-surveillance. The ethical responsibilities were further echoed in research by [4], who pointed out the growing importance of protecting student privacy, particularly with the rise of learning analytics and digital platforms. Institutions were expected to go beyond compliance, ensuring a fiduciary relationship between the data controllers and the subjects, preserving trust, and safeguarding privacy.

Operationalizing these governance frameworks proved to be another challenge for higher education institutions. As noted by [5], raising awareness about data security and privacy was critical to ensuring the effectiveness of data governance. Institutions needed to establish clear policies that were communicated across all levels of the academic community. This effort required continuous education, training, and a collective commitment to data stewardship. [6] proposed that an all-encompassing approach to data governance was necessary, one that spanned every aspect of data management, including collection, storage, processing, and dissemination. By ensuring that each individual involved understood their role and responsibility, institutions could maintain the integrity and security of their data systems.

Moreover, researchers stressed the significance of leveraging established governance frameworks such as the FAIR (Findable, Accessible, Interoperable, Reusable) and CARE (Collective Benefit, Authority to Control, Responsibility, Ethics) principles to guide data management in higher education. These frameworks provided institutions with a comprehensive set of guidelines for managing data in a way that ensured regulatory compliance and promoted transparency and accountability. Such principles also fostered best practices in data stewardship, encouraging higher education institutions to move beyond mere compliance and towards a culture of continuous improvement in their governance practices.

Data governance has proven crucial in the accreditation processes of higher education institutions, playing a significant role in ensuring the quality and effectiveness of educational programs. Accreditation, which functions as a quality assurance mechanism, requires institutions to meet predefined standards of

accountability and excellence. Effective data governance supported this process by ensuring the data used in accreditation was accurate, reliable, and timely. This, in turn, facilitated more informed decision-making and fostered an environment of continuous improvement across educational programs.

The implementation of a robust data governance framework often enhanced institutional accountability. Research [8] pointed out that while accreditation processes could be burdensome, requiring substantial financial and human resources, institutions with well-structured data governance frameworks were better positioned to handle these challenges. Data governance allowed for streamlined data collection and reporting, reducing the administrative burden associated with accreditation. This improved efficiency and ensured that institutions could present credible, evidence-based data to demonstrate compliance with accreditation standards. Moreover, the systematic approach of data governance frameworks provided a structured method to organize institutional data, making the entire process less stressful and more manageable for administrative teams.

Academic leadership also benefited from effective data governance during accreditation efforts. As noted by [9], deans and academic leaders were pivotal as change agents within their institutions, guiding accreditation processes and driving necessary improvements. Data governance frameworks empowered these leaders by providing reliable data insights, enabling them to make informed decisions aligned with accreditation goals. With accurate data, leaders could implement strategic initiatives that strengthened institutional compliance with accreditation standards. This alignment between leadership and data governance created a cycle of improvement, where institutions met accreditation requirements and enhanced the overall quality of their educational programs.

The connection between accreditation and student performance further emphasized the importance of data governance. [10] found that accreditation positively influenced student outcomes, with a clear correlation between the quality of accredited programs and academic success. Through data governance, institutions could ensure the availability and accuracy of performance data, which was essential for demonstrating effectiveness in meeting educational standards. Data-driven insights allowed institutions to track student progress, evaluate program success, and identify areas for intervention or enhancement. By presenting solid evidence of program effectiveness, institutions reinforced the value of accreditation in supporting student achievement.

Furthermore, [11] highlighted that accreditation often led to institutional improvements, particularly in medical education, where accreditation activities contributed to better student outcomes. Effective data governance was central to this improvement, enabling institutions to systematically collect and analyze data on educational practices, student performance, and compliance with accreditation metrics. Institutions with strong data governance frameworks could assess their alignment with accreditation requirements, develop performance indicators, and continuously refine their programs to meet evolving standards.
Data governance frameworks in higher education have played a critical role in maintaining institutional programs' integrity, quality, and accountability. These frameworks provided structured approaches to managing data, which are particularly important for accreditation processes, institutional effectiveness, and adherence to regulatory standards. Over time, various models and frameworks have been developed to assist higher education institutions in implementing robust data governance practices.

One widely recognized model was the "fit for purpose" framework for accreditation systems, as introduced by Taber et al. This model emphasized that accreditation systems, particularly in medical education, needed to be designed in alignment with the specific requirements and context of the programs they evaluated. It outlined fundamental elements that should be considered when developing and operationalizing accreditation systems, offering a principle-based approach that could be adapted to diverse educational settings [12]. The framework highlighted the importance of ensuring that data governance practices were tightly aligned with accreditation requirements, allowing institutions to demonstrate compliance with quality standards effectively.

Silva et al. proposed another comprehensive model that integrated quality assessment into higher education management. Their case study focused on how data governance could support the evaluation of educational quality by addressing key areas such as pedagogical practices, infrastructure, and administrative efficiency [13]. This holistic model underscored the necessity of managing data across multiple dimensions of institutional performance, thus promoting continuous improvement and accountability. It illustrated the interconnected nature of data governance and quality assurance, demonstrating how institutions could enhance their decision-making processes through better data management.

Additionally, research conducted by Elliott and Goh explored the connection between data governance, accreditation, and organizational learning within higher education. Their findings suggested that strong data governance frameworks contributed to a culture of learning and continuous improvement, which was crucial for meeting evolving accreditation standards [14]. Through the effective use of data insights, institutions could identify areas for enhancement and implement strategic initiatives aligned with accreditation goals. This perspective reinforced that data governance extended beyond mere compliance and was a key driver of institutional development and educational quality.

