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## Bridging the ICT Gap: TOGAF ADM's Role in Modernizing Educational Institutions

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### ABSTRACTS

In the rapidly advancing world of Information and Communication Technology (ICT), various industries have recognized and started to harness technology's transformative power, especially when it comes to data management and processing. One significant component of this technological evolution is Enterprise Architecture (EA). This offers a structured framework for integrating vast amounts of data across large-scale systems. However, an area that remains somewhat untapped is the application of EA within the educational sector, which presents its own unique set of ICT challenges. This research seeks to address and bridge this knowledge gap. It takes an in-depth look at how EA, utilizing the TOGAF ADM framework, can be implemented in educational settings. Through a series of structured interviews conducted at SMA St. Bellarminus, the research aims to tailor the institution's information systems architecture to its specific and nuanced needs. While there have been previous studies that touched upon organizational systems and structures, our research distinguishes itself by modifying and adapting the TOGAF ADM approach to cater explicitly to educational environments. As the digital realm continues to expand and evolve, it's imperative for educational institutions to have the tools and methodologies in place to stay relevant and efficient in this ever-changing landscape.

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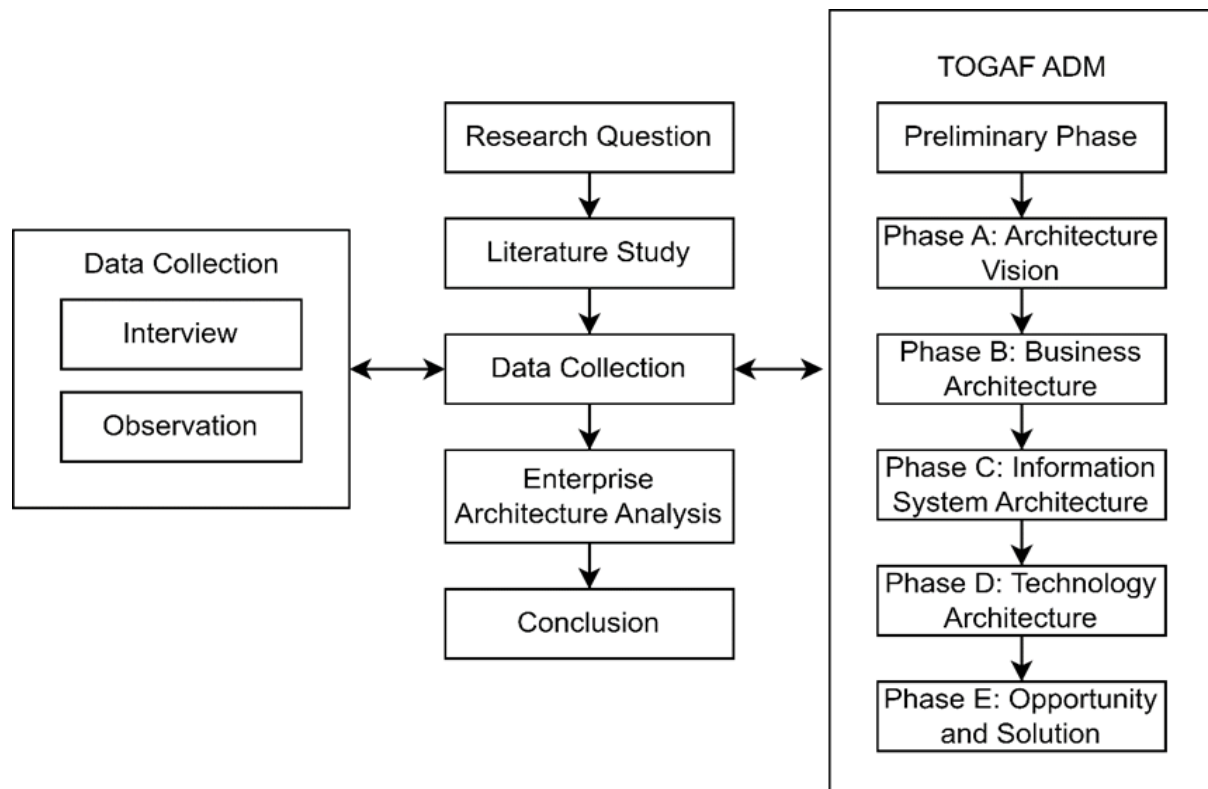
## 1. INTRODUCTION

