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Enterprise Architecture of the Basic Banking Feature for a New Challenger of Digital Banking in Indonesia

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Abstract: Digital transformation has significantly impacted Indonesia's banking industry, leading to the rise of digital banks that leverage technology for their operations, posing challenges to traditional banking models. This research investigates the implementation of enterprise architecture within the core features of digital banking in Indonesia, utilizing the combination of TOGAF and Archimate modeling. While various enterprise architecture frameworks, such as Zachman and FEAF, exist, TOGAF was chosen for its structured and scalable approach, particularly suited to managing the complex IT systems of digital banks. The study's primary objective is to identify the core processes, challenges, and opportunities associated with managing the complex architecture of digital banks. Employing a qualitative methodology, data were gathered through in-depth interviews, direct observations, and a review of pertinent literature. The research identified three central processes in digital banking operations: deposits, time deposits, and loans. These processes were then modeled using the TOGAF framework and Archimate while Archimate complements TOGAF by providing a comprehensive visual modeling language to represent these architectures clearly. Together, TOGAF and Archimate offer a powerful combination for aligning business strategies with operational activities. The SWOT analysis conducted highlights digital banks' strengths in operational efficiency, strategic partnerships, and innovation capabilities, while also recognizing weaknesses such as technological dependency and challenges in serving the less tech-savvy population. The study also identifies opportunities for product innovation, market expansion, and ecosystem integration. However, threats like regulatory changes, increased competition, and cybersecurity risks must be carefully managed. The research recommends adopting emerging technologies, enhancing third-party risk management, and improving customer data security and privacy to bolster digital banks' global competitiveness, operational sustainability, and service innovation.

Keywords: Archimate; Digital Banking; Enterprise Architecture; SWOT Analysis; TOGAF

INTRODUCTION

Digital transformation has profoundly impacted various industrial sectors, including banking. In Indonesia, this transformation is particularly evident in the transition from traditional banking models, which depend on physical branch networks, to fully digital banking services driven by technology. This shift is fueled by the widespread adoption of internet and mobile banking, enabling banks to provide services that are accessible to customers at any time and from any location. Moreover, digital banks offer features that significantly enhance the customer experience by making financial management more intuitive, facilitating seamless transactions, and providing real-time financial information, thereby making banking more personalized and convenient (Hermiyetti, 2024; Hie, 2021; Wulandari et al., 2024).

Digital banks are financial institutions that fully integrate digital technology into their operations and services, allowing them to function without a physical presence or branch offices. Unlike traditional banks, which rely on in-person interactions at branch locations, digital banks provide services exclusively online through devices such as smartphones or computers. This approach eliminates the need for face-to-face customer interactions, offering the convenience of accessing banking services anytime and anywhere. (Haryono et al., 2023; Hie, 2021; Kuswandi et al., 2022). This digital transformation offers numerous advantages, including enhanced operational efficiency,

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improved customer satisfaction, and the capability to develop new business models that are better aligned with the demands of the digital era (Hie, 2021; Nguyen-Thi-Huong et al., 2023).

Despite the many advantages of digital banking, significant challenges arise in managing enterprise architecture. Enterprise architecture is a methodology designed to help organizations structure, manage, and develop their overall strategy, ensuring alignment between critical components such as business processes, applications, data, and technology with the organization's goals. This alignment is essential for building an effective and efficient organization that can fully leverage the benefits of digital transformation (Dewi Asih Pramesti et al., 2021; Saputra & Rahmania, 2022; Werner & Lehan, 2023).

Figure 1. Net Interest Income & User in Million Digital Banking Indonesia (Statista, 2024)

In 2024, digital banking in Indonesia is projected to generate a net interest income of 3.61 billion USD, with the number of users reaching 10.36 million, particularly gaining popularity among the millennial generation (Statista, 2024). This marks a significant increase compared to the previous year, highlighting that the prevailing trend in the banking sector, especially in Indonesia, is increasingly focused on digital banking.

In the realm of digital banking, enterprise architecture plays a critical role by offering a comprehensive view of the organization's activities. It ensures that all stakeholders have a clear understanding of the various components within the organization, as well as how these components interact and influence one another. This holistic approach is essential for aligning the organization's strategies with its operations, ultimately enhancing efficiency and effectiveness (Beese et al., 2023).

The use of TOGAF (The Open Group Architecture Framework) has proven effective for digital banks, offering a structured approach to managing the complexity of IT systems and business processes while ensuring alignment with organizational business needs (Gunadham et al., 2022). TOGAF also presented as the most comprehensive framework, particularly for organizations seeking scalability and performance management (Dumitriu & Popescu, 2020). TOGAF enables banks to align digital initiatives with business objectives, ensuring efficient integration into daily operations and adding value to the organization (Kevin Dwi Saputra et al., 2023; Maita et al., 2022). In contrast, TOGAF excels in its flexibility, scalability, and ability to integrate with tools like Archimate, which provides a visual modeling language to support architecture design (The Open Group, 2018). This combination of structured development and clear communication of architecture components has made TOGAF the preferred choice for industries looking to manage complex IT systems efficiently. Thus, the choice of TOGAF in this study is supported by its proven track record and suitability for addressing the architectural challenges of digital banks.

Digital banks continue to face several challenges, especially in ensuring efficient and effective implementation. These challenges include complying with local regulations, integrating with rapidly evolving technologies, and maintaining the security and privacy of customer data (Haryono et al., 2023). This research **aims** to analyze the implementation of TOGAF-based enterprise architecture in Indonesia's digital banking industry, assess its current state, and provide recommendations for enhancing the performance and competitiveness of digital banks in a global market. By adopting this approach, the study expects that digital banks in Indonesia will be better equipped to navigate the challenges of digital transformation and deliver innovative services that meet customer needs.

