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Digital Transformation and Performance Optimization at XYZ Higher Education through TOGAF-based Enterprise Architecture

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Abstract
Information technology (IT) has become an indispensable component of the corporate landscape in the digital age, reshaping how organizations operate. The rapid development of IT has revolutionized traditional business methods, transforming them into more efficient, technology-driven operations. Companies and institutions worldwide increasingly focus on digitalization to integrate business processes, streamline workflows, and enhance productivity. XYZ University in Indonesia, as an educational institution, is not immune to this shift. To stay competitive and efficient, the university aims to implement fundamental principles of coordination and integration within its internal structure and with external partners. A central goal of XYZ University's digital transformation efforts is to streamline its business processes and bolster its cybersecurity framework. These initiatives are critical to the university's broader strategy of developing a robust Enterprise Architecture (EA). This research focuses on the Academic Directorate and addresses three fundamental domains: business processes, data and information management, and application systems. By concentrating on these areas, the research aims to develop an EA blueprint to provide a comprehensive framework for enhancing the university's digital capabilities. This blueprint is intended to serve as a strategic solution for integrating information systems, ensuring smooth data flow across departments, and improving the overall efficiency of business processes within the institution. It will help XYZ University achieve its digital transformation goals in the long term, leading to better coordination, more robust security, and higher operational efficiency.

Keywords: blueprint, digital transformation, solution, enterprise architecture (EA), TOGAF ADM

1 Introduction

In the context of higher education, digital transformation plays a crucial role in improving operational efficiency, transparency, and the effectiveness of educational services [1]. Just like in corporations, information technology (IT) has become inseparable from the core activities of universities in the digital era. This shift affects how data is managed, administrative processes are handled, and academic services are delivered, which increasingly rely on digital technologies [2], [3]. Universities embracing IT can manage information more efficiently, enhance competitiveness, and deliver more transparent and effective educational services [4]. Like businesses, universities must design their business processes and technologies to align with their strategic goals by implementing Enterprise Architecture (EA) [5]. EA helps align academic and administrative needs with the technologies being used, ensuring that all systems within the institution are well-integrated. The implementation of EA in higher education provides a structured digital strategy for teaching and learning processes and resource management, such as student information and research data [6].

In digital transformation, digital platforms or applications supporting academic processes are essential. The data generated, from student information to research outputs, must be managed with high security, especially regarding personal data protection. Law No. 27 of 2022 on Personal Data Protection (PDP) is a relevant legal framework for universities to ensure data protection. This highlights that business process digitalization in universities is not just about technology integration but also about safeguarding data security and complying with regulations. The study on the Classification of Barriers to Digital Transformation in Higher Education Institutions highlights the complexity of implementing digital transformation initiatives in academic settings [7]. Through a systematic literature review, 20 key barriers are identified and categorized into six main areas: environmental, strategic, organizational, technological, people-related, and cultural. Environmental factors, such as regulatory constraints and economic challenges, limit flexibility and investment in digital infrastructure [7]. Strategic issues arise

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from the lack of a clear digital vision and misalignment between IT strategies and institutional goals [7], [8]. Organizational barriers include resistance to change and bureaucratic inertia, which slow the adoption of digital technologies. Technological barriers, such as outdated infrastructure, cybersecurity risks, and interoperability challenges, further complicate the process [9]. People-related issues, including the lack of digital competencies among staff and unequal access to digital tools among students, exacerbate these challenges [10]. Lastly, cultural resistance to innovation and traditional teaching methods hinders the full integration of digital transformation [7]. The study recommends addressing these barriers through leadership commitment, strategic planning, investment in modern infrastructure, and continuous training and development for staff and students [11].

The rapid advancement of digital technologies has profoundly impacted the education sector, making digital transformation a critical agenda for higher education institutions (HEIs) [8]. In recent years, global events such as the COVID-19 pandemic have accelerated the necessity of adopting digital strategies, which forced many institutions to adopt remote and hybrid learning models. However, despite its importance, many HEIs need help implementing a holistic and integrated approach to digital transformation[12]. These challenges include technological fragmentation, resistance to change among faculty and staff, and misalignment between IT initiatives and institutional goals. Addressing these issues is essential for HEIs to remain competitive and effectively meet the demands of the evolving educational landscape [8].