In the era of rapid advancements in Information and Communication Technology (ICT), industries are harnessing the transformative potential of technology to transcend conventional spatial and temporal boundaries (Fazil & Arifin, 2019). This dynamic is most evident in how ICT is employed for the handling and dissemination of data (Fazil & Arifin, 2019). Within this landscape, Enterprise Architecture (EA) has emerged as a critical solution for seamlessly integrating and managing data in large-scale organizations (Hartono et al., 2020). EA strategically orchestrates ICT, facilitating the planning, design, and management of technological infrastructure and information systems (Hartono et al., 2020). Its significance becomes particularly pronounced during times of organizational change, where it aids in decision-making and enhances adaptability (Putra, 2019). However, the practical application of EA, especially within educational institutions grappling with ICT challenges, remains an uncharted territory (Pramungkas, 2020; Arifin, 2023). Our research endeavours to fill this void by concentrating on the development and implementation of EA within the realm of educational institutions (Sena, 2021). Drawing inspiration from prior research (Setiawan & Yulianto, 2018; Riwanto & Andry, 2019; Geasela & Andry, 2019; Soraya & Sari, 2019; Supriyadi & Amalia, 2019; Anderson & Andry, 2021; Monita, 2021; Wibawa et al., 2021; Geasela & Legowo,

2022; Noviansyah & Hudhori, 2022) we rely on the TOGAF Architecture Development Method (ADM) framework for architectural analysis and design, incorporating a blend of literature reviews, observational data, and interviews. What sets our work apart is our innovative extension of TOGAF into the domain of technology architecture (Monita, 2021), thereby harmonizing architectural design and educational contexts (Geasela & Andry, 2019; Monita, 2021).

## 2. METHOD

In the study conducted at SMA St. Bellarminus, structured interviews were employed as the primary data collection method, targeting the principal and vice-principal of student affairs as informants. This choice of structured interviews, where questions are pre-prepared and presented based on a specific guideline, ensures reproducibility and consistency in data collection. The interview guide itself was meticulously crafted, drawing inspiration from the requirements of TOGAF artifacts and insights from previous research (Geasela & Legowo, 2022). The overarching goal of this data analysis was to elucidate the nuances of the information system architecture, aligning it with the specific business needs of the school. To achieve this, the study leaned on the TOGAF ADM framework, a recognized method for architectural design, guiding the research from the preliminary phase right through to the opportunities and solutions stage.



**Fig. 1. Research Method**

Figure 1 provides a visual representation of the research method employed in this study. While the methodology provides a clear trajectory for the research, it would be beneficial to delve deeper into aspects such as ethical considerations, potential limitations, and any modifications made to the established methods to ensure a comprehensive understanding of the research process.

**Table 1. Requirement Catalogue**

No	Business Requirements
1	An integrated information system among teachers, parents, and students.
2	A neat and real-time data system.
3	Including business resources in system development.
4	Requires a large capacity for data storage.

### 3. RESULTS AND DISCUSSION

#### 3.1. Preliminary Phase

The system emphasizes an integrated information platform connecting teachers, parents, and students. It prioritizes organized, real-time data management, incorporates business resources during its development, and necessitates substantial storage capacity.

Table 1. provides a detailed requirement catalogue for the system.