To align with the research objectives on enterprise architecture in digital banking in Indonesia, several key research questions are posed: How is TOGAF-based enterprise architecture developed within the banking industry, with a particular focus on digital banking? (RQ1). How are the business architecture, information system architecture, and technology architecture phases implemented using TOGAF, along with Archimate modeling, in a digital banking-focused company? (RQ2). In TOGAF's Phase E (Opportunities and Solutions), what recommendations can be made based on a SWOT analysis of the enterprise architecture in digital banking? (RQ3).

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LITERATURE REVIEW

Enterprise Architecture

Enterprise architecture is a methodology that helps organizations design, manage, and develop their overall structure and strategy. Its primary goal is to align key elements such as business processes, applications, data, and technology with the organization's objectives, ensuring that all components function cohesively to create an effective and efficient organization (Dewi Asih Pramesti et al., 2021; Werner & Lehan, 2023). Enterprise architecture is essential as it offers a holistic view of the organization's activities, allowing stakeholders to understand the components and their interactions. By utilizing enterprise architecture, organizations can manage and reduce the complexity of IT systems and business processes, which are often barriers to achieving business objectives (Crosley et al., 2023; Horn et al., 2021; Jager, 2023).

The Open Group Architecture Framework (TOGAF)

TOGAF, developed by The Open Group in 1995, aids in planning, developing, implementing, and managing enterprise architecture (Dewi Asih Pramesti et al., 2021; Jager, 2023; The Open Group, 2018). It uses the ADM (Architecture Development Method) to design and manage architecture aligned with business needs, covering phases like vision, business, information systems, and technology architecture. The key pillars of TOGAF include business, data, application, and technology architecture (Camatti et al., 2020; Hannemann et al., 2022). In this digital banking research, phases A to E are applied as outlined below.

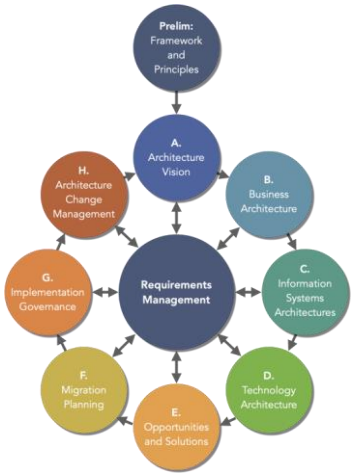

Figure 2. TOGAF Architecture Development Method (Cruz, 2023)

Phase A, Vision Architecture, aims to create a shared understanding of enterprise architecture's role in achieving organizational goals. It defines the architecture's scope, identifies stakeholders, formulates the vision, and secures approval to proceed. This phase also ensures alignment between the organization's vision and the realities of remote work, considering both technology and human resources. Additionally, it accounts for budget and internal policies to ensure the architecture supports the organization's long-term needs and vision (Anderson & Andry, 2021; Kalbuadi & Ryano Yohanis, 2024).

Phase B (Business Architecture) outlines the business processes, organizational structure, and strategies necessary to achieve the organization's goals. The objective is to ensure that the business architecture aligns with the company's needs and vision, which is subsequently supported by the relevant information system and technology architectures (Naila Quin Azisah Alisyahbana et al., 2024; D. Y. Prawira et al., 2023; Vinardo et al., 2023).

Phase C, Information System Architecture, covers data and application architecture to ensure alignment with the company's business needs and strategic vision (Kalbuadi & Ryano Yohanis, 2024; Vinardo et al., 2023). Data architecture focuses on organizing, storing, and utilizing data to support business functions, while application architecture defines the necessary applications for managing this data. The result is a blueprint that aligns the data and application architecture with the company's business strategy (Andry et al., 2023; Fikri et al., 2020; D. Y. Prawira et al., 2023).

Phase D in Technology Architecture focuses on developing the infrastructure to support the data and application needs. It identifies the necessary software, hardware, and networks, resulting in outputs like a technology standards catalog, application/technology matrices, and network topology diagrams. This phase ensures the technology components align with the data and application architecture and support the company's business objectives (Andry et al., 2023; Fikri et al., 2020; Gunawan et al., 2019; D. Y. Prawira et al., 2023).

Phase E, Solutions and Opportunities, focuses on evaluating opportunities for architectural improvements and selecting the best solutions to meet targets. It involves conducting a gap analysis between the current and target

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states and developing a detailed implementation plan that includes responsibilities, schedules, and budgets. This phase also considers the transition architecture to ensure gradual changes without disrupting business operations (Anderson & Andry, 2021; Andry et al., 2023; Vinardo et al., 2023).

Archimate

Archimate is an enterprise architecture modeling language developed by The Open Group, used to describe, analyze, and communicate enterprise architecture within an organization in an easily understandable manner. This is achieved through visual diagram representations, ensuring that all stakeholder interests and needs are thoroughly considered and addressed (D. Y. Prawira et al., 2023; The Open Group, 2019). Its advantages include ease of use, which sufficiently represents the modeling needs of the designed enterprise architecture (The Open Group, 2019).

SWOT Analysis

SWOT analysis is a systematic method used to formulate appropriate strategies for an organization by focusing on four key elements: strengths, weaknesses, opportunities, and threats. This method considers the current external environmental conditions and the internal capabilities of the organization (Alfadri et al., 2023).. The strength component represents internal positive factors that provide an advantage to the organization, while the weakness component includes internal negative factors that may limit the organization's ability to achieve its goals. Additionally, the opportunities component consists of external positive factors that can be leveraged to enhance the organization's performance, helping it grow and achieve its objectives. In contrast, the threats component refers to external negative factors that could hinder or jeopardize the organization (Nurfitasari & Sumadhinata, 2022; Sanchia Grafita Ryana Devi et al., 2022). The purpose of this SWOT analysis is to identify internal strengths and weaknesses, as well as external opportunities and threats that impact IT strategy in the development of digital products. Through this analysis, IT strategies can be designed to leverage strengths, address weaknesses, mitigate threats, and enhance customer value through digital innovation (Litvishko et al., 2020; Susanto & Safaria, 2024).