Duarte and Vardasca's systematic literature review examined accreditation systems from various countries, analyzing the challenges and opportunities of different data governance frameworks. Their review concluded that robust data governance was essential for navigating the complexities of accreditation, ensuring that quality assurance systems remained adaptive to the unique needs of higher education institutions [15]. Their work highlighted the importance of developing data governance frameworks that were flexible enough to accommodate diverse regulatory environments while remaining rigorous enough to uphold institutional accountability.
Incorporating international standards, such as ISO 21001, into national accreditation processes also demonstrated the growing importance of global benchmarks in higher education


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governance. Trisnawati and Rosiawan discussed how these international standards improved data governance practices by offering structured approaches to quality assurance and accountability [16]. The integration of such standards reflected the global trend toward standardized governance models that facilitated accreditation and compliance across national borders. Furthermore, the 3-D ACS framework proposed by Inderawati et al. introduced a collaborative approach to external quality assurance. This framework emphasized the need for cooperation between stakeholders—government bodies, educational institutions, and accrediting agencies—to ensure effective data governance [17]. Collaboration among these stakeholders was essential for aligning governance practices with accreditation requirements, ultimately enhancing institutions' overall quality of education.

### *2.2. Zachman Framework*

The Zachman Framework has been recognized as a key enterprise architecture framework providing a structured methodology for organizations to analyze and document their architecture comprehensively. Initially developed by John Zachman in the 1980s, the framework is known for its matrix structure, which categorizes the components of an organization's architecture into six perspectives: What (data), How (function), Where (network), Who (people), When (time), and Why (motivation). These perspectives are cross-referenced against six levels of abstraction: Scope, Business Model, System Model, Technology Model, Detailed Representations, and Functioning System. This dual categorization allows organizations to comprehensively view their processes, systems, and operational activities, ensuring business goals consistently align with information technology (IT) strategies.

The framework's structure is particularly effective in enabling organizations to break down complex architectures into manageable components, making it easier to identify gaps, streamline processes, and facilitate decision-making. One of the critical features of the Zachman Framework is its adaptability, which allows it to be implemented across various industries. For instance, in corporate settings such as PT Karya Niaga Abadi and PT Shopee Internasional Indonesia, the Zachman Framework has been used to map and integrate information systems, ensuring the IT architecture aligns with different organizational perspectives [18]. These implementations demonstrate the framework's effectiveness in enhancing operational efficiency and maintaining compliance with internal and external standards.

Applications of the Zachman Framework extend beyond traditional enterprise settings, as it has also been leveraged in sectors such as education and digital services. A notable case study involved improving digital service delivery by implementing the framework to optimize resource allocation and decision-making processes, benefiting both the organization and its end-users [19]. Furthermore, its application within educational institutions for customer relationship management (CRM) systems highlights its adaptability to different organizational structures [20]. The framework's flexibility enables institutions to address specific needs while comprehensively analyzing their data and systems architecture.

Another example of the framework's utility is its application in aligning enterprise architecture with business objectives. Research [21] emphasized that the Zachman Framework provides a robust foundation for organizations seeking to integrate IT systems with broader business goals, ensuring that all architectural components—from data to people—are accounted for in strategic planning. Such alignment between business strategies and IT systems is critical in industries with rapidly evolving technological requirements, making the framework a valuable tool for maintaining organizational agility and responsiveness to change.

The Zachman Framework has been widely applied across multiple sectors to improve enterprise architecture and ensure better alignment between organizational processes and information systems. Originally developed by John Zachman, this framework provides a systematic approach to analyzing and defining the components of an enterprise architecture, allowing organizations to manage and integrate their technological infrastructure more effectively [22], [23]. Its versatility has made it a valuable tool in both corporate and public sectors, including higher education, where its implementation has enhanced the design and development of data systems.

Several studies have explored the practical application of the Zachman Framework in the education sector to improve Learning Management Systems (LMS) and streamline institutional processes. [24] investigated its use in LMS development, emphasizing the framework's role in enhancing system effectiveness and user satisfaction. The study demonstrated how the Zachman Framework helped to resolve common challenges related to system functionality and user engagement in educational technology.

Beyond system design, the Zachman Framework has proven helpful in preparing higher education institutions for accreditation. Research [25] applied the framework to manage integrated data systems for higher education accreditation readiness. Their study revealed how the Zachman Framework supported institutions in organizing and managing the required data for accreditation purposes, ensuring that data governance and information systems met the standards set by accrediting bodies. Another study [26] reviewed the adoption of enterprise architecture within higher education, noting that the Zachman Framework provided a comprehensive methodology to align technological capabilities with the institution's educational mission. This alignment was critical for institutions aiming to optimize operational efficiency and educational quality through effective data governance practices [27].

The flexibility of the Zachman Framework extends beyond higher education into the realm of public service. [23] applied the framework in local government contexts, developing public service information systems blueprints. Their research showed that the framework could be adapted to meet the unique requirements of local government operations, ensuring that information systems supported the specific needs of public administration. This adaptability highlights the Zachman Framework's broad utility in ensuring system design aligns with the unique requirements of various sectors, whether in education, corporate, or public service contexts.

### *2.3. Integration of Data Systems*

Integrating data systems in education posed several significant challenges, particularly as institutions sought to modernize their infrastructure and adopt data-driven approaches to improve educational outcomes. One of the primary challenges involved incorporating advanced technologies such as data analytics and artificial intelligence (AI) into decision-making processes. Research [28] emphasized that the educational landscape had transformed, requiring institutions to manage resources more effectively while integrating technology to enhance student performance. However, the complexity of utilizing large datasets and advanced analytics often created barriers for educators and administrators who needed more training or understanding of these tools.