Digital transformation and enterprise architecture (EA) are closely connected, especially in the context of higher education institutions (HEIs) aiming to modernize and enhance their operations [8]. Digital transformation involves adopting new technologies across all institutional functions, fundamentally changing how educational services are delivered [13]. EA is pivotal in providing a comprehensive framework aligning technological advancements with the institution's strategic objectives [14], [15]. EA ensures that introducing new digital tools is integrated across departments, facilitating system interoperability and avoiding technological fragmentation. Furthermore, EA supports change management by offering a structured approach that mitigates resistance from faculty and staff, a common challenge during digital transitions [12]. By optimizing resource use and guiding the seamless integration of digital initiatives, enterprise architecture becomes essential for ensuring the success and sustainability of digital transformation efforts [12].

This paper will examine digital transformation in higher education institutions through the lens of Enterprise Architecture (EA). EA offers a structured framework to align digital advancements with institutional goals, addressing key challenges such as strategic misalignment, technological fragmentation, and resistance to change. By integrating EA, institutions can enhance system interoperability, optimize resource use, and facilitate smoother transitions to digital platforms. Additionally, the study will explore how EA supports compliance with data protection regulations, including Indonesia’s Law No. 27 of 2022 on Personal Data Protection, ensuring a legally compliant and effective digital transformation process.

2 Literature Review

In digital era, a deep understanding of Enterprise Architecture (EA) is crucial for organizations to achieve competitive advantage. EA serves as a framework that unites processes, capabilities, application systems, data, and IT infrastructure to support the achievement of strategic goals. In the context of digital transformation, EA plays a critical role in integrating new technologies and business processes, enabling organizations to swiftly adapt to market changes and customer demands. As part of this study, we will begin with an explanation of Enterprise Architecture, referencing its definition and role in aligning business strategies with IT resources. Next, we will delve into The Open Group Architecture Framework (TOGAF), which provides a systematic approach to designing and managing enterprise information architecture. TOGAF not only assists organizations in planning and implementing architecture but also supports the journey of digital transformation by ensuring that all aspects of IT are integrated efficiently and effectively.

By understanding these two concepts, readers are expected to recognize the importance of applying Enterprise Architecture in a broader context, as well as its contributions to the success of organizations amid existing challenges. The digital transformation driven by EA not only focuses on technology but also involves cultural and procedural changes that underpin how organizations operate and innovate.

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A. Enterprise Architecture

Enterprise Architecture (EA) is defined as the current and desired future state of an organization's processes, capabilities, application systems, data, and IT infrastructure, providing a roadmap to achieve organizational goals (Graeme Shanks, 2018). Enterprise Architecture services implement business strategies by integrating digital processes, application systems, and databases that support the automation of key business processes within the organization. Today, Enterprise Architecture services are considered a crucial investment for companies, facilitating flexible integration between assets and IT resources within business processes to deliver value aligned with business strategies and gain a competitive advantage.

Many companies now utilize EA for a range of purposes, such as strategic goal transformation, driving business innovation, mergers and acquisitions, technology interoperability, compliance assessment, IT-business alignment, and technology standards management (Graeme Shanks, 2018). According to van de Watering (2021), a company's ability to introduce innovations in business processes and leverage the latest technological advancements to develop new products depends on dynamic capabilities enabled by EA. Thus, EA is recognized as a dynamic capability. This dynamic capability allows organizations to identify business opportunities, drive transformation, and implement them while ensuring that their resource assets align with strategic goals and market demands.