Previous Research & State of the Art

Several previous studies serve as references and comparisons for the application of enterprise architecture using TOGAF, spanning various industries and organizations.

First (K. T. Prawira et al., 2023), discusses the use of TOGAF in developing enterprise architecture for a financial business focused on payment systems and user savings. The study provides an overview of all TOGAF phases but concentrates primarily on the Solutions and Opportunities phase. Notably, the research does not include ArchiMate modeling, and while it explains TOGAF within the financial industry, it does not incorporate a SWOT analysis to support Phase E (Solutions and Opportunities). Additionally, the study's focus is not specifically on the banking industry, particularly digital banking.

Second (Wedha et al., 2023), discusses research that implements TOGAF in an online financial service, focusing on the use of enterprise service bus technology as part of SOA (Service-Oriented Architecture) software development. The study identifies several gaps, such as the absence of ArchiMate modeling to depict enterprise architecture, a primary focus on enterprise service bus technology used by SOA, a lack of explanation regarding business processes, and an incomplete description of TOGAF phases. Moreover, the research does not specifically focus on the banking industry, particularly digital banking.

Third (Michael et al., 2022), focuses on the development of enterprise architecture for cloud computing service providers using TOGAF, covering phases A through E and continuing to Phase H, which involves architecture change management. The gaps identified in this research include a lack of focus on the banking industry, particularly digital banking, and the absence of a SWOT analysis that could be used to identify opportunities, plan and develop strategies, make strategic decisions, and monitor and evaluate the business.

Across the three studies referenced in this research, commonalities include the implementation of TOGAF enterprise architecture, primarily focusing on phases B through E across various industries. However, gaps were noted, such as incomplete coverage of TOGAF phases A through E, limited use of ArchiMate for visualizing business, data, application, and technology architecture, and a lack of in-depth analysis in Phase E (Solutions and Opportunities). Additionally, none of the studies specifically focused on digital banking.

This research advances the **state of the art** by applying the TOGAF enterprise architecture framework specifically to digital banking in Indonesia. It covers phases such as vision architecture, business architecture, information system architecture, and technology architecture, all visualized using ArchiMate. A SWOT analysis is also employed to identify solutions and opportunities, providing recommendations that enable digital banking service providers to compete both nationally and globally. The findings will serve as an architecture blueprint.

The aim of this study is not to critique previous research but to build upon it, refining and enhancing its accuracy by applying insights to the current digital banking landscape. This approach ensures that digital banking applications, which are critical revenue sources for organizations, can withstand both external and internal disruptions in the digital era. The scope includes using TOGAF from phases A through E within the context of digital banking in Indonesia.

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METHOD

This research employs a qualitative approach that integrates **TOGAF**, **Archimate**, and **SWOT analysis** to develop a comprehensive enterprise architecture for digital banking in Indonesia. Each method plays a crucial role in achieving the research objectives, and their interactions ensure both strategic and technical alignment. The application of TOGAF enterprise architecture to digital banking in Indonesia is explained through the following stages.

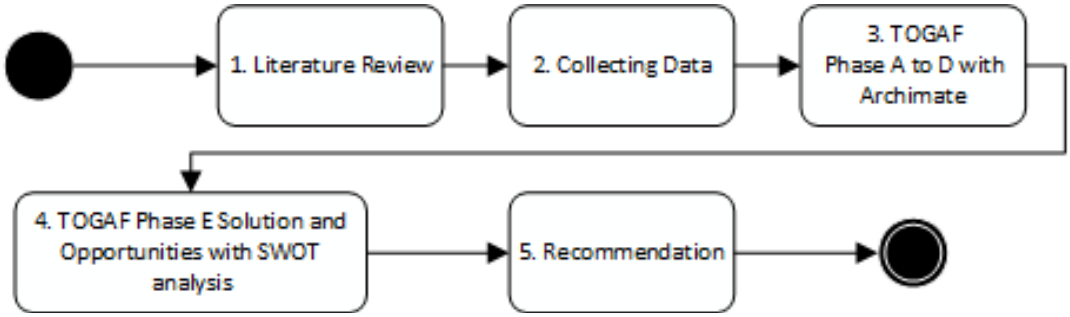

Figure 3. Research Method

The research begins with a literature review of journals on the application of enterprise architecture using the TOGAF framework across various industries to understand previous research and identify current trends. Next, data is collected through interviews with relevant stakeholders and observations to gather up-to-date information on business processes, applications, data, and technology used in digital banking. This is followed by the analysis and design of enterprise architecture, covering TOGAF Phases A through D, with visualization using ArchiMate. Phase A outlines the organization's strategy, Phase B details core business processes, Phase C focuses on data and application architecture, and Phase D addresses software development and cloud services. Finally, a SWOT analysis is conducted to assess the current state of digital banking, leading to recommendations for improvement and the development of an architecture blueprint using ArchiMate models.

The TOGAF (The Open Group Architecture Framework) provides the primary structure for this study, using its Architecture Development Method (ADM) to guide the development of the business, information systems, and technology architectures. In this phase, critical business processes, data flows, and technological requirements are identified. These include key banking processes such as deposits, time deposits, and loans, as well as the underlying technologies needed to support these operations, such as infrastructure, security systems, and core applications. The outputs from TOGAF, particularly from the Business Architecture, Information Systems Architecture, and Technology Architecture phases, lay the groundwork for both Archimate modeling and the SWOT analysis. This structured approach ensures that the architecture aligns with the bank's strategic objectives while also addressing the technical aspects necessary for digital operations.