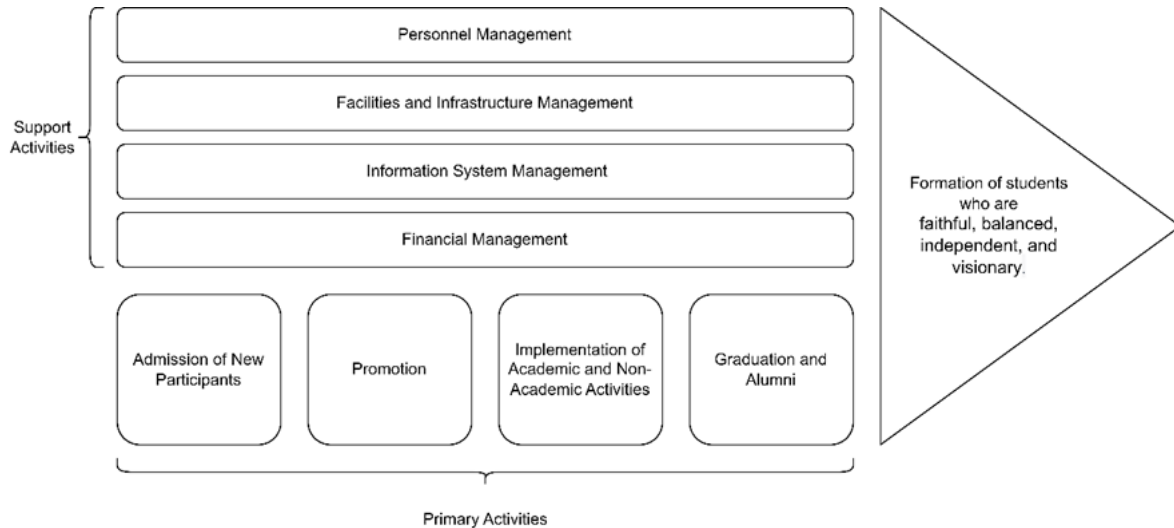
#### 3.2. Phase A: Architecture Vision

SMA St. Bellarminus Bekasi's value chain comprises main activities like student admissions, promotions, academic implementations, and alumni graduation. Concurrently, supporting activities focus on personnel, facilities, information systems, and financial

management, ensuring the school's holistic and efficient operation. Fig. 2 provides a visual representation of the value chain diagram for SMA St. Bellarminus Bekasi.

### 3.3. Phase B: Business Architecture

Table 2 presents the challenges and targeted business architecture objectives for SMA St. Bellarminus Bekasi.



**Fig. 2. Value chain diagram**

**Table 2. Business Architecture Conditions and Targets.**

Current Business Activities	Problem analysis	Target Business Architecture
Manual attendance report	Manual student attendance requires daily teacher input, delaying parent notifications.	Integrated system for teachers and parents for easier attendance and real-time data.
School fee info is emailed only	School fee reminders via email are often missed by parents.	System connecting to parents' WhatsApp for easy information dissemination.
Full file collection	Student uploads can overload laptop storage.	Dedicated storage for assignments and exams to save laptop space.
Lack of data security and secure data storage	Data is accessed with just email and password, requiring security measures	Need for exclusive admin-accessible data storage for security and organization.

Recognizing these challenges and aiming to mitigate their negative impacts, a solution concept diagram was formulated as an output from the enterprise architecture vision phase. As

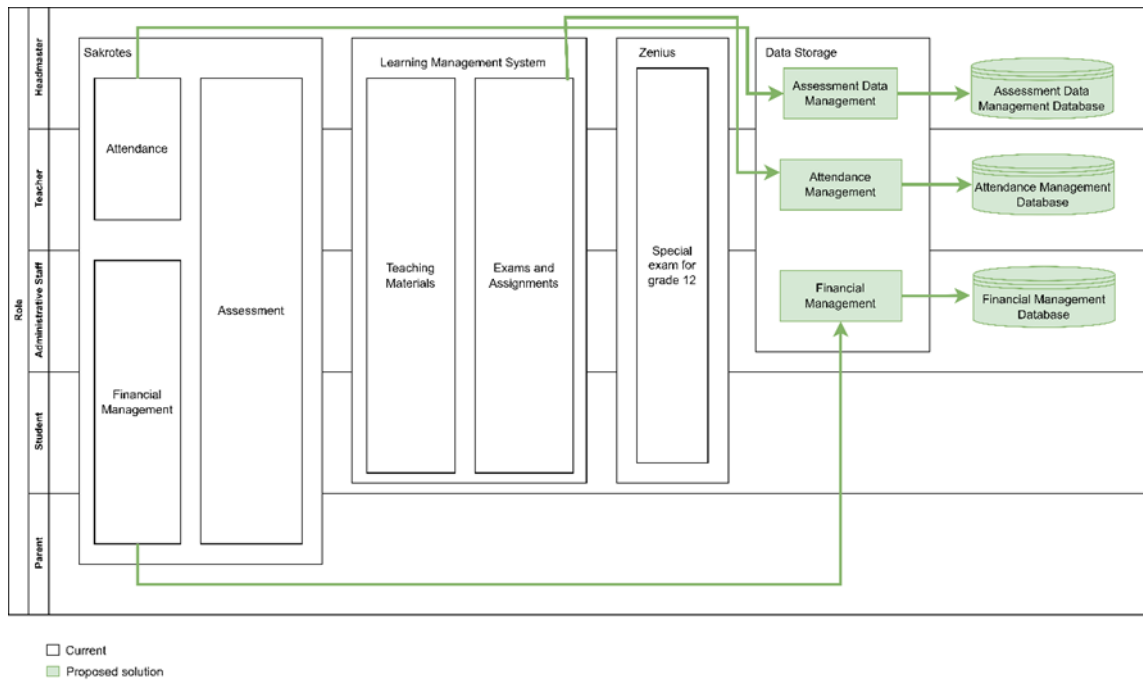
detailed in Table 3, SMA St. Bellarminus Bekasi provides business services in areas such as student affairs, finance, and personnel. These services cater to various stakeholders including students, parents,