B. The Open Group Architecture Framework

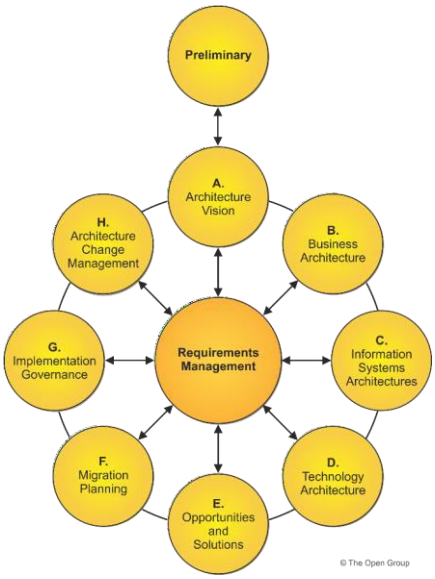

Figure 1. The open group architecture framework [16], [17]

Figure 1 explains that The Open Group Architecture Framework (TOGAF), developed in 1995, provides a comprehensive approach to designing, planning, implementing, and governing enterprise information architecture. Its architecture development method (ADM) specifically guides enterprise architecture development. TOGAF ADM comprises nine phases, each playing a crucial role in managing the lifecycle of Enterprise Architecture [17]. The process begins with the Preliminary Phase, which prepares and initiates activities to meet business objectives in the new Enterprise Architecture. This phase involves defining the specific architectural framework and organizational principles. Next is Phase A: Architecture Vision, which represents the initial stage where the scope is defined, stakeholders are identified, the vision is created, and approval is obtained. Phase B: Business Architecture then focuses on developing the Business Architecture, which defines the structure, processes, and interactions to support the approved vision. Following this is Phase C: Information Systems Architecture, where data and application architecture are developed. This ensures that the organization’s data entities and the necessary applications for processing data are clearly defined [17].

In Phase D: Technology Architecture, the focus shifts to designing the technology architecture, ensuring alignment with the data and application architecture while including the

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necessary hardware and software components. Phase E: Opportunities & Solutions involves initial implementation planning and identifying solutions for the architecture delivery. Phase F: Migration Planning formulates steps for transitioning the architecture with an implementation and migration plan. The following phase, Phase G, Implementation Governance, manages the project and ensures the successful realization of the architecture. Lastly, Phase H: Architecture Change Management creates a blueprint to oversee and adapt the Enterprise Architecture over time [17], [18]. In addition to these phases, Requirements Management is a continuous process that ensures the architectural plan aligns with the company's objectives. This phase enables organizations to manage the transition from the existing architecture to the new one, ensuring that it meets the intended goals and strategic needs [17].

C. Digital Transformation

Digital transformation refers to the comprehensive shift within organizations as they adopt digital technologies to enhance processes, products, and business models. This transformation involves the implementation of new technologies and fundamental changes in organizational culture, business strategy, and operational methods [2], [19]. Key aspects include adopting new business models, improving customer experience through personalized services, and optimizing operations by automating manual processes and integrating digital platforms [20]. Technologies like cloud computing, artificial intelligence, and big data drive innovation, while organizational success depends on leadership, dynamic capabilities, and a culture open to change. The digital transformation ultimately requires aligning technology, strategy, and human resources to remain competitive in an increasingly digital landscape [19], [20].

3 Research Method

A conceptual model is an abstract representation that visualizes the research framework by addressing the identified problems and illustrating the relationships between various components. Its purpose is to evaluate, validate, and verify the proposed architectural design. Structured frameworks are employed to provide systematic guidance when constructing a conceptual model. One such framework is the IS Research Framework, which integrates critical elements such as the environment, IS research (information systems research), and a knowledge base. This framework ensures the research operates comprehensively, considering operational environments and existing knowledge. Doing so ensures that the proposed solutions are innovative and aligned with identified needs and industry standards. This advanced approach structures the research process and enhances the rigor and relevance of the final architectural design based on Figure 2.