Archimate plays a complementary role by providing a visual modeling language that translates the complex architecture developed through TOGAF into clear, graphical representations. The data used in Archimate, such as business processes and technology components, is sourced directly from the results of the TOGAF Business and Technology Architecture phases. For instance, Archimate visualizes the relationships between account registration, loan management, and the supporting technology stack. This graphical representation ensures that stakeholders across the organization can easily understand the architecture and its alignment with business processes, enabling better decision-making and communication.

The SWOT analysis adds a strategic dimension to the research by assessing the strengths, weaknesses, opportunities, and threats of the digital banking architecture. The data for the SWOT analysis is drawn from both the TOGAF framework and the Archimate models. Strengths and weaknesses are primarily identified from the Business and Information Systems Architectures in TOGAF, focusing on areas like operational efficiency and technological dependencies. Meanwhile, opportunities and threats are derived from external market trends, customer needs, and the technological risks outlined in TOGAF's Technology Architecture. This analysis helps identify areas where the bank can innovate, expand its services, and mitigate risks, ensuring that the enterprise architecture is not only technically sound but also strategically positioned to compete in the digital banking landscape.

By integrating TOGAF, Archimate, and SWOT analysis, this research aims to deliver a holistic enterprise architecture that balances technical precision with strategic insight. The combination of these methods ensures that the architecture addresses both the business objectives and the technological complexities of digital banking, providing a robust framework for future growth and innovation.

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RESULT

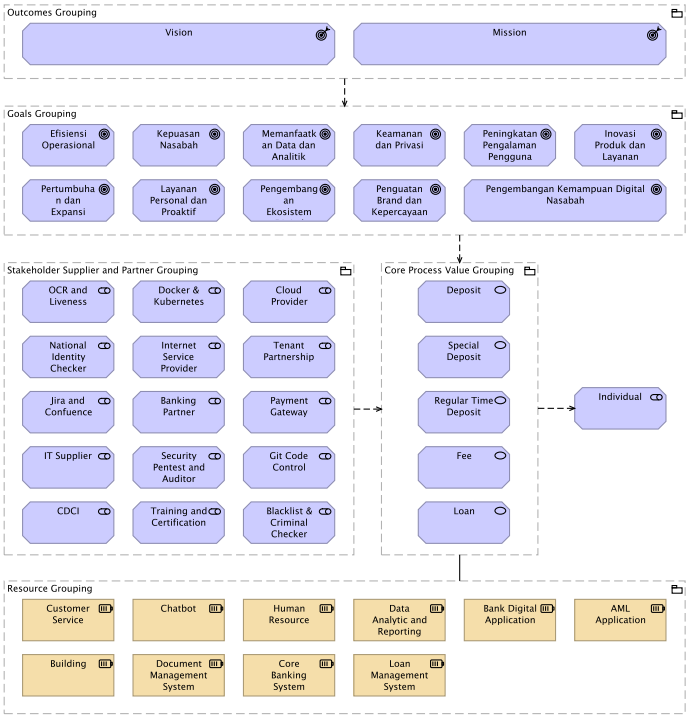

Figure 4. Architecture Vision

In the **Architecture Vision** phase of a digital bank, the organization's strategy is outlined to ensure alignment between the architecture and the business goals. This alignment is depicted in ArchiMate, highlighting outcomes, goals, stakeholders (including suppliers and partners), core value-generating processes, and the resources employed, all with a central focus on the individual customer.

The **outcomes** from the Architecture Vision include a vision to become the leading digital bank, offering innovative, secure, and easily accessible financial solutions for all societal segments, while supporting financial inclusion and the growth of the digital economy. The mission encompasses delivering superior financial services, fostering continuous innovation, ensuring security and reliability, promoting financial inclusion, providing excellent service, enhancing financial literacy, contributing to the digital economy, and upholding social responsibility.

The **goals** illustrated using ArchiMate encompass operational efficiency, customer satisfaction, data and analytics utilization, security and privacy, enhanced user experience, product and service innovation, growth and expansion, personalized and proactive services, ecosystem development, brand strengthening and trust, and the enhancement of customers' digital capabilities.

Suppliers and partners stakeholders are service and solution providers that support the operational performance of digital banking externally, as explained in the following table.

Table 1. List of Suppliers and Partners Notations

Notation	Documentation
OCR and liveness	A partnership that provides API products for the extraction and verification of data on identity cards and photos to ensure the authenticity of customers.
Docker dan Kubernetes	A partnership is established for leveraging technology to streamline the deployment process across various environments, including development, SIT, UAT, pre-production, and production. This partnership also facilitates orchestration and communication between services within the digital banking application.
Notation	**Documentation**
Cloud provider	A partner is engaged to provide cloud services essential for the operational aspects of the digital banking application.
National identity checker	A partnership provided by the government to confirm the authenticity of customer identity card data and photos.
Internet service provider	Internet connection services to support the organization's performance in terms of operations and other services.

