

DEVELOPING ENTERPRISE ARCHITECTURE FOR BPRACO SMEs DIGITAL TRANSFORMATION BY USING TOGAF 10

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Abstract

Organizations must embrace emerging technology through Digital Transformation (DT) to remain competitive in the digital revolution era. While previous research has highlighted the critical role of DT strategy and architecture in driving DT success in large banks, these insights have not been thoroughly tested in small-scale banks. Small and medium-sized enterprise (SME) banks like BPR often encounter significant challenges in the DT journey, including limited infrastructure, reliance on outdated and poorly integrated systems, and slow technology adoption. These barriers hinder their ability to support the DT initiatives necessary for thriving in the digital age. This study aims to develop an enterprise architecture blueprint tailored to support DT in BPRACo, an SME-scale bank. The research follows a five-stage Design Science Research (DSR) methodology, encompassing problem explication, requirement specification, design and development, demonstration, and evaluation. Data were collected through semi-structured interviews, validated through document triangulation, and analyzed using the TOGAF 10 framework, covering phases from preliminary planning to migration. The resulting blueprint was integrated into BPRACo's DT Strategy for 2024-2026. This research enhances the understanding of enterprise architecture's role in DT within the context of SME banks. It offers practical guidance for BPRACo and similar institutions to implement prioritized enterprise architecture artifacts, facilitating a successful DT journey.

Keywords: BPR, Digital Transformation, Enterprise Architecture, TOGAF, SMEs

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1. INTRODUCTION

In the era of the digital revolution, organizations are required to adapt to digital technology disruption through Digital Transformation (DT) [1]. DT is defined as "a fundamental change process with innovative use of digital technologies accompanied by strategic utilization, resources, and key capabilities to radically improve an entity (e.g., organization, business network, industry or society) and to redefine the value proposition for stakeholders" [2]. DT is needed as a strategy to improve services and efficiency in organizational business processes [3]. DT in organizations can begin by implementing IT Governance to achieve alignment between business and information technology (IT). Therefore, IT Governance (ITG) plays a crucial role in ensuring the success of DT [4]. ITG is defined as "a structure,

process and relational mechanism for business and IT stakeholders to carry out their responsibilities in aligning business and IT and creating and protecting IT business value" [5].

The findings from a research literature review explained that the structural, process, and relational mechanisms of ITG play a crucial role in supporting DT efforts by directing and controlling the use of IT [6]. While ITG mechanisms positively impact organizations, they have not yet shown an evident influence of DT on organizational performance (OP) [6]. Subsequently, to address this issue, Mulyana et al. [7] conducted a study in large banks to measure the extent to which traditional and agile/adaptive ITG mechanisms influence DT and OP. Their research provided insights into the ambidextrous ITG mechanisms that moderately impact DT while DT significantly influences OP.

ITG within organizations is essential to ensure alignment between their strategic, tactical, and operational' initiatives. This requires an IT architecture encompassing technology, information, applications, and business processes [7]. Moreover, previous research has found the importance of IT service-based enterprise architecture based on ITIL and TOGAF frameworks [8]. In addition, IT governance mechanisms that influence DT and OP specifically for the banking sector have been found [9]. These findings were further expanded by examining various DT influence models in subsequent studies [10], [11]. Furthermore, prior studies also found the importance of IT service [12], IT risk [13], information security [14], and DevOps mechanisms [15] to support DT in large banks, based on COBIT 2019 framework in specific focus areas. There is also research focused on the case of successful DT at a large bank [16] and continued with the findings that enterprise strategy and architecture are important key ambidextrous ITG for DT success in the context of banks and insurance [17]. However, there is still a knowledge gap in the context of enterprise architecture importance in small and medium enterprises (SMEs) organizations' scale, in particular small banks.

Adopting appropriate IT and digital technology provides numerous advantages for SMEs including the potential to enhance efficiency and productivity [18]. DT of SMEs can be done by using IT to improve public services through faster and more accurate data and information management [19]. Based on research by Alfaro-Mendoza & Aguilar-Alonso [20], the significance of SMEs for the global economy is emphasized. In Europe, for instance, countries consider SMEs the foundation of their economies, with 23 million SMEs representing 99.8% of all businesses in the region. One of the key factors influencing the development and competitiveness of SMEs is the low adoption of IT. Given the low adoption of IT, enterprise architecture can serve as a reference to help align business and IT capabilities with crucial aspects of evolution, business, and IT [20].