and the government. The school utilizes 'Sakrotes' for tasks like assessment, attendance, and finance, benefiting from features like specialized storage and real-time updates via WhatsApp. Additionally, the 'LMS' system manages teaching materials and exams for grades 10 and 11, optimizing laptop memory usage. For grade 12 students, 'Zenius' offers specialized exams, ensuring broad

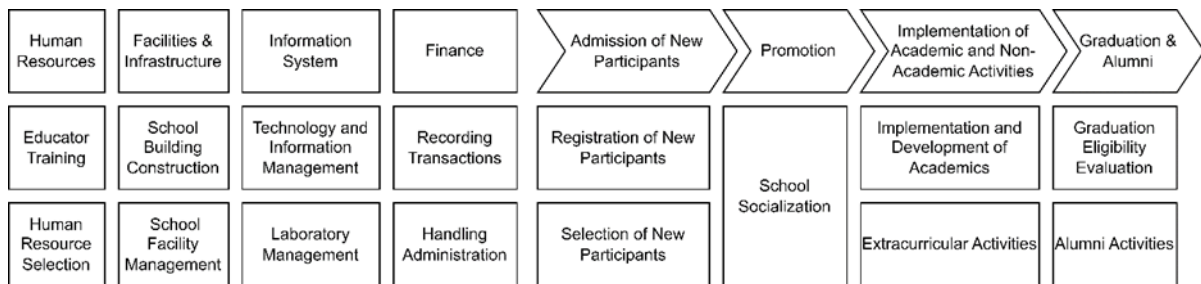
accessibility and functionality. This comprehensive approach is visually represented in Fig. 3, which showcases the solution concept diagram based on the needs analysis. The functional decomposition diagram, based on the value chain diagram, assesses organizational capabilities related to architecture. This is presented in Fig. 4.

**Table 3. Business Interaction Matrix**

		Providing Business Services		
		Student Affairs	Finance	Human Resources
Consuming Business Services	Student	Offering academic and non-academic support aligned with curriculum standards	Scholarships based on student performance.	Delivering quality knowledge and behavioral education
	Parent		Financial aid for needy students	Entrusting educators with teaching responsibilities
	Headmaster	Schools undergo accreditation and adhere to curriculum standards for teaching	Transportation support for needy students	Specialized training for school educators



**Fig. 3. Solution Concept Diagram**



**Fig. 4. Functional Decomposition Diagram**

### 3.4. Phase C: Information System Architecture

The ERD depicts the Sokrates system's data structure and is shown in Fig. 5. SMA St. Bellarminus uses Sokrates, LMS, and Zenius apps for academic and non-academic tasks but needs updates for real-time, integrated data in attendance, finance, and assignments. Current gaps include non-integration with WhatsApp and limited download options. A use case diagram, with green indicating existing features and white for

new ones, will depict roles of principal, educators, students, parents, and staff in Sokrates. This use case is illustrated in Fig. 6.

### 3.5. Phase D: Technology Architecture

This phase focuses on creating technology architecture aligned with business needs and documenting the system's technological aspects. The Technology Architecture covers the application's hardware and network. Designing begins with a gap analysis comparing current technology to

recommended technology, as shown in the technology gap analysis Table 4.