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Tenant partnership	A partnership for providing promotional services in the form of discounts to customers who use the digital banking application.
Jira and Confluence	A partnership is established to provide a web application for managing projects and sharing project information or documentation online. This allows internal digital banking stakeholders to view, study, and collaborate through the website system.
Banking & ecosystem partner	Banking organizations collaborate to develop and maintain their systems within their digital ecosystem.
Payment gateway	A partnership feature designed to facilitate payments.
IT supplier	A type of partnership that provides IT hardware products such as laptops, projectors, and other equipment to support the organization's operations.
Git code control	A paid application used by developers to store and manage code versions for the development of the digital banking application.
CD/CI	(Continuous Deployment Continuous Integration) A paid application used to assist with the deployment process of all digital banking services.
Blacklist and criminal checker	An international partnership that functions to check whether customers registering, onboarding, or applying for loans are involved in criminal activities.
Security pentest and auditor	A partnership is formed to test the security of the digital banking application and ecosystem, as well as to support audits, ensuring that governance and management practices comply with regulations.
Training and certification	A partnership that provides training and certification services for bank employees.

Individual stakeholders represent the use of the digital bank's application and its features by individual customers. **Resources** used by digital banking to support internal operations are detailed in the following table.

Table 2. List of Resources Notation

Notation	Documentation
Chatbot	An AI application focused on adding value by providing information based on inquiries from customers or digital bank users to meet their needs.
Human Resource	Workforce resources or staff supporting digital banking operations, including governance, network security, risk management, product development, and developers.
Digital Banking Application	Key applications that support the organization's performance in generating profit by delivering value to customers through available features.
AML Application	An application used for financial monitoring and reporting on customers to prevent undesirable events that could harm the digital bank.
Building	A place where digital employees carry out operations to deliver value to customers.
Document Management System	An application owned by a digital bank to manage all necessary and important documents in digital banking operations.
Core Banking System	The core of banking, featuring functions like deposits, time deposits, and loans.
Loan Management System	An internal application that manages loan system operations, including approval processes, loan security, and other related aspects.
Customer Service	Resources that assist in developing and maintaining relationships between digital banking app users and the organization.

The **core process value** encompasses the essential functions or features of digital banking that deliver value to both customers and the organization, such as deposits, regular time deposits, and loans. These will be detailed in the following table.

Table 3. List of Core Process Value Notations

Notation	Documentation
Deposit	A core process that serves as a repository for funds obtained through transfers from other banks. This process allows customers to earn interest provided by the bank, creating added value for both parties.
Regular Time Deposit	A core process involving the borrowing of funds from customers by the bank, where customers ultimately benefit through the interest provided by the bank.
Loan	A core process involving the lending of funds to customers.

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In the Architecture Vision phase, **three core processes** have been identified that are crucial in helping the organization achieve its business objectives: **deposits, regular time deposits, and loans**. These processes are depicted in the **Business Architecture** using ArchiMate and are explained as follows.

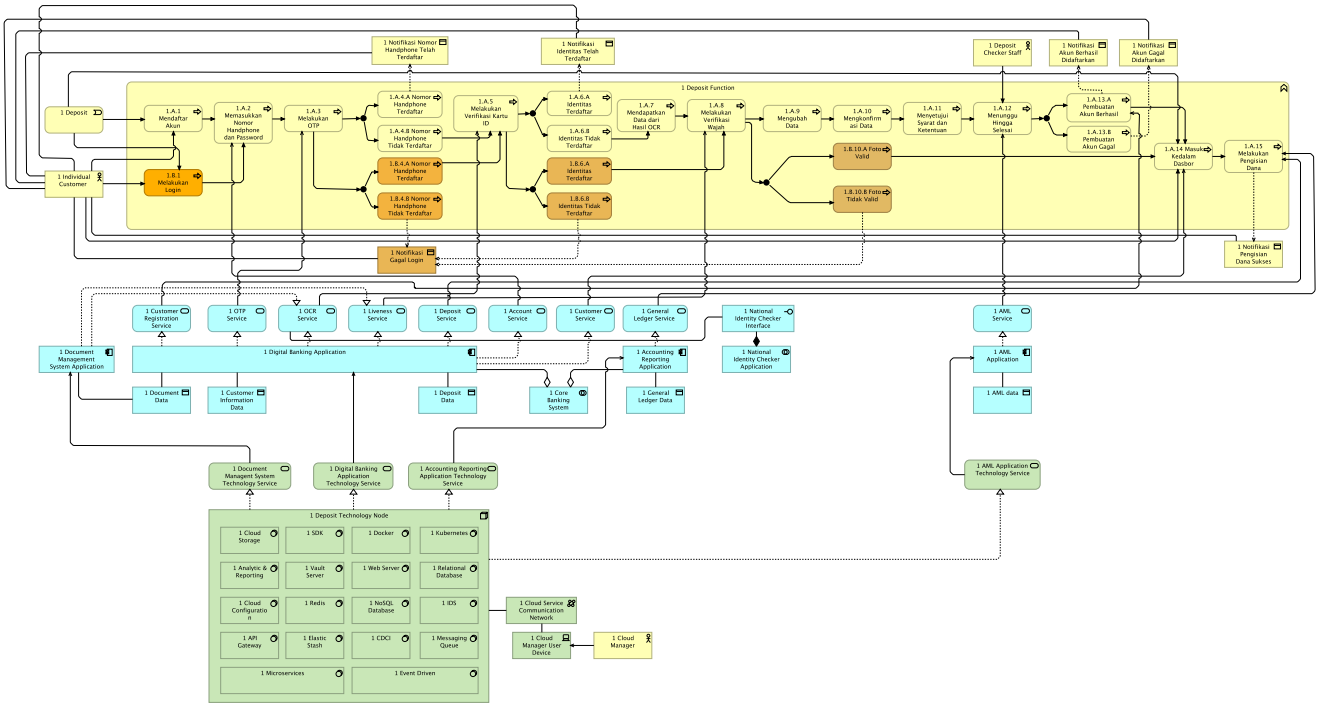

Figure 5. Deposit Business, Data, Application and Technology Architecture

The **business architecture for deposits**, shown in figure 5 using ArchiMate, highlights three main processes: account creation, login, and dashboard access, leading to fund deposits via the digital banking app.