This study focuses in Indonesia as the research location because it is the only ASEAN country member of the G20 and is projected to experience significant digital economic growth, from USD 44 billion in 2020 to USD 124 billion in 2025. Additionally, the financial sector in Indonesia has a promising market for digital banking services [21]. "Bank Perekonomian Rakyat" (BPR) is an Indonesian banking institution that conducts its business and operations conventionally and cannot provide payment traffic services [22]. In this research, BPRACo was chosen as a case study because it is focusing on digital transformation, which is considered important to improve competitiveness and operational efficiency in the face of changes in the financial industry. BPRACo has been operating since 1991 and took corporate action in 2023. With the

corporate action with the three BPRACo groups, the scope of the bank's business will expand, and product innovation and customer service will be optimized. BPRACo plays a significant role in supporting financial inclusion at the local level. BPRACo offers various banking products and services, including savings, loans, deposits, and digital banking services. The company's primary focus is to provide quality customer service, aligning with management's commitment to grow with SMEs. BPRACo regularly optimizes technology to improve services for customers and employees. Currently, BPRACo has 10 branch offices and 1 cash service office.

The Financial Services Authority's (OJK) Master Plan for the Financial Services Sector 2021-2025 emphasizes the importance of resiliency and competitiveness, the development of the financial services ecosystem, and the acceleration of digital transformation in Indonesia's financial services sector [23]. This is aligned with POJK No.75/POJK.03/2016 and SEOJK No.15/SEOJK.03/2017, which set the standards for IT implementation in BPR [24], [25]. Referring to these IT regulations, BPRACo has an IT strategic plan to leverage IT for operational support, including developing digital financial products. This indicates that BPRACo requires DT to support its operations. Furthermore, UU No. 4 of 2023 on Financial Sector Development and Strengthening (P2SK) also supports the development of BPR/BPRS for the better, one of which is by conducting DT. To realize this, BPR can cooperate with commercial banks or other financial service institutions [26]. BPRACo needs to design and recommend an IT architecture solution to improve the effectiveness and efficiency of its operations and achieve DT success.

Enterprise architecture (EA) is a framework that can be used to design the DT for BPRACo SMEs. EA aims to bridge the gap between stakeholders and Information Technology (IT) and improve business and IT alignment [27]. EA can design and create artefacts for business process modelling, enabling the integration of business and IT strategies for implementing DT [28]. The Open Group Architecture Framework (TOGAF) is an EA framework developed through collaborative efforts within the community [29]. TOGAF is open source and flexible, facilitating the creation of a consistent EA that reflects organizational needs. The TOGAF 10 makes it easier to adopt stable best practices and emerging ideas [29].

This research will focus on developing EA for DT UMKM BPRACo using the TOGAF 10 framework and aims to answer the following research questions: How is the preparation of enterprise architecture solution recommendations based on the results of the assessment gap analysis on the scope of business processes and artefacts TOGAF 10 priorities for the digital transformation of BPRACo SMEs? How is the design of an enterprise architecture blueprint and DT Strategy based on TOGAF 10 prioritized for the digital transformation of BPRACo SMEs? This aims to

produce an EA blueprint and DT Strategy that can guide BPRACo SMEs and other similar organizations in achieving DT success.

2. RESEARCH METHOD

This research is based on a conceptual model. In the research process, the design science research (DSR) framework is adopted as a problem-solving framework. DSR can explain the performance of research with design science in information systems so that it has clear guidelines for understanding, carrying out and evaluating research through a conceptual model [30].

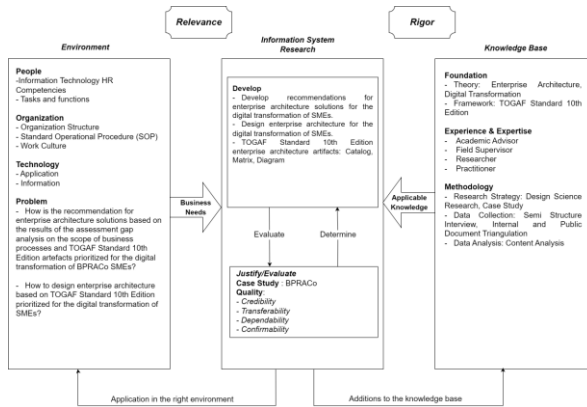


Figure 1. Conceptual Model (Adapted from DSR Hevner [30])

Figure 1 is the framework of the conceptual model adapted from Hevner. The model has three elements: environment, Information System (IS) Research, and knowledge base [30]. This conceptual model can define the problem, identify relevant factors, and form relationships between elements to facilitate understanding of the core problem.