In addition to technological and cultural challenges, the COVID-19 pandemic further exposed gaps in educational institutions' readiness to adapt to rapid changes in teaching modalities. Many institutions were forced to implement distance learning solutions without adequate preparation, resulting in difficulties related to access to technology and teacher training. [29] noted that institutions faced immense pressure to provide students and faculty with technological resources such as computers and internet access.

Several best practices emerged to address these challenges, focusing on collaboration, knowledge sharing, and adopting innovative approaches. Research [30] suggested that benchmarking practices among institutions could help share effective strategies for data integration, allowing for disseminating successful approaches that enhance educational quality.

However, successfully integrating these technologies required careful planning and a deep understanding of their capabilities and limitations. Ethical considerations, particularly related to data privacy and inclusivity, also played a crucial role in determining the effectiveness of these initiatives [31].

Integrating data systems in higher education has increasingly been considered essential for improving institutional efficiency, student success, and informed decision-making. Several case studies demonstrate the successful application of data integration strategies, highlighting their benefits and the challenges faced during implementation.

One significant case involved the implementation of a centralized data warehouse across Indonesian higher education institutions. [32] explored how this initiative streamlined data management by integrating academic reports from various universities into a single platform. The system facilitated easier access to crucial information for decision-makers, improving administrative efficiency and resource allocation. The study emphasized the need for institutional readiness and effective change management strategies during such a transformation, illustrating how centralizing data can simplify processes and enhance the overall operation of educational institutions.

Another successful case was using big data analytics to enhance student experiences. Research [33] demonstrated how big data could provide critical insights into student engagement and learning patterns. In their study, sensing devices were used to monitor student attention during lectures, which allowed instructors to adapt their teaching strategies accordingly. The results showed that data analytics could improve classroom planning and lecture delivery, leading to higher student satisfaction and improved learning outcomes. This case exemplified the power of big data to personalize educational experiences and optimize pedagogical approaches in higher education.

Integrating Learning Management Systems (LMS) has also played a crucial role in modern education. Research [34] highlighted how LMS platforms revolutionized traditional learning by enabling online environments that catered to various learning styles. The study underscored the importance of user engagement and accessibility in the success of LMS implementation. With data on student performance and engagement readily available through LMS, educators could make more informed decisions, enhancing teaching strategies and learning outcomes.

Furthermore, enterprise resource planning (ERP) systems have been effectively integrated into universities to optimize academic and administrative processes, qualifications, and research output. Institutions are evaluated based on their ability to consistently deliver quality education and their commitment to continuous improvement in both academic and administrative areas. The accreditation criteria include comprehensive evaluations of the institution's governance structure, strategic planning, financial resources, and the overall effectiveness of its educational programs.

Regarding data governance, the LAM Infokom accreditation standards emphasize integrating data systems within institutions. The criteria require institutions to implement robust data management practices, which involve accurately collecting, storing, and analyzing data related to student performance, faculty activities, research output, and institutional operations. These data governance requirements are crucial for institutions to demonstrate effective compliance with accreditation standards and provide reliable evidence of their educational quality.

Many institutions have also focused on aligning LAM Infokom accreditation criteria with international frameworks to enhance their global competitiveness. By integrating established frameworks such as COBIT 2019, institutions have improved their IT governance and risk management capabilities in accordance with accreditation requirements.

### *2.4. LAM Infokom Accreditation Criteria*

The accreditation criteria established by LAM Infokom (Lembaga Akreditasi Mandiri Informatika dan Komputer) were designed to ensure educational programs' quality, relevance, and effectiveness in informatics and computer science across Indonesia. These criteria are aligned with national higher education standards and international best practices, supporting the goal of producing graduates who are equipped to meet the evolving needs of the industry. The framework plays a crucial role in shaping institutions' academic quality and operational and technological infrastructures.


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One key aspect of the LAM Infokom accreditation process was evaluating IT delivery value within educational institutions. This component is essential for assessing how effectively institutions utilize IT resources to achieve their educational and operational objectives. It directly improves educational quality and operational efficiency, thus maximizing the return on IT investments. It was particularly relevant in demonstrating how technology-supported learning environments met accreditation requirements.

Risk management also played a prominent role in the LAM Infokom criteria, focusing on the capability of institutions to mitigate risks associated with IT and data governance. By identifying gaps and recommending improvements in these areas, institutions were better positioned to manage operational risks and enhance resilience, a requirement directly related to maintaining accreditation and operational stability in a digitalized educational environment.

Another critical aspect of the criteria was performance management, which ensured that institutions remained compliant with policies and procedures related to educational governance. Study [38] explored using COBIT 2019's MEA01 domain to continuously monitor and continuously assess institutional performance against LAM Infokom standards. This domain focused on ensuring educational institutions adhered to regulations and constantly improved their operations. Ongoing monitoring ensured compliance and fostered a culture of accountability and performance enhancement. Institutions were expected to implement regular reviews to maintain and enhance their standing within the accreditation framework, directly linking operational success to educational outcomes.

The broader goal of the LAM Infokom accreditation process was to promote excellence across academic and non-academic domains within educational institutions. This was achieved through the comprehensive integration of governance frameworks such as COBIT 2019, which provided the structure for institutions to strengthen their IT governance, risk management, and overall performance. Such frameworks supported continuous improvement efforts, allowing institutions to remain agile and responsive to the shifting demands of the academic landscape and the broader IT industry. This alignment with internationally recognized best practices ensured that institutions met national standards and positioned themselves as educational quality and innovation leaders.