In **account creation**, new users provide their mobile number and password, verified through OTP, followed by identity card verification via OCR and cross-checking with the national database. After verifying a self-photo and personal data, the account enters a waiting period for staff re-verification of identity and blacklist checks. Successful verification grants dashboard access.

For **login on a new device**, users must re-verify their mobile number, identity card, and photo before accessing the dashboard.

Existing **users not transferring to a new device** can **directly access** the dashboard. Deposits are transferred from the initial bank to the digital bank, with successful transactions triggering a notification.

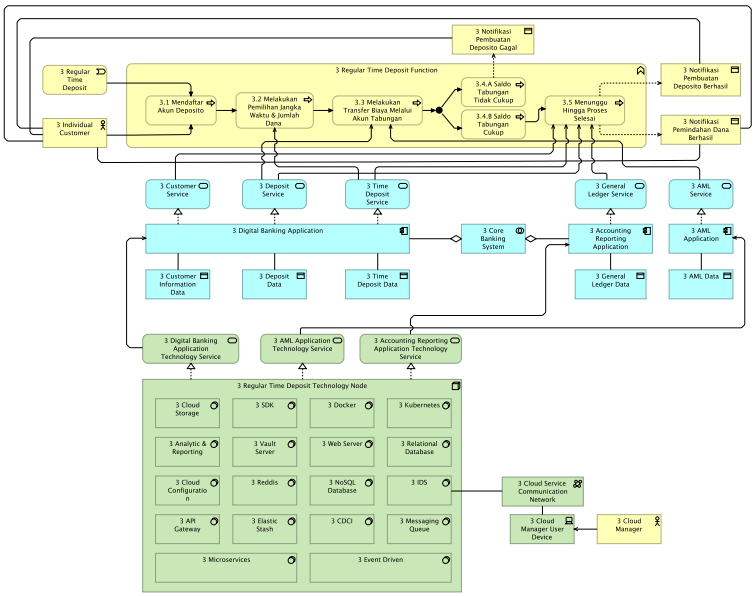

Figure 6. Regular Time Deposit Business, Data, Application, and Technology Architecture

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The **business architecture for regular time deposits** outlines the customer journey for creating a time deposit using a digital banking application. The process begins with the user registering a deposit account, selecting the deposit term, and entering the deposit amount. The user then transfers the required funds from their savings account. If the balance is sufficient, the process moves to a waiting period while the account is created. Upon completion, the user receives two notifications: one confirming the deposit creation and another confirming the successful transfer of funds.

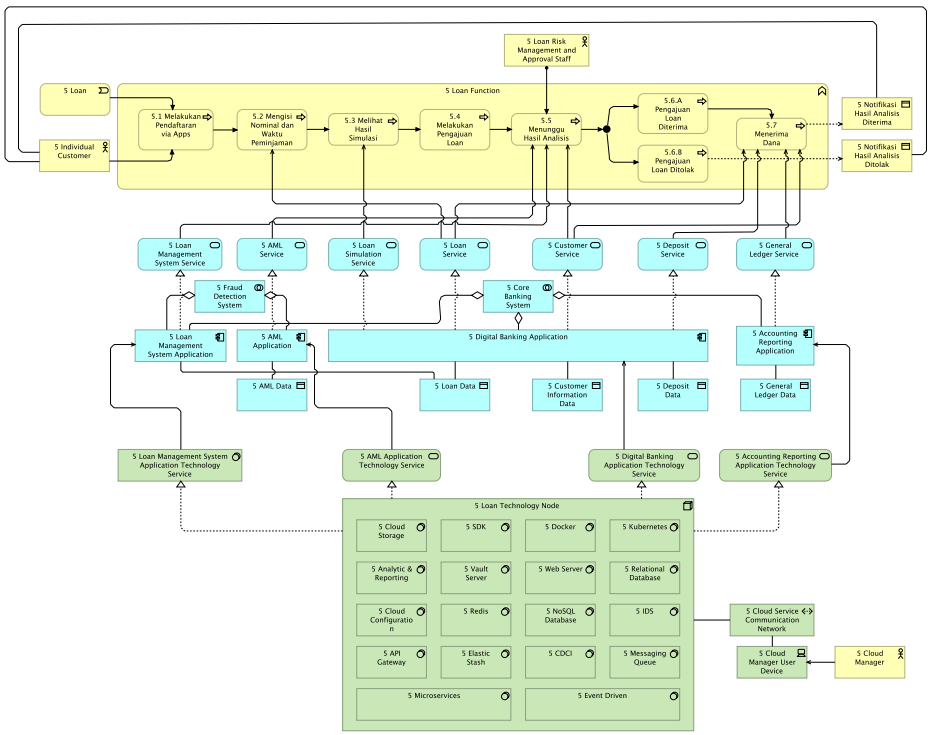

Figure 7. Loan Business, Data, Application, Technology Architecture

The **business architecture for loans** outlines the customer journey for obtaining a loan through a digital banking application. The process begins with the customer applying for a loan via the app, entering the desired loan amount and repayment term. The customer then runs a loan simulation to assess the potential loan terms. If satisfied, they proceed with the loan application. The loan request is then analyzed by the loan risk management and approval staff. If approved, the funds are transferred to the customer's savings account, and a notification confirming the loan approval is sent to the customer. If not approved, the customer receives a notification stating that the loan application was rejected.

The next phase, **Information System Architecture**, details the applications, services, and data that consolidate to support the processes within the business architecture. This phase includes two architectures: **22 notations for application architecture** and **7 notations for data architecture**, which are explained sequentially in the following table.