The following research process was used to produce recommendations for enterprise architecture solutions for the digital transformation of BPRACo SMEs.

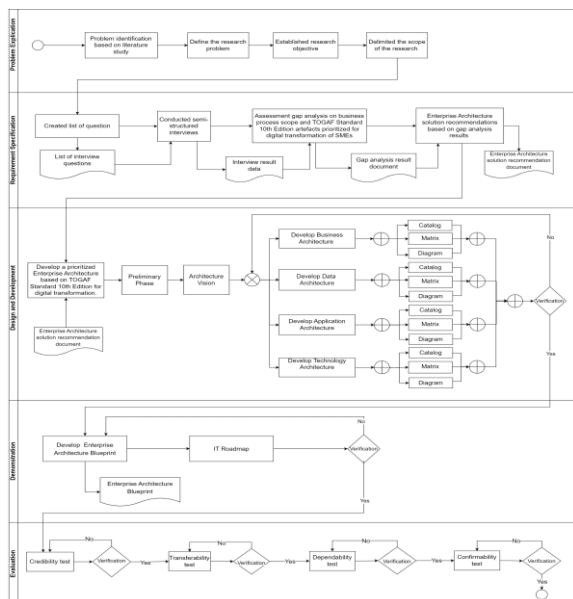


Figure 2. Research Process

Figure 2 shows five stages of DSR: problem explication, requirement specification, design and development, demonstration, and evaluation.

2.1 Data Collection

Data collection is carried out to obtain valuable information during the research. This study collects two types of data: primary and secondary.

1. Primary data

This research used semi-structured interviews to obtain primary data because this method makes it possible to explore organizational needs in-depth [31]. Before the interview, we sent a research request letter and received feedback in the form of a research acceptance letter. Interview activities were conducted offline for two days at the BPRACo head office and online through the Microsoft Teams platform. The meetings were recorded for transcription. Interviews were conducted until data saturation was achieved [32]. That is, interviews were conducted until no new significant information was discovered. To achieve data saturation for this research, we conducted several rounds of interviews to ensure comprehensive coverage of the topic [32]. Semi-structured interviews were conducted with three representatives from BPRACo. Table 1 shows the primary data obtained.

Table 1. Primary Data

Respondents	Position	Discussion	Date & Duration
Interviewee 1	IT Manager	Issues related to Digital	March 14 - 15, 2024 (Onsite)
Interviewee 2	IT Staff	Transformation	(09.00 – 16.00)
Interviewee 3	Business Staff	Existing business processes	April 26 and June 20, 2024 (Online)
Interviewee 2	IT Staff		(10.00 – 11.00)
Interviewee 3	Business Staff		

Regarding the interview results, interviewee 1 said, “BPRACo will always need digital transformation to improve banking operational services. Digital Transformation will improve operational efficiency, enhance customer service, and enable BPRACo to remain competitive in an ever-evolving market [33].” Based on this statement, BPRACo needs to transition from some conventional activities to digital ones to improve customer efficiency. Interviewee 2 also conveyed this: “Then, BPRACo also always reflects on commercial banks, such as services. Nowadays, customers have started to switch to gadgets. Banking activities are expected to be carried out through gadgets and digitally based. [33].”

2. Secondary data

Secondary data was collected through internal and public document triangulation to gain more

information and a comprehensive understanding of the data. Table 2 shows the secondary data used.

Table 2. Secondary data

Data Type	Data
Secondary Data	Organizational Structure. Annual Report. Strategy Plan. Hardware and software documents. IT Implementation SOP. BPRACo Official Website.

2.3 Analysis and Design of Artefact

Data processing or artefact design is a stage that provides an overview of the plans, processes, activities, or techniques for processing and analyzing data. The artefact design was carried out using the TOGAF ADM method. TOGAF ADM has several phases in building architecture. All of these EA design activities are carried out in a cycle [29].