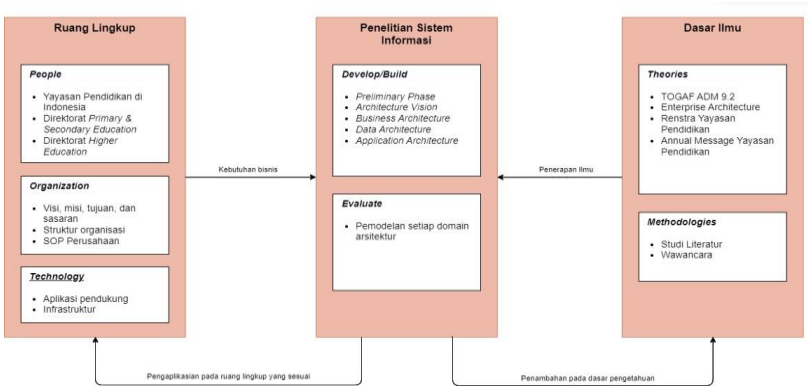

Figure 2. Reseach method

4 Results and Analysis

A. Preliminary Phase

The preliminary phase is the first stage in developing enterprise architecture using TOGAF ADM. This phase serves as the initial step in preparing and initiating the enterprise architecture process, providing clarity on "where, what, why, who, and how we approach architecture" in

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addressing the organization's challenges. The critical artifact produced during this phase is the Principal Catalog based on Table 1.

Table 1. Principle catalog

Domain	Principle
Business	Maximize Benefit to the Enterprise
	Information Management is Everybody's Business
	Common Use Applications
	Service Orientation
	Compliance with Law
Data	Data is an Asset
	Data is Shared
	Data is Accessible
	Common Vocabulary and Data Definitions
	Data Security
	Data Integration
Application	Technology Independence
	Ease-of-Use
	Application Integration

B. Architecture Vision

The first phase, or Phase A, in Enterprise Architecture is the Architecture Vision, which focuses on defining the scope, identifying the stakeholders within the organization, formulating the architecture vision, and obtaining approval. This phase creates several vital artifacts, including a stakeholder map matrix, a value chain diagram, and a solution concept diagram. The value chain represents the series of business activities that a company undertakes to create value, focusing on sources of competitive advantage that generate profits for the organization based on Figure 3.

Figure 3. Value chain

The value chain is classified into two main components based on Figure 3: primary activities and support activities. Primary activities refer to the core activities conducted to generate value that is directly related to the company's central processes. In contrast, support activities facilitate the primary activities, ensuring operational processes run efficiently.

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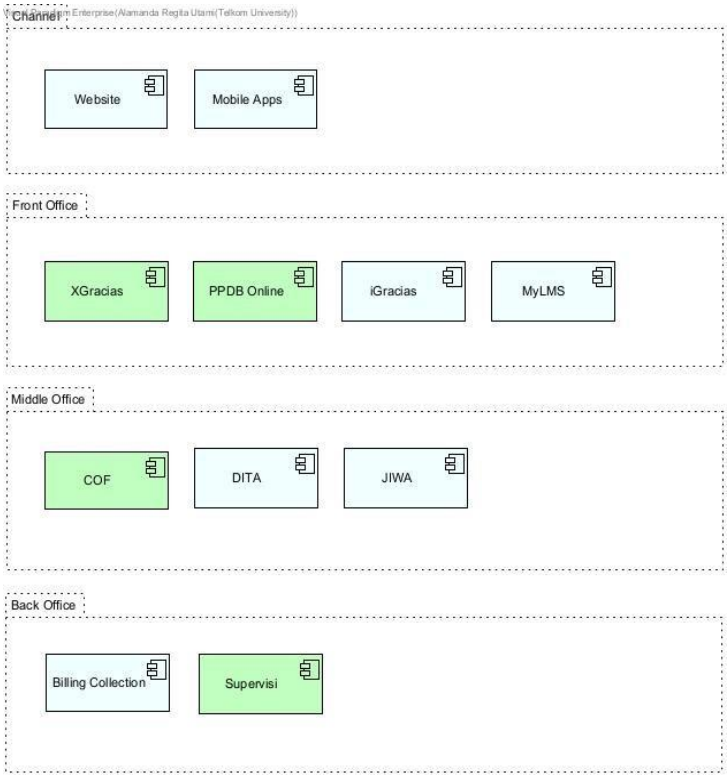