### *2.5. Importance of Data Management in Meeting These Criteria*

Data management played a fundamental role in helping institutions meet the accreditation criteria set by LAM Infokom. Effective data management practices were essential for collecting, analyzing, and presenting the information required to demonstrate compliance with accreditation standards. These practices facilitated the organization and retrieval of relevant data, ensuring that educational institutions could meet the rigorous demands of quality assurance processes and provide evidence of their educational programs' effectiveness.

One of the key reasons data management was vital in accreditation was its ability to support quality improvement initiatives. Institutions used data to track performance and identify areas that needed enhancement, aligning with the accreditation standards' focus on continuous improvement. According to Gleeson et al., educational organizations often relied on data gathered through surveys and internal assessments to evaluate performance and implement necessary legal data to handle changes in norms.

Preparing for site visits and evaluations required institutions to present comprehensive evidence of their academic and operational performance. Data management systems were pivotal in this preparation, providing a streamlined approach to gathering, verifying, and organizing data in line with accreditation requirements. Institutions that excelled in their data management practices often found the accreditation process more efficient and effective.

Applying frameworks such as Green's Five Safes framework further demonstrated the importance of structured data management in educational settings. This framework provided a comprehensive approach to ensuring the safety of data access, use, sharing, linking, and retention, which were all critical components in maintaining compliance with accreditation standards [40]. Institutions that adhered to the principles of the Five Safes framework were better positioned to safeguard sensitive information while ensuring the accessibility and usability of data needed for accreditation assessments.

## 3. METHOD

### *3.1. Research Design*

This research employed a multi-faceted design incorporating a literature review, case analysis, and prototype development. The purpose was to explore and propose an optimized data integration system tailored to the accreditation criteria set by LAM Infokom. The research began with an extensive literature review to establish a theoretical foundation, focusing on data governance in higher education and the application of frameworks such as the Zachman Framework. This review provided insights into existing data integration and system optimization models, ensuring that the research was grounded in proven best practices. Additionally, the literature review helped identify gaps in current academic discourse on system integration in the accreditation context, guiding the research's subsequent phases.

Following the literature review, a case analysis was conducted to examine successful examples of data integration in similar sectors and educational institutions. The analysis focused on identifying strategies and methodologies aligned with LAM Infokom accreditation requirements. Key case studies were selected to evaluate how institutions overcame challenges related to system integration and how those strategies could be adapted for this study. Insights from the case analysis were instrumental in shaping the development of the proposed prototype, which aimed to address the specific needs of data governance and accreditation compliance in higher education.

Finally, the research culminated in the prototype development phase. Based on the literature and case analysis findings, a prototype system was designed using the Zachman Framework to demonstrate how different data systems could be integrated to

meet LAM Infokom's accreditation requirements. The prototype illustrated how the data flows, system architecture, and governance mechanisms could be streamlined to enhance overall institutional performance. This approach provided a tangible solution for system administrators and decision-makers in higher education, offering a blueprint for implementing an effective data governance model in line with accreditation standards. Figure 1 presents the entire sequence of research stages, including the literature review, case analysis, and prototype development, showing how each step informed the next and contributed to the final solution.

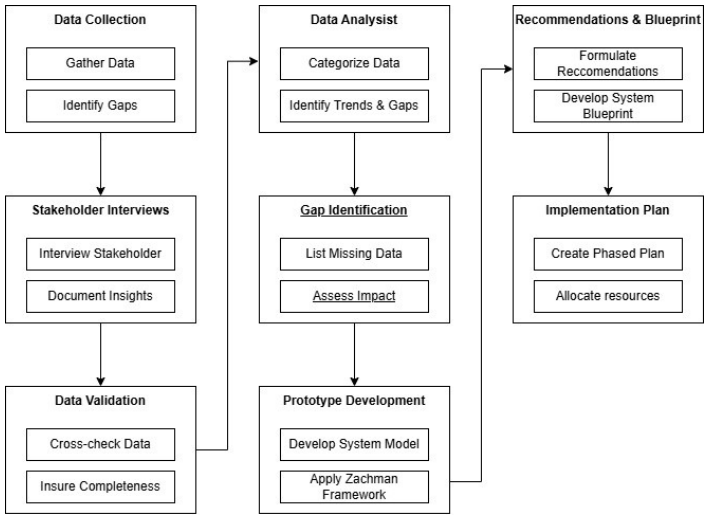


Figure 1. Research Design Workflow

### 3.2. Data Collection and Validation

The data collection process focused on gathering relevant information from the university's existing information systems. These systems contained academic, financial, and administrative data necessary for fulfilling the requirements of the LAM Infokom accreditation, specifically related to the LKPS (Laporan Kinerja Program Studi) and LED (Laporan Evaluasi Diri) documents. The data collected included student enrollment records from the Student Information System (SIS), faculty credentials from the Human Resources (HR) system, and financial reports from the Finance system. These datasets were crucial in addressing specific criteria under LKPS and LED, such as those related to student performance (LKPS 3, 9), faculty qualifications (LKPS 4), and financial management (LKPS 5).

Once data was collected, a thorough validation process was conducted to ensure the accuracy and completeness of the information. This involved comparing the data against the detailed criteria specified in the LKPS and LED documents, ensuring that each dataset met the accreditation requirements. Additionally, cross-checks with manual records were performed to identify discrepancies, particularly in cases where digital records might have been incomplete or inconsistent. This cross-referencing helped to maintain data integrity and ensure that the information provided to accrediting bodies accurately reflected the university's performance and operations. The validation process was further supported by the development of a visual representation depicted in Figure 2. This diagram outlines the step-by-step method of gathering, cross-referencing, and verifying data.