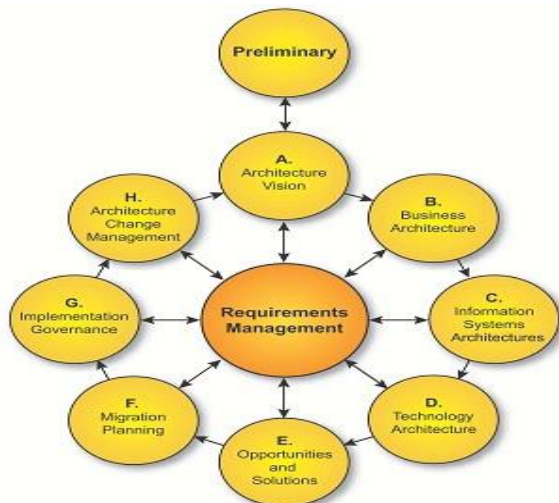


Figure 3. Architecture Development Cycle [29].

Figure 3 shows 9 (nine) phases that are passed in doing development and design architecture. Based on the analysis results, EA solution recommendations will be identified by following the TOGAF ADM phases, from the preliminary phase to migration planning. According to [34] data processing and artefact development in SMEs can be done as follows:

Table 3. Analysis and Design of Artefact

Architecture Phase	Analysis and Design of Artefact
Preliminary	Define Organization Identify the Architecture Type. Select the Modelling Language Identify Stakeholder
Architecture Vision Architecture Development	Baseline Enterprise Architecture Target Enterprise Architecture 1. Business Architecture 2. Application Architecture 3. Data Architecture 4. Technology Architecture
Perform Gap Analysis	Perform Gap Analysis: Baseline Enterprise Architecture Target Enterprise Architecture

Project Recommendation	The results of the gap analysis determine project recommendation. 1. Opportunities and Solutions 2. Migration Planning
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3. RESULT AND DISCUSSIONS

3.1 Preliminary Phase

The preliminary phase is the initial stage of an enterprise architecture design using the TOGAF framework. The purpose of this preliminary phase is to provide a foundation for defining and designing architectural capabilities based on the business needs of BPRACo. In the preliminary phase, a principle catalog guides each phase of designing enterprise architecture. Table 4 is the principles catalog used in designing BPRACo architecture.

Table 4. Principle Catalog

Architecture	Principle
Business Architecture	Primacy of Principle Maximize Benefits to the Enterprise Business Continuity Service Orientation IT Responsibility Compliance with Law
Data Architecture	Data is an Asset Data is Shared Data Accessible Data Trustee Common Vocabulary and Data Definitions Data Security
Application Architecture	Technology Independence Ease-of-use
Technology Architecture	Requirements-Based Change Responsive Change Management Interoperability

3.2 Architecture Vision

Architecture Vision defines the scope, stakeholders, and vision of the architecture. Architecture vision aims to describe the design of EA at BPRACo towards the development of capabilities and business value at a high level. The resulting artefacts are the value chain diagram, solution concept diagram, and business capability model.

The Value Chain Diagram defines the activities carried out at BPRACo. These activities consist of primary activities and support activities. This research focuses on the primary activity and operational services and is supported by information technology. Figure 4 is a Value Chain Diagram BPRACo.



Figure 4. Value Chain Diagram

The solution concept diagram describes the proposed information technology solutions in the company that can be used as a reference in

implementing EA to fulfill BPRACo needs in operational services. Figure 5 is a solution concept diagram of BPRACo operational services.