Figure 4. Solution concept diagram

Based on Figure 4, the solution concept diagram serves as a high-level representation of the proposed solutions that address specific needs or challenges within a higher education institution. This diagram is a stakeholder communication tool and provides a foundation for further solution development. It illustrates the categorization used by the institution to depict existing layers, which include the Channel, Front Office, Middle Office, and Back Office. The Channel layer represents how applications or data can be accessed, often called the Interface Layer. The Front Office encompasses applications or systems that directly interact with students and other stakeholders, potentially including the Business Process Layer. The Middle Office bridges the Front and Back Offices, combining customer interactions with internal data processing. Finally, the Back Office focuses on internal operations, managing data, and administrative functions to support both the Front and Middle Offices. In the context of a higher education institution, the solution concept diagram highlights applications that require development or modification to resolve issues and enhance existing systems, ultimately improving operational effectiveness and meeting user needs.

C. Business Architecture

The process map identifies an organization's core and supporting processes. The map incorporates elements related to the organization's strategy by aligning these processes with standard requirements. One effective method for creating this map is the SIPOC principle, which stands for Supplier, Input, Process, Output, and Customer, as explained in Figure 5.

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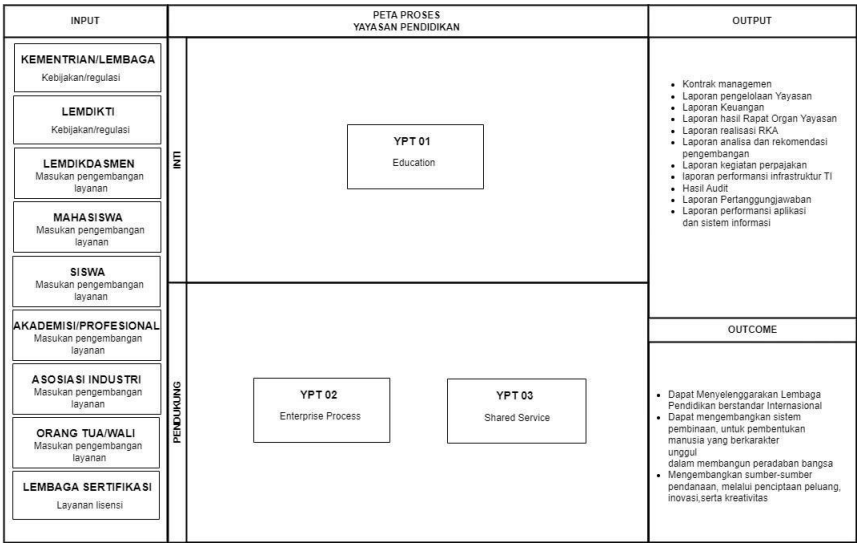

Figure 5. Business process map of higher education directorate

Based on Figure 5, suppliers provide the necessary input to support processes, including people, systems, or organizations. Inputs are the resources needed to ensure smooth operations, encompassing the 4Ms: Man, Method, Material, and Machine. The Process consists of activities that transform these inputs into outputs, which can be goods or services. Finally, Customers are the individuals or entities that receive or utilize the outputs produced by the process. Utilizing SIPOC for mapping provides a high-level overview that helps understand the key elements of a business process, making it a valuable tool for organizations looking to enhance their operational efficiency.

D. Data and Information Architecture Phase

The Data and Information Architecture Phase is a crucial component of the Enterprise Architecture framework. It focuses on effectively managing and organizing data and information within an organization. During this phase, the primary objective is ensuring data is structured, accessible, and aligned with business processes and strategic goals.