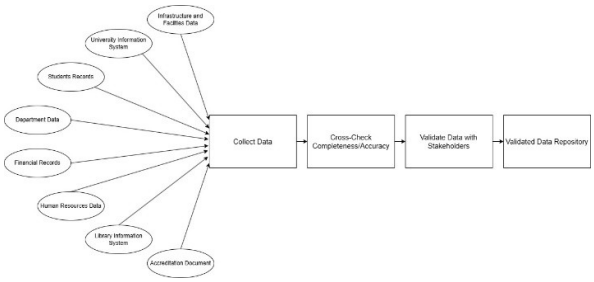


Figure 2. Data Collection and Validation Process

### 3.3. Stakeholder Interviews

Stakeholder interviews were essential to the data collection process, providing insights into the current data management practices and challenges related to LAM Infokom accreditation. Interviews were conducted with key personnel from various departments, including faculty members, administrative staff, and IT personnel. These individuals were directly involved in data management, accreditation preparation, and system integration efforts within the university. The interviews were designed to capture specific challenges related to data accessibility, integration, and alignment with accreditation standards, which are crucial for identifying areas requiring improvement in the existing systems.

The interview process revealed significant gaps in data integration across departments, especially in areas related to academic and financial reporting. The Head of the IT Department highlighted that current infrastructure limitations made integrating data from different sources difficult, leading to delays in accessing real-time data. Similarly, the Accreditation Manager from the Academic Affairs department pointed out difficulties in meeting compliance requirements set by LAM Infokom due to


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the need for a unified data management system. These gaps in data integration and accessibility were seen as critical barriers to achieving accreditation, emphasizing the need for an enhanced system that could address these shortcomings.

### *3.4. Zachman Framework for System Integration*

The Zachman Framework was applied as a core methodology for structuring the integration of university data systems with the LAM Infokom accreditation criteria. This framework facilitated a systematic and comprehensive approach to system integration, organizing all critical elements into six distinct perspectives: What, How, Where, Who, When, and Why. Each perspective addressed different dimensions of the institution's data management and system requirements, ensuring that all aspects, from data collection to technical implementation, were aligned with accreditation goals.

The existing university data systems were mapped to the LAM Infokom accreditation criteria during the framework's application to assess and improve alignment. The "What" column focused on identifying the specific data points required for accreditation, such as student records and faculty qualifications. The "How" column examined the processes for managing this data, while "Where" outlined the data storage locations and systems involved. Each framework element was reviewed in depth to ensure that the data integration process was comprehensive and in line with the institutional objectives related to accreditation.
The resulting analysis provided comprehensive coverage across all levels of the Zachman Framework. This ensured that each accreditation requirement was addressed through proper data collection, system integration, and governance measures.

To provide further detail on how each element of the Zachman Framework aligns with specific data integration strategies for accreditation, Table 1 below outlines the university's data integration plan according to the framework. This matrix categorizes the elements across the six perspectives (What, How, Where, Who, When, and Why) and the six levels (Scope, Business Model, System Model, Technology Model, Detailed Representations, and Functioning System). Through this structured mapping, the university's data integration efforts effectively meet both operational needs and LAM Infokom accreditation criteria.

Table 1. Zachman Framework Matrix for University Data Integration

| | What (Data) | How (Function) | Where (Network) | Who (People) | When (Time) | Why (Motivation) |
|---|---|---|---|---|---|---|
| Scope (Contextual) | Accreditation-related data (student records, faculty credentials, research outputs) | Define system integration requirements for LAM Infokom accreditation | University's central data repository, faculty databases | IT department, accreditation officers, academic staff | Pre-accreditation assessment timeline | Ensure compliance with LAM Infokom standards |
| Business Model (Conceptual) | Data types for accreditation (enrollment data, research data) | Conceptual processes for data validation and reporting | Data exchanged between academic departments and central repository | Accreditation team, faculty heads, IT staff | Quarterly data reviews, submission deadlines for accreditation | Streamline reporting and meet quality standards |
| System Model (Logical) | Logical structure of data repositories (student info system, research data system) | Data integration workflows and validation rules | Data communication between faculty databases and university server | System users (faculty, IT, accreditation officers) | Periodic data sync and validation checks | Enhance data consistency and reliability |
| Technology Model (Physical) | Database technologies (SQL servers, cloud storage) | APIs or Middleware for data integration | University's physical data center or cloud infrastructure | System administrators, IT support | Scheduled data backup and syncing intervals | Ensure data security and integrity for accreditation |
| Detailed Representations | Data architecture schema (tables, fields, relationships) | Documented integration protocols, API specs | Physical database locations and cloud configurations | Access permissions (IT staff, accreditation team) | Data syncing times and validation scripts | Meet accreditation and regulatory compliance requirements |
| Functioning System | Final integrated system (centralized accreditation data platform) | Automated data flows and reports for LAM Infokom submission | Operational data servers and cloud platforms | End-users (faculty, accreditation team, IT support) | Ongoing data updates and system operation timelines | Achieve LAM Infokom accreditation and maintain continuous improvement |

### *3.5. Data Analysis*

Following the data collection and validation process, the collected data was systematically analyzed to identify trends, patterns, and any inconsistencies relevant to the LAM Infokom accreditation criteria. This step was crucial in understanding how well the institution's current data systems aligned with the LKPS and LED standards and where improvements were necessary. The focus was on ensuring that the analysis highlighted both areas of strength and gaps that could hinder the accreditation process.
Data was first categorized according to the specific accreditation requirements outlined by LKPS and LED. This categorization provided a clear framework for analysis, allowing for a direct comparison between the collected data and the accreditation

standards. For example, data related to student enrollment was mapped to LKPS 3 and 9, while faculty credentials were aligned with LKPS 4 and LED 4. This step ensured that each data point was systematically assessed, making it easier to identify where data was complete, incomplete, or entirely missing. Once the data was organized, analytical tools were employed to identify trends, patterns, and inconsistencies across the dataset. These tools facilitated the discovery of issues such as incomplete faculty credentials or gaps in financial reporting, which needed to be addressed to meet accreditation requirements.