Table 4. List of Information System Architecture Notations

Notation	Documentation
Loan management system application component	An application where officers conduct screening of loan applications submitted by digital banking app users.
AML application component	An application that detects financial fraud, used to ensure the security of digital banking.
Digital banking application component	An application that serves as a core component supporting the overall digital banking business, providing value to both the organization and its customers.
Accounting reporting application component	An application that records accounting entries for every transaction made by customers, including fee payments and other related transactions.

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Document management system technology service	A supporting application for other system components focused on processing and encrypting critical operational documents in digital banking. In this case, the documents processed and used include identification cards and user photos.
Notation	**Documentation**
Fraud detection system application collaboration	The collaboration between the AML application and the loan management system is focused on verifying loan applications to prevent fraudulent activities related to the loan functions within the digital banking application.
Core banking system application collaboration	A collaboration involving core banking systems, including digital banking applications, loan management systems, and accounting reporting applications, which work together for reporting and recording in the general ledger.
National identity checker application interface	A service in the form of an API interface, developed and maintained by the government, to validate the authenticity of data generated by OCR.
Customer registration application service	An application service that manages data and processes during customer registration for digital banking.
OTP application service	A service with features to generate OTPs and validate them during account registration and login processes.
OCR application service	A service within the application that validates identity card photos using OCR to ensure user authenticity and prevent account duplication, as each account can only use one phone number and one identity card.
Liveness application service	A service used to validate photo processing during registration and login, with the primary function of ensuring user authenticity.
Account application service	A service that encompasses all processes for maintaining account functions in digital banking, used for login and data verification.
Time deposit application service	A service that supports the entire deposit process, from creation and management to the deposit's maturity.
General ledger application service	A service used to process and input transaction data, with the final output being a report generated according to specified requirements.
Loan management system application service	A function within the loan system that connects staff with the system and data entered by digital banking users, facilitating the screening process for loan applications.
AML application service	A service that handles financial record-keeping and the detection of fraud and money laundering, aimed at preventing adverse events related to digital banking operations.
Loan simulation application service	A service that provides a simulation to assist users in calculating desired loan terms, based on the parameters of loan duration in years and the amount borrowed.
Loan application service	A service dedicated to processing loan-related tasks, such as interest calculations, applications, due dates, and other related functions.
Customer application service	A service used to manage customer personal data, such as CIF and other important information.
Deposit application service	A service used for all processes related to deposits or savings for each customer or user in digital banking.
Document data	A storage location for OCR-processed identity card (KTP) documents and user liveness photos, used by the document management system and digital banking application to validate user authenticity.
AML data	A repository where AML data is stored and used by the AML application.
Loan data	A repository where loan data is stored and accessed within the loan management system and digital banking application to support operations.
Customer information data	A storage location used to store customer personal information data, or CIF.
Deposit data	A repository where data related to the deposit process is stored, used by the digital banking application.
General ledger data	A repository for storing banking transaction data for bookkeeping or the general ledger.

Phase D in TOGAF, known as Technology Architecture, represents the use of technology in digital banking applications to support operational performance through networks, infrastructure, and development-supporting technologies. A total of 26 technology architecture components or notations have been identified, which are explained in the following table.

Table 5. List of Technology Architecture Notations

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Notation	Documentation
Loan management system application technology service	The use of cloud technology in the loan management system application.
AML application technology service	Technology that supports applications such as networking, security, storage, and configurations by utilizing cloud technology for the AML application.
Digital banking application technology service	A set of technologies within cloud services that support the performance of digital banking applications.
Accounting reporting application technology service	Represents various technologies used to support the performance of accounting reporting applications by leveraging cloud services, including integrated networking.
Document management system technology service	Technologies within cloud services and networking designed to support the operations of the document management system application.
Cloud service communication network	Technology representing the communication between technologies and applications, where all applications focus on utilizing cloud technology to support organizational activities.
Cloud manager user device	Users with the rights to access, control, monitor, and configure cloud services using devices such as smartphones, computers, laptops, and other equipment.
Technology node	A collection of technologies used in the operation of digital banking applications and services.
Notation	**Documentation**
Cloud storage system software	Describes a part of the cloud used for storing physical data such as images, documents, and other files within cloud services, which can be accessed by applications at any time.
SDK system software	A library (Software Development Kit) that enables an application to be readable on existing systems and runnable within the cloud instance in use.
Docker system software	Docker container technology in applications and services, supported by cloud computing, streamlines the virtualization of applications running on the same operating system. This technology enables efficient vertical and horizontal scaling, adapting to varying conditions and requirements.
Analytic and reporting system software	Functions to analyze data such as customer habits and behavior, application performance, testing, debugging, detection, and troubleshooting through application logs, as well as software maintenance and trend development in big data. Reporting is used to generate analysis and monitoring based on specific timeframes, such as daily, weekly, monthly, and yearly.
Vault server system software	A technology that stores various forms of data online, such as global parameters, application credentials, and other critical information. This storage enhances the efficiency, effectiveness, and security of data usage, including application settings, secret codes, and data lists in key-value format.
Web server system software	A technology used to run applications or services on a web server, making them publicly accessible, but equipped with security measures to protect against potential attacks.
Relational database system software	A storage location for structured data utilizing cloud features, crucial for supporting the operational performance of digital banking.
Cloud configuration system software	Technology is a platform used to configure connections, access, and other settings related to the use of existing cloud services.
Redis system software	Functions to temporarily store data using cache, making data processing faster, more effective, and efficient. Redis is ideal for use when the data is frequently accessed repeatedly.
NoSQL system software	Represents cloud service software used to process unstructured data, such as JSON and other documents. This data can then be analyzed to identify or understand trends among customers.
IDS system software	A system used to detect suspicious or unauthorized activities within a computer network or information system. An IDS (Intrusion Detection System) operates by monitoring and analyzing network traffic and system logs to identify signs of attacks or suspicious behavior. In this context, IDS is employed to examine penetration attempts against API systems and services in digital banking.