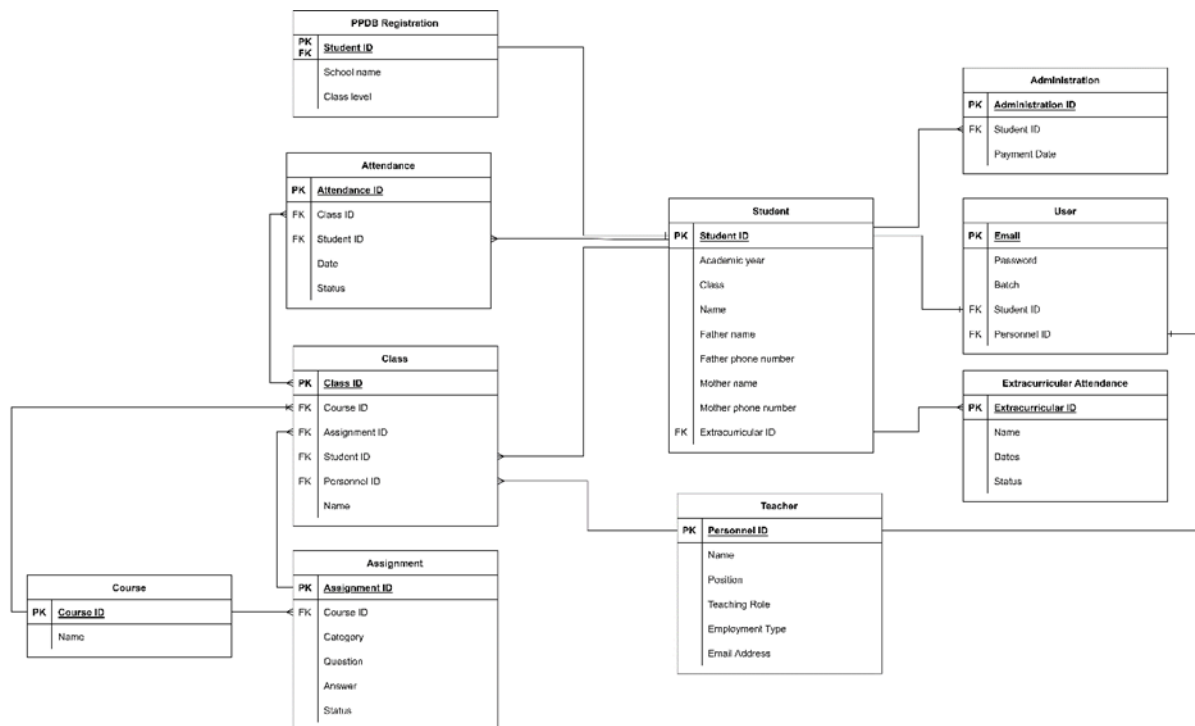
### 3.6. Phase D: Opportunity and Solution

Fig. 7. shows the benefits of implementing the enterprise architecture design at SMA St. Bellarminus, highlighting an integrated, real-time system with organized data storage that bolsters business processes.

### 3.7. Discussion

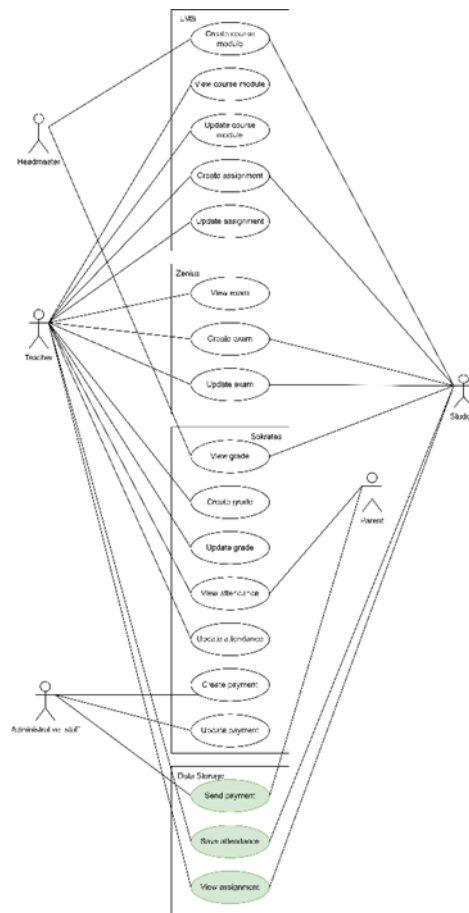
In analyzing the implementation of Enterprise Architecture (EA), the current research conducted at SMA St. Bellarminus provides valuable insights

into the challenges and strategies involved (Olsen & Trelsgård, 2016). The study highlights common hurdles such as the lack of governance and disagreements over responsibilities and costs. It emphasizes the importance of establishing an architecture council to ensure top management commitment and control over EA efforts (Seppänen et al., 2009; Ylimäki, 2006). Additionally, the role of Chief Information Officers (CIOs) is pivotal, yet there's a tendency to focus solely on technical aspects, neglecting business integration (Olsen & Trelsgård, 2016). Despite these challenges, the research acknowledges the potential benefits of EA.