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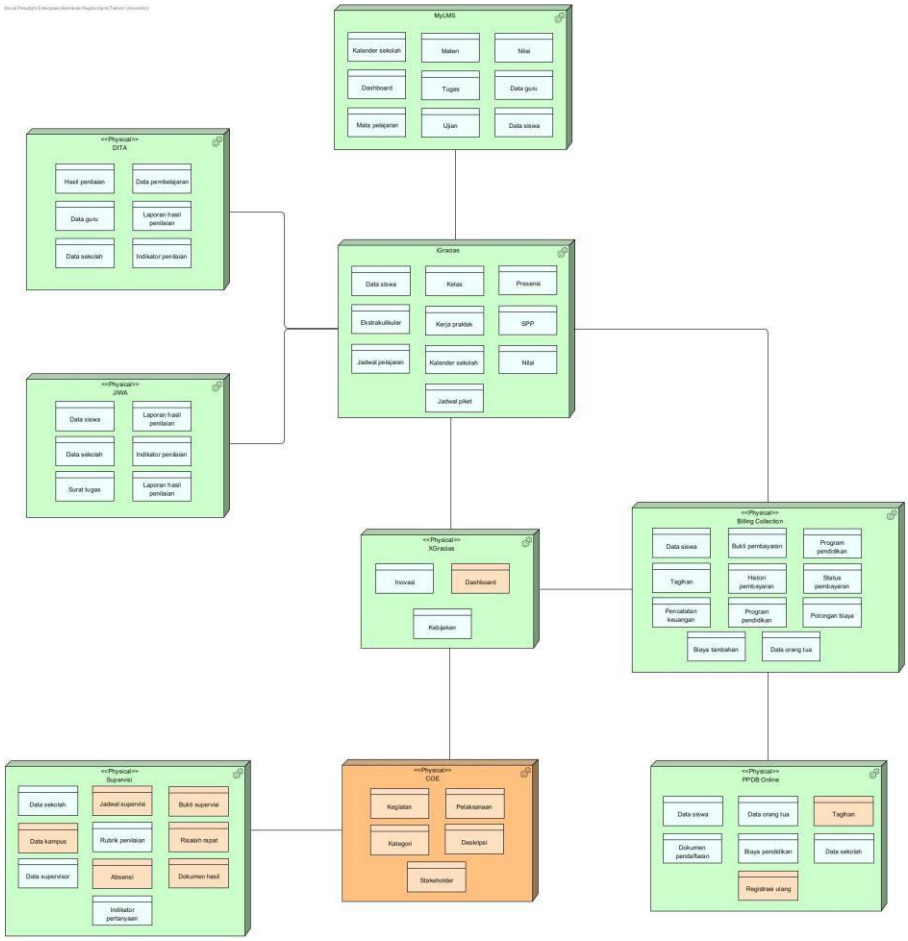

Figure 6. Data dissemination diagram

Based on Figure 6, The data dissemination diagram illustrates the connections between data entities, business services, and application components within the Directorate of Higher Education. It demonstrates how logical entities can be implemented within application components. Table 2 is the dissemination diagram for the Directorate of Higher Education and explains the gap analysis of data architecture.

Table 2. Gap Analysis Data Architecture

Requirement	Fullfillment			Description	Solution
	N	P	F		
Data and information are documented and managed effectively as important assets.	V			The data that is used or generated has not been properly recorded.	Create documentation or recording of the entity diagram for HE (Higher Education
They support the applications being developed and the business processes being executed.	V			Not all business processes are documented with the data produced or utilized.	Group business processes with catalog entities.
Access to data and information is controlled according to user needs, ensuring that it is consistent to avoid ambiguity and enhance understanding.		V		Access is granted only to authorized individuals within the Educational Foundation. There are still duplicate data entities	Entities with the same function should be standardized.

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Requirement	Fullfillment			Description	Solution
	N	P	F		
				across applications.	

E. Application Architecture phase

Figure 7 explains application communication diagram aims to illustrate or visualize the application interface catalog so that the relationships and interactions between applications are easily understood.