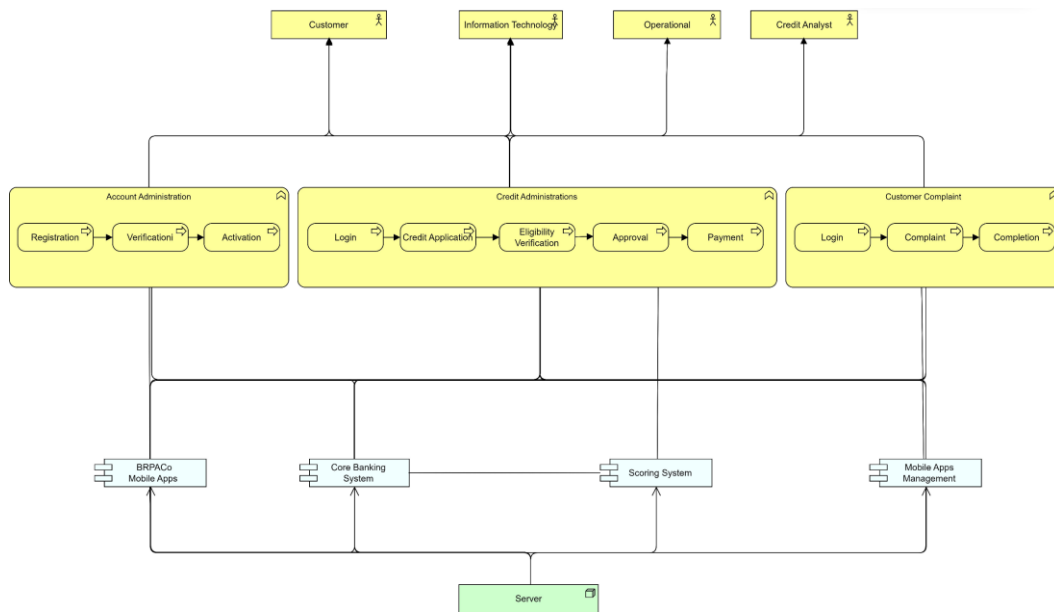


Figure 5. Solution Concept Diagram

A business capability model is a diagram showing a company's capabilities or abilities to run its business to achieve specific goals. Table 5 is a business capability model.

Table 5. Business Capability Model

Strategic	Business Planning	Market Planning	Vendor Management
	Capital Management	Regulatory Compliance Management	
Core	Funding	Lending	
Support	Financial Management	IT Management	Operations Management
	HR Management	Asset Management	

3.3 Business Architecture

Business Architecture is a stage to determine and design business activities that will be the target of the company, to improve ongoing business processes. With business architecture, it can achieve the company's desired business strategy.

In BPRACo operational services, a Business Service/Function Catalog describes business services based on primary and support activities at BPRACo. Table 6 is a business service/function catalog of BPRACo operational services.

Table 6. Business Service / Function Catalog

Services	Business Process
Account Administration Service	Bank Account Registration
	Credit Application

Credit Administration Service	Credit Payment
Customer Complaint Service	Customer Complaint

3.4 Data Architecture

Data architecture is a phase that contains a draft solution or target for data architecture. The goal is to define the data used today and the data needed by BPRACo in the future.

Application/Data Matrix is an artefact that describes the relationship between applications, data entities, and data types used in BPRACo operational services. Table 7 is the application/data matrix.

Table 7. Application/Data Matrix

Application Component	Entity	Type
Core Banking System	Customer	Master Data
	Account	Master Data
	Transaction	Transactional Data
	Credit	Transactional Data
	User Management Report	Master Data Transactional Data
Mobile Apps Management	Customer	Master Data
	Mobile Apps	Master Data
	Account	
	Products and Services	Transactional Data
	Credit Approval	Transactional Data
	User Management Complaint	Master Data Transactional Data

BPRACo Mobile Apps	Mobile Apps	Master Data
	Account	Master Data
	Customer	Master Data
	Interaction History	Transactional Data
	Product and Service	Transactional Data
Scoring System	Credit Approval	Transactional Data
	Credit	Transactional Data
	Analysis Result	Transactional Data
	Risk Criteria	Master Data
	User Management	Master Data

Based on the application/data matrix defines that the data entities used will be integrated into each application. This is depicted in the conceptual data diagram.

A Conceptual Data Diagram is an artefact that describes the relationship between data entities. It is represented using an Entity Relationship Diagram (ERD) that focuses on BPRACo operational services. Figure 6 is a conceptual data diagram of several applications, including the core banking system, mobile app management, BPRACo mobile app, and scoring system.