### *3.6. Identification of Data Gaps*

The data collected from the university's information systems was systematically compared against the specific LKPS and LED requirements to ensure compliance with LAM Infokom accreditation standards. Each piece of data, ranging from student enrollment figures to faculty credentials, was mapped to its corresponding accreditation criterion. This thorough comparison allowed the research team to pinpoint areas where data was missing, incomplete, or did not meet the required level of detail. These gaps were critical to identify, as they directly impacted the institution's ability to fully comply with the accreditation criteria. After the comparison, a detailed gap analysis was conducted, creating a comprehensive list of missing or incomplete data points. For example, gaps were noted in faculty credentials where information on staff qualifications was incomplete.

To prioritize solutions, an impact assessment was performed to evaluate how each identified gap could affect the accreditation process. The assessment considered both the severity of the gap and its relevance to the accreditation outcomes. Missing faculty credentials, for instance, were deemed a high priority because they play a crucial role in meeting the academic standards set by LAM Infokom. Less critical gaps, such as inconsistencies in non-academic administrative data, were ranked lower in terms of immediate attention. This structured approach ensured that efforts to address the gaps were targeted and efficient.

## 4. RESULTS

### *4.1. Data Integration Strategies*

The university's current information systems analysis revealed significant gaps and fragmentation across data sources, necessitating a robust integration strategy to align with LAM Infokom accreditation requirements. To address these challenges, several integration methods were proposed. Application Programming Interfaces (APIs) were recommended as a primary approach, facilitating the connection between disparate systems and enabling seamless data exchange. Middleware solutions were also considered for integrating legacy systems with newer applications. These middleware solutions act as a bridge, allowing older systems to communicate effectively with modern data processing applications, ensuring that essential data is available and consistent across all platforms.

A centralized data warehouse was also suggested as a long-term solution to house integrated data from various university departments. This warehouse would serve as a single source of truth, where data from student information systems, human resources, finance, and other administrative areas are stored, consolidated, and accessed. Implementing a data warehouse improves data consistency and facilitates better data governance, as data stored centrally can be managed, tracked, and audited more efficiently, meeting the requirements of both LKPS and LED criteria.

Figure 3 illustrates the proposed Data Integration Flow Diagram, which demonstrates how data flows from different university systems into the Central Data Warehouse. The diagram shows that the Student Information System, HR System, Finance System, and Research Database each contribute data through specific integration methods. The ETL (Extract, Transform, Load) process handles data from the Student Information System, while Middleware manages connections from the HR System, and API Integration facilitates data transfer from the Finance System and Research Database. Once consolidated in the Central Data Warehouse, the data is accessible to key stakeholders, including the Accreditation Team, Academic Administrators, and Quality Assurance personnel. This setup streamlines data access and ensures that each department has up-to-date, accurate information necessary for meeting LAM Infokom accreditation standards.

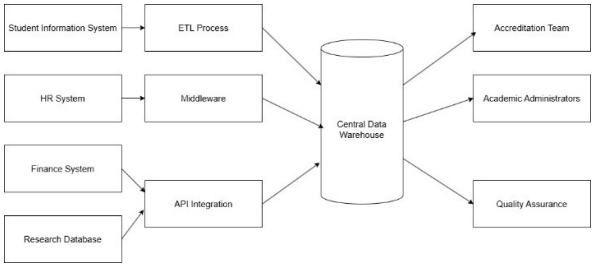


Figure 3. Data Integration Flow

### *4.2. Suggested Tools and Frameworks*

Specific tools and frameworks were recommended to support these integration strategies, with the Zachman Framework serving as the primary architecture framework. The Zachman Framework provided a structured approach to organizing and aligning the data systems with the university's accreditation goals. Each perspective within the framework (What, How, Where, Who, When, and Why) was utilized to assess and structure the integration process, ensuring that all elements of the data systems were comprehensively addressed. For instance, the "What" column focused on data elements required by LAM Infokom, while the "How" column guided the integration methods needed to achieve seamless data flow.

Furthermore, data integration tools such as ETL (Extract, Transform, Load) software were suggested to automate data extraction from various systems, transforming it to meet accreditation standards before loading it into the centralized data warehouse. These ETL tools simplify data management by ensuring data accuracy and completeness during integration. Other tools, such as data governance platforms, were recommended to help track data lineage, enforce data access policies, and enhance overall data quality. These platforms play a crucial role in meeting the stringent data governance standards required for accreditation.


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### *4.3. Guidelines for Improving Data Collection and Management*

Alongside the technical solutions, guidelines for improving data collection and management practices were outlined to support accreditation requirements. Emphasis was placed on implementing standardized data collection processes across departments, ensuring that data entered into each system was accurate, timely, and relevant. Clear data entry protocols were proposed to minimize human errors and discrepancies that might arise due to variations in data handling practices among different departments. Standardization also aids in data validation processes, making assessing data quality and completeness easier when preparing for accreditation assessments.

Best data management practices were also suggested, focusing on enhancing data accessibility, security, and transparency. Regular data audits were recommended to verify data integrity and promptly identify inconsistencies. Training programs for staff involved in data collection and management were also proposed, to cultivate a data-centric culture within the university. These programs emphasize the importance of data quality and how it directly impacts the university's compliance with accreditation standards, ensuring that all personnel understand their role in maintaining high-quality data.