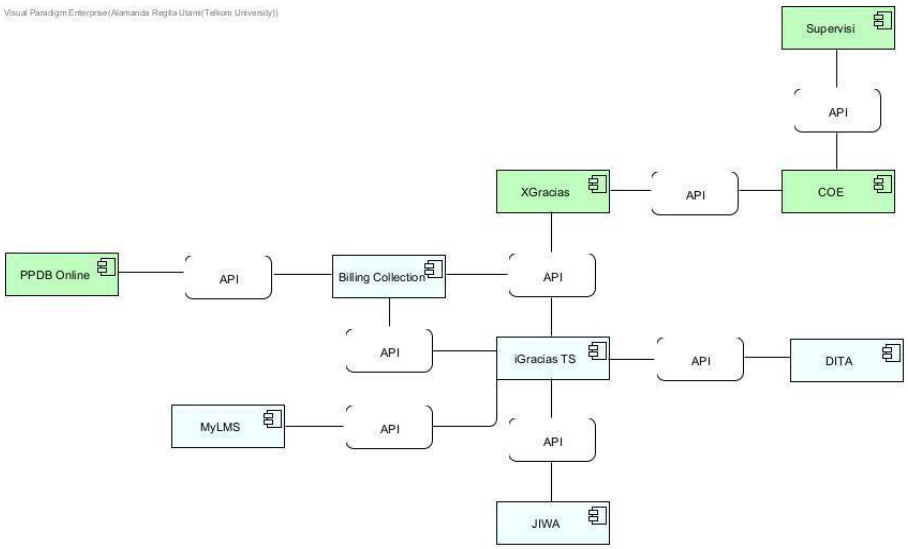

Figure 7. Application communication diagram

F. Blueprint Enterprise Architecture

Table 3. Blueprint digital transformation

Blueprint Digital Transformation and Performance Optimization at XYZ Higher Education through TOGAF-Based Enterprise Architecture	
SCOPE THE DIRECTORATE OF HIGHER EDUCATION	**ORGANIZATIONAL STRATEGIC DIRECTIONS** Vision: To become a quality educational foundation with international standards, aimed at cultivating individuals with outstanding character to build the nation's civilization. Mission: 1. To organize educational institutions that meet international standards. 2. To develop a coaching system to shape individuals with outstanding character for the advancement of the nation's civilization
BASIC GUIDANCE DOCUMENTS 1. Strategic Plan of the Higher Education 2. Annual Message 2023 3. Organizational Structure of the Higher Education 4. Quality Document 5. Law on Personal Data Protection No. 27 of 2022	
BISINESS PROCESS ARCHITECTURE DOMAIN	**DATA AND INFORMATION ARCHITECTURE DOMAIN**

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1. Improvements to business processes including the initial preparation of the Calendar of Events (COE), curriculum development, supervision of Lemdikdasmen, new student admissions, and supervision of Lemdikti.	1. Mapping of data entities in the applications used by the Directorate of Primary & Secondary Education and the Directorate of Higher Education, including PPDB Online, Supervision, DITA, JIWA, XGracias, Billing Collection, and COE.

APPLICATION ARCHITECTURE DOMAIN

1. Development of the Supervision application by adding features, as it was previously only used for Lemdikdasmen, with the aim of eventually expanding its use to Lemdikti.
2. Integration between the PPDB Online application and Billing Collection so that tuition fee bills will appear immediately when students are accepted into the registered schools, along with real-time updates on their payment status.
3. Addition of the COE application, which functions as a timeline or schedule for activities within the Directorate of Primary & Secondary Education, Higher Education, and the schools under the foundation, making monitoring easier."