**Fig. 5. Entity Relationship Diagram**



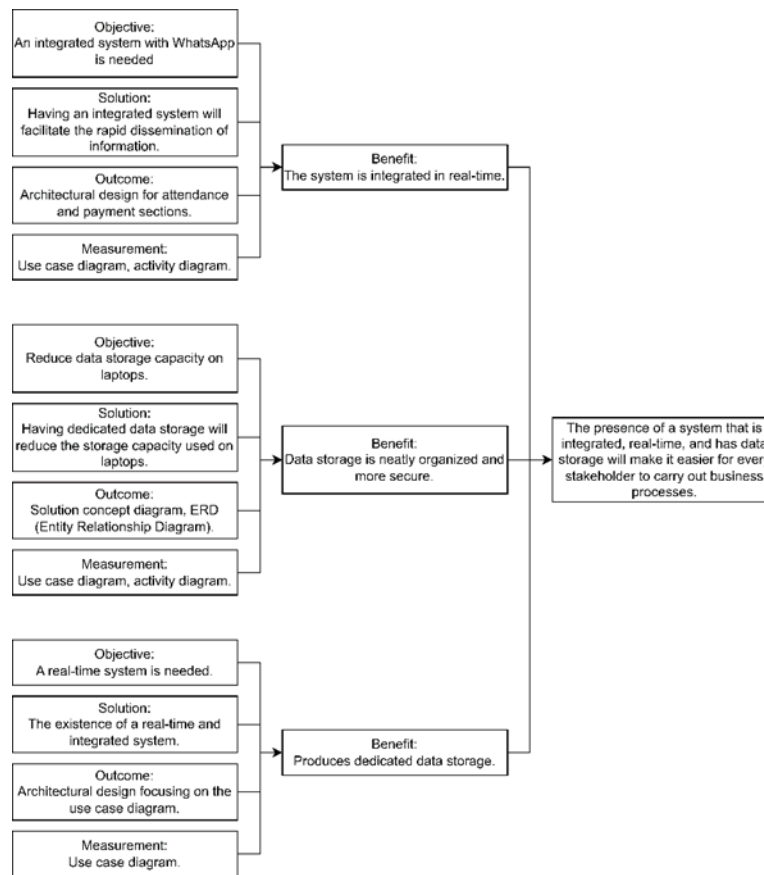


**Fig. 6. Use Case Diagram**

**Table 4. Technology Gap Analysis**

Target \ Baseline	Laptop/PC	Printer	Application Server	Database Server	Router	Switch
Laptop/PC	Included					
Printer		Included				
Application Server			Gap: Additional capacity for new or modified system			
Database Server				Gap: Additional capacity for new or modified system		





**Fig. 7. Benefit Diagram**

Including enhanced business agility and integration (Fallmyr & Bygstad, 2011; Harrell & Sage, 2010; Niemi, 2006; Pessi et al., 2011; Ross et al., 2006; Tamm et al., 2011). While differing from studies focusing on value chains and stakeholder mapping, the study offers a unique perspective on EA implementation through the application of the TOGAF ADM framework. In conclusion, addressing governance issues and involving CIOs strategically can help organizations leverage EA's benefits to achieve strategic objectives.

#### 4. CONCLUSION

In light of the swift advancements in Information and Communication Technology (ICT), the transformative potential of technology, particularly in

data management and dissemination across industries, is profound. Enterprise Architecture (EA) has risen to prominence as a crucial instrument, adeptly guiding ICT to streamline the planning, design, and oversight of technological infrastructure and information systems. This research delves into the lesser-explored realm of EA's application in educational institutions, with a specific focus on the TOGAF Architecture Development Method (ADM) framework. While foundational insights have been provided by earlier studies into organizational activity analysis, our research stands out by adapting the TOGAF ADM framework to the distinct challenges and intricacies of the educational sector. This novel approach not only introduces new viewpoints but

also acts as a nexus, merging broad organizational studies with the specific hurdles and prospects of the sector. As we progress further into the digital age, such bespoke approaches will be instrumental in navigating the evolving landscape.

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