### *4.4. Blueprint for System Improvement*

A comprehensive blueprint was developed to outline the steps needed to enhance the university's information systems and align them with LAM Infokom accreditation standards. This blueprint began by identifying key components of the current system and mapping out the necessary upgrades and integrations. A focus was placed on creating a modular architecture allowing the system to scale and adapt over time. Each module was aligned with specific accreditation requirements, ensuring that the system directly supported compliance with LKPS and LED criteria. This modularity also made it easier to implement upgrades or changes without disrupting the entire system, fostering a more agile and responsive approach to system maintenance.

The blueprint included detailed technical specifications to guide the development and integration process. These specifications guided required system capabilities, such as data storage, processing power, and security protocols, to ensure the system meets functional and regulatory standards. Data flow diagrams were incorporated to illustrate the movement of information between different modules, highlighting areas where integration was essential. For instance, data flow diagrams depicted how student enrollment data from the Student Information System (SIS) interacted with financial data and the flow of data between human resources and academic departments to ensure accurate reporting for accreditation purposes.

To further clarify the blueprint, a system architecture model was included to demonstrate how each component interacted within the larger system. This model depicted various layers of the information system architecture, including data storage, processing, and user interface layers. Each layer was designed to ensure that data governance best practices were upheld, allowing for seamless data integration and access. The architecture model also highlighted specific data governance features, such as data lineage tracking, data access controls, and audit trails, which were integrated to enhance data security and transparency. This model clearly represented how the improved system would function and ensure compliance with accreditation standards.

In addition to the technical details, the blueprint emphasized best practices for data governance and quality assurance to support the university's continuous improvement efforts. Recommendations included establishing data validation protocols, conducting regular audits, and enforcing standardized data entry procedures across all departments. Quality assurance measures were embedded within the system's design to maintain data integrity throughout the lifecycle. Training programs for personnel involved in data management were also proposed as part of the blueprint, focusing on data accuracy and compliance with accreditation requirements. These practices collectively contribute to a robust and reliable system that aligns with the university's goals and supports its commitment to quality in education.

### *4.5. Phased Implementation Plan*

The phased implementation plan ensured a systematic approach to enhancing the university's information systems. This plan began with Phase 1: Initial Assessment and System Preparation, where an in-depth evaluation of the current system was conducted to identify specific technical requirements. Tasks in this phase included setting up the necessary infrastructure and preparing existing data for integration. Completing this phase provided a solid foundation for further development and ensured all prerequisite conditions were met. Key milestones, such as infrastructure setup and preliminary system testing, were identified to mark progress in this initial phase.

Phase 2: System Integration and Development focused on implementing the data integration strategies and system architecture outlined in the blueprint. During this phase, data flow channels between different systems were established, middleware solutions were applied to facilitate smooth data transfer, and any required Application Programming Interfaces (APIs) were configured. Personnel from IT and administrative departments were actively involved in configuring the system to align with LKPS and LED accreditation requirements. Milestones for this phase included the successful configuration of data pipelines and the completion of initial data transfers between key systems, allowing for the testing of system connectivity and data accuracy. Moving into Phase 3: Testing and Quality Assurance, the team conducted comprehensive testing to ensure the integrated system met technical specifications and accreditation standards. This phase included functional testing, user acceptance testing, and data validation to confirm that the integrated system effectively addressed identified data gaps. Quality assurance protocols were also implemented, such as data accuracy checks and compliance with security standards. Key milestones here encompassed the resolution of any system issues identified during testing and final approval of the system's readiness for deployment by key stakeholders.

The final phase, Phase 4: Full Deployment and Ongoing Support, focused on the official launch of the improved information system. Resources were allocated for staff training and ongoing technical support to assist users in navigating the new system

features and data management protocols. A timeline for this phase included specific training sessions and a structured feedback loop for addressing post-deployment challenges. The phased plan also outlined the budget allocation for each phase, detailing personnel, technology, and training resources expenses. This comprehensive approach ensured that the system was operational and optimized to support continuous improvement and compliance with LAM Infokom accreditation requirements.

### *4.6. Monitoring and Evaluation*

A comprehensive monitoring and evaluation framework was established to ensure the system integration's effectiveness. This framework incorporated Key Performance Indicators (KPIs) to measure progress and performance. Key metrics included data accuracy rates, system uptime, user satisfaction ratings, and compliance with LAM Infokom accreditation requirements. Each KPI was selected based on its relevance to the system's core functions and its ability to provide insights into areas requiring further enhancement. Regularly monitoring these indicators allowed the team to track improvements in data accessibility, quality, and overall system reliability.

In addition to KPIs, a detailed Evaluation Plan was developed to assess the impact and effectiveness of the system improvements. This plan included periodic evaluations, such as quarterly system audits and annual compliance checks, to ensure ongoing alignment with accreditation standards. User feedback surveys were implemented to gather input from faculty, staff, and administrative users on their experience with the integrated system. This feedback was instrumental in identifying any usability issues and making necessary adjustments to support user needs and improve satisfaction.

The evaluation plan also featured Data Quality Audits, conducted regularly to verify the integrity of the data flowing through the system. These audits focused on data accuracy, completeness, and consistency, helping maintain high standards of quality across different data categories. The audits provided valuable insights into any remaining data gaps and inconsistencies, guiding targeted corrective actions to enhance data reliability. Using this systematic approach, the evaluation framework reinforced the system's compliance with accreditation criteria and supported continuous improvement.

Finally, the monitoring and evaluation process involved Compliance Reporting, where evaluation findings were documented and reported to stakeholders. These reports included detailed system performance analyses against the KPIs and highlighted any areas for future improvements. The compliance reports were essential for maintaining transparency and accountability throughout the project, as they demonstrated the university's commitment to meeting LAM Infokom standards. This structured monitoring and evaluation process ensured that the system was effective upon implementation and continued to meet the evolving needs of the institution and accreditation requirements over time.