SOLUTION CONCEPT DIAGRAM

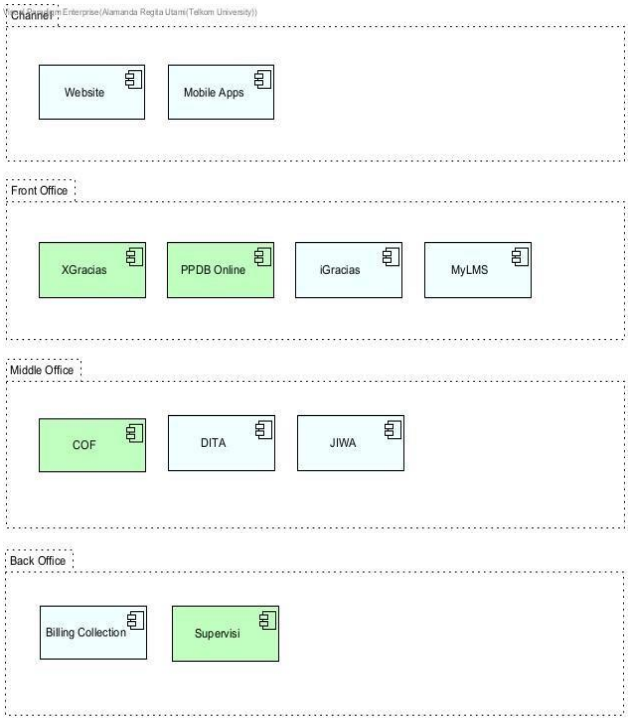

Figure 8. Solution concept diagram

G. Roadmap Implementation Digital Transformation

This roadmap outlines a phased approach to implementing digital governance in a higher education context, ensuring alignment with strategic goals, effective management of digital assets, and continuous improvement of governance practices, as described in Table 3.

Table 3. Roadmap DT implementation

Phase	Timeline	Objective	Activities
1. Foundation Phase	Q1 - Q2 2024	Establish foundational elements for	• Define Digital Governance Framework • Identify Stakeholders

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Phase	Timeline	Objective	Activities
		digital governance	• Conduct Digital Readiness Assessment • Develop Training Programs • Create Digital Governance Board
2. Strategic Alignment Phase	Q3 - Q4 2024	Align digital initiatives with organizational strategy	• Develop Digital Transformation Strategy • Map Business Processes to Digital Goals • Establish Key Performance Indicators (KPIs)
3. Architecture Development	Q1 - Q2 2025	Develop detailed architecture blueprints	• Design Business Architecture • Develop Data Architecture • Plan Application Architecture • Plan Technology Architecture
4. Implementation Phase	Q3 2025 - Q4 2026	Implement digital transformation initiatives	• Deploy Digital Governance Tools • Implement Data Management Systems • Automate Governance Processes • Conduct User Training & Change Management
5. Optimization Phase	Q1 - Q4 2027	Optimize and refine digital governance practices	• Establish Continuous Improvement Programs • Integrate Advanced Analytics & AI • Expand Digital Governance Scope • Conduct Governance Maturity Assessment
6. Maturity & Innovation	2028 onwards	Achieve maturity and drive continuous innovation	• Innovate Governance Practices • Conduct Digital Governance Benchmarking • Plan for Sustainability & Resilience

5 Conclusion

The development of Enterprise Architecture within the Educational Foundation, focusing on the Directorates of Primary and Secondary Education and Higher Education, is closely linked to the implementation of digital transformation in higher education institutions. This blueprint, created using the TOGAF ADM framework, provides a structured approach to enhancing operational efficiency and service delivery through digital solutions. The Business Architecture design emphasizes mapping business processes based on strategic documents, aligning with digital transformation goals to streamline operations and improve student experiences. By refining processes at level 3 according to BPMN standards, institutions can enhance service delivery, a best practice in digital transformation. In the context of Data Architecture, identifying data entities supports effective information management, enabling better decision-making and personalized services for students. This aligns with the best practice of leveraging data analytics in digital transformation to drive insights and improve educational outcomes. The Application Architecture documentation illustrates how various applications can be integrated to support digital services. Developing applications such as LMS, fostering an interconnected

system, and ensuring seamless access to information and services are critical aspects of successful digital transformation in higher education. Enterprise Architecture facilitates the implementation of digital transformation and embodies best practices by ensuring alignment between technology, processes, and organizational goals. This holistic approach enhances the institution's ability to adapt to changing educational demands and improve overall performance.

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