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API gateway system software	Software technology provided by cloud providers as an API gateway, supporting the performance of all applications by centralizing access and managing security configurations.
Elastic stash system software	Three core tools such as Elasticsearch, Logstash, and Kibana integrated to process, store, and visualize large-scale data sets, commonly used in big data environments.
CD/CI system software	Software technology that combines Continuous Integration (CI) and Continuous Delivery (CD) to enhance efficiency and quality in software delivery.
Messaging queue system software	A part of the technology node used in digital banking to process various tasks such as logging, AML data recording, and writing data to the general ledger. This messaging queue serves as a container for asynchronous data transmission.
Microservices system software	Software development technology used in digital banking, where applications are built as a collection of small, independent services. Each service is responsible for a specific business function and can be developed, tested, and deployed separately from other services.
Event driven system software	Software development technology focused on communication and coordination between components or services within a system through event exchange. These events operate asynchronously using messaging and streaming types.

In Phase E, Solutions and Opportunities, solutions and opportunities are depicted using ArchiMate based on the findings from the previous TOGAF phases. Through prior observations and interviews, several solutions and opportunities were identified using a SWOT analysis, which is explained from four perspectives.

Table 5. SWOT Analysis Result

Strength	Weakness	Opportunities	Threats
1. Low Operational Costs 2. Strategic Partnerships 3. Strong Digital Security and Technology 4. High Scalability 5. Enhanced User Experience 6. Flexibility in Product Releases 7. Focus on Continuous Innovation	1. Dependence on Technology 2. Limited Reach to the Technologically Unaware Population 3. Operational Risks from Third-Party Providers 4. Digital Banking Security Risks 5. Limited Availability of Expert Resources	1. Product and Service Innovation 2. Integration into Ecosystems 3. Expansion into New Markets 4. Effective Data Utilization 5. Creation of New Revenue Streams 6. Development of a Digital Ecosystem 7. Increased Customer Trust 8. Providing Financial Management Recommendations	1. Strict Regulatory Changes 2. Increasing Competition 3. Economic Volatility and Market Uncertainty in Indonesia 4. Rapid Technological Evolution 5. Cyber Attacks

Based on the four aspects of the SWOT analysis above, it is recommended to **strengthen the security** of the digital banking environment by regularly reviewing the business impact analysis, investing in cybersecurity tools, training employees to raise awareness, using high-level encryption, and enhancing real-time IDS monitoring. **Regular security audits, including penetration testing**, should be conducted to identify and fix vulnerabilities before any attacks occur. **Address competition** by offering new, unique features that are difficult to replicate, such as varied promotions, investment services, digital insurance, online loans, personal finance management, and partnerships with other industries. Leverage **AI and data analytics** to identify predictions and trends. Managing third-party dependencies cannot be eliminated, but ensuring quality results requires clear agreements, reviewing security and reputation, and maintaining backup providers as contingencies. **Studying and adopting relevant new technologies** can improve transaction speed and enhance security in digital banking applications, informed by successful trends from other countries.

DISCUSSIONS

To address the three research questions, detailed explanations were provided in the research discussion. This section offers a brief summary.

For the first question, information was gathered through a literature review of previous research on enterprise architecture, with a focus on TOGAF. Primary data was collected via interviews and observations of digital

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banking providers in Indonesia. The architecture was then designed using the TOGAF ADM phases from A to D, visualized with ArchiMate, and supported by a SWOT analysis in Phase E, resulting in an architecture blueprint.

For the second question, data was similarly collected through interviews and observations, complemented by a literature review to gain scientific insights into enterprise architecture, particularly in the context of TOGAF for digital banking in Indonesia. The study identified three core processes deposits, regular time deposits, and loans which were mapped in the business architecture. The findings included 29 information architecture notations and 26 technology architecture notations, all represented using ArchiMate.

For the final research question, based on the SWOT analysis covering strengths, weaknesses, opportunities, and threats, recommendations were made for the development of digital banking providers in Indonesia. These include adopting new technologies, managing dependencies on third parties, addressing existing business competition, and enhancing resilience in the digital banking environment by focusing on prevention and mitigation to ensure continued operations in the face of potential threats.

CONCLUSION

An effective enterprise architecture not only helps digital banks manage the complexity of IT systems and business processes but also ensures their ability to quickly adapt to global market changes while continuing to deliver innovative and secure services to customers. Digital transformation has significantly impacted Indonesia's banking industry, leading to the rise of digital banks that rely entirely on technology for their operations and services. By applying the TOGAF framework and ArchiMate modeling, this study successfully identified five core processes essential to the operations of digital banks: deposits, special deposits, regular time deposits, fees, and loans. These processes are depicted in a structured enterprise architecture, enabling digital banks to efficiently and consistently align their business strategies with daily operations.

The SWOT analysis in this study reveals that digital banks have strengths in operational efficiency and strategic partnerships, providing them with a competitive advantage in the market. However, the study also identifies significant weaknesses, such as a high dependency on technology and challenges in reaching less tech-savvy populations. Additionally, opportunities for product innovation, market expansion, and ecosystem integration are highlighted as areas digital banks can leverage for further growth. Conversely, threats like regulatory changes, increased competition, and cybersecurity risks must be carefully managed to maintain the stability and sustainability of digital banks.

In response to these findings, the study recommends the adoption of relevant new technologies, improved third-party risk management, and enhanced customer data security and privacy as critical steps to strengthen the competitive position of digital banks.

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