## 5. DISCUSSION

### *5.1. Interpretation of Findings*

The data analysis revealed several critical insights into optimizing the existing information system to meet LAM Infokom accreditation requirements. Key areas of improvement emerged from the data, particularly regarding data accessibility, consistency, and governance. The analysis showed that fragmented data silos and a lack of standardized data management practices had previously hindered the institution's ability to report and track relevant metrics accurately. The new approach bridged these gaps through integrated data management strategies, creating a more cohesive framework for data sharing and analysis, which is essential for meeting accreditation standards.

The proposed data integration model, guided by the Zachman Framework, directly addressed these identified gaps. The model established a structured approach for connecting disparate data sources, facilitating seamless data flow across departments. This integration reduced data redundancies and ensured that accurate, real-time data could be accessed for accreditation reporting purposes. The model's alignment with the LAM Infokom criteria demonstrated its effectiveness in supporting academic and administrative processes, providing a solid foundation for continuous improvement. As a result, the system's capacity to maintain data integrity and facilitate comprehensive data analysis significantly enhanced the institution's readiness for accreditation.

Moreover, aligning the data integration model with the LAM Infokom accreditation criteria underscored the framework's adaptability to specific institutional needs. The Zachman Framework allowed for systematic mapping of data elements to accreditation requirements, ensuring that each information system component contributed meaningfully to compliance efforts. By structuring the integration around accreditation goals, the model reinforced data governance practices beyond compliance, supporting long-term institutional objectives such as operational efficiency and strategic planning.

The findings from the gap analysis further emphasized the importance of a robust data governance framework. The ability to identify and rectify data deficiencies highlighted the value of proactive data management in meeting accreditation demands. The implemented model exceeded minimum standards; it introduced a proactive approach to managing data quality and accessibility. This approach fostered a culture of accountability within the institution, where data stewardship became an integral part of operational practices, ultimately ensuring sustained alignment with accreditation standards.

### *5.2. Challenges and Limitations*

Integrating multiple data systems presented several challenges, with resource constraints being a primary concern. Budget limitations and the need for specialized personnel, such as data architects and IT specialists, strained the implementation efforts. These resource constraints potentially limited the scope of integration, requiring prioritization of high-impact areas to ensure alignment with the LAM Infokom accreditation criteria. Additionally, technical complexities emerged from the need to


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integrate legacy systems with modern data platforms, which required substantial modifications to maintain data consistency and compatibility across systems.

Technical complexities also posed significant challenges, particularly in ensuring data interoperability and consistency. Legacy systems, often built with outdated technology, must be compatible with newer, more advanced data platforms. This disparity led to challenges in data synchronization and posed risks related to data accuracy and completeness. Addressing these issues required custom integration solutions and adjustments to the existing IT infrastructure. Such modifications demanded higher expertise and introduced further complexities, often extending the timeframe required for complete integration and adding unforeseen costs to the project.

To mitigate these challenges, a phased implementation strategy proved effective. The institution could allocate resources efficiently by first breaking down the integration process into manageable stages, focusing on critical areas. This approach also allowed for gradual adjustments to the system, minimizing disruptions to daily operations and enabling the team to address emerging issues proactively. Each phase included stakeholder feedback sessions, ensuring the integration aligned with institutional needs and was flexible enough to adapt to any changes in accreditation requirements or technological advancements.

Engaging stakeholders throughout the process was another essential strategy in overcoming these challenges. Collaborating with faculty, administrative staff, and IT personnel provided valuable insights into each department's specific needs and operational workflows. This engagement fostered a sense of ownership and commitment among stakeholders, facilitating smoother implementation and contributing to a sustainable data governance culture within the institution. By involving end-users in the process, the institution ensured that the integrated system met technical and functional requirements, ultimately supporting the long-term goals of LAM Infokom accreditation.

## 6. CONCLUSION

This study examined integrating data systems in higher education institutions, focusing on aligning these systems with LAM Infokom accreditation requirements through the Zachman Framework. The research demonstrated that structured data integration strategies could address key data gaps, streamline information flow, and enhance the alignment of institutional data with accreditation criteria. Specifically, the application of the Zachman Framework facilitated a comprehensive approach to system integration, ensuring that each layer of data governance — from data collection to analysis — met the institutional and regulatory requirements for accreditation.

Findings highlighted that data integration supported compliance with LAM Infokom standards and contributed significantly to the institution's overall data governance and quality assurance practices. The study identified the importance of phased implementation and stakeholder engagement in successfully integrating disparate data systems. These steps proved essential in navigating technical complexities and ensuring the new system fulfilled functional and accreditation-related needs. Ultimately, the research underscored the value of adopting structured frameworks like the Zachman Framework in improving the quality and reliability of data systems within educational institutions.

While the study successfully implemented a data integration framework aligned with accreditation standards, several areas for further research emerged. One key area involves exploring additional data governance frameworks, such as COBIT or TOGAF, to examine how they may complement or enhance the Zachman Framework's approach in higher education. Investigating these frameworks could provide deeper insights into best practices for integrating legacy systems and managing data to ensure continuous compliance with evolving accreditation standards.

Future research could also expand the data integration model to incorporate emerging technologies, such as artificial intelligence and machine learning, to automate data validation and enhance predictive analytics capabilities. Additionally, longitudinal studies on the impact of integrated data systems on accreditation outcomes and institutional performance could offer valuable insights into these systems' long-term benefits and challenges. Future research can further refine the model developed in this study, advancing data governance and system integration practices in higher education through these extensions.

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