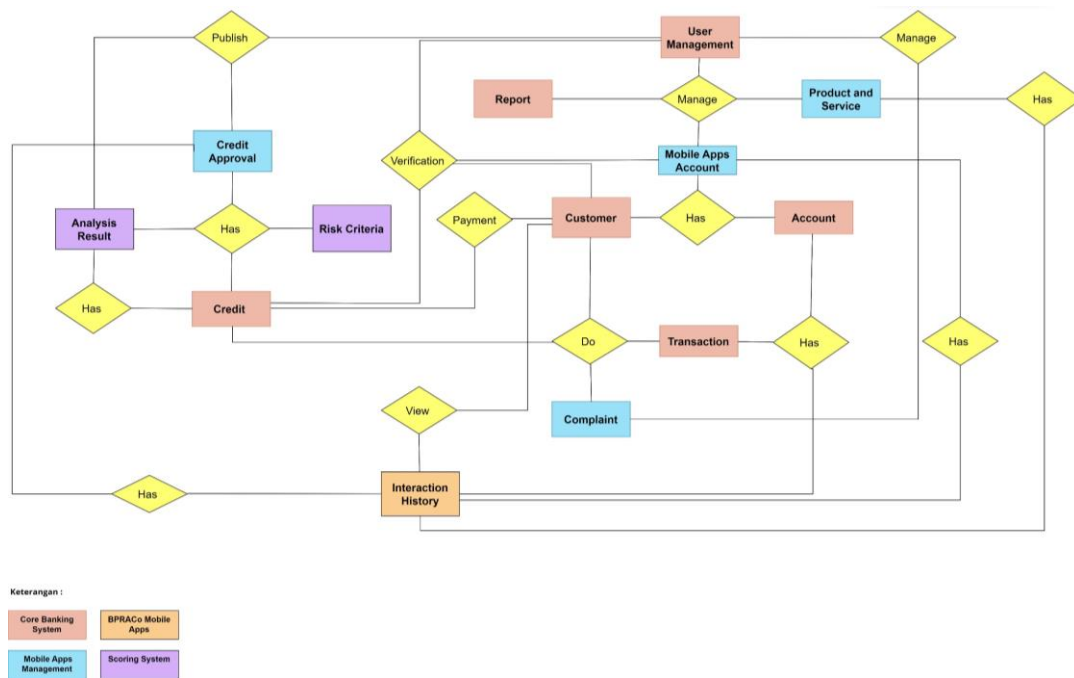


Figure 6. Conceptual Data Diagram

3.5 Application Architecture

Application Architecture is the phase that defines the application needs in business activities. This application architecture supports BPRACo operational activities through application development to maximize services. The produced artefacts include the application portfolio catalog and application communication diagram.

Application Portfolio Catalog is an artefact that defines the applications used today and the target applications that will be developed at BPRACo. Table 8 show an application portfolio catalog of BPRACo operational services.

Table 8. Application Portfolio Catalog

Application Component	Description
Core Banking System	Applications are used to manage various banking operations in an integrated system and can manage data based on the results of core banking processes.
Mobile Apps Management	Applications are used by user management to manage administrative and service activities

BPRACo Mobile Apps	performed by customers on mobile apps and are integrated with the core banking system. The mobile applications facilitate customers access to various banking services and administration in one integrated platform.
System Scoring	The application is used by companies to assess creditworthiness based on several specific criteria or parameters.

Based on Table 8, there are BPRACo mobile apps and mobile apps management as target applications that are solutions in improving the effectiveness of company operations. BPRACo mobile apps and mobile apps management are two applications that have different functions and purposes. BPRACo mobile apps are used by customers as external companies to carry out various banking activities such as Bank Account Registration, Credit Application, Credit Payment, and Customer Complaints. The aim is to increase the convenience and ease of customers in accessing banking services. Meanwhile, mobile apps management can only be used by internal companies to manage, monitor and analyze activities carried out

by customers through BPRACo mobile apps. The purpose of mobile apps management is to ensure that all activities carried out by customers run safely, efficiently, and by company policies.

Furthermore, the application is depicted in the Application Communication Diagram as an artifact that describes the relationship between physical applications. The application communication diagram shows that the applications are interrelated.

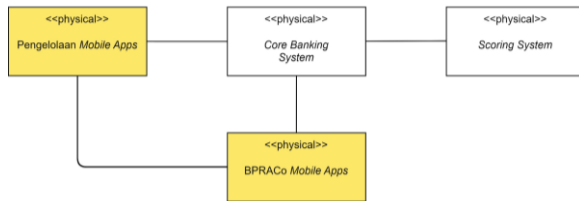


Figure 7. Application Communication Diagram

Based on Figure 7 shows that there are target applications, namely BPRACo mobile apps and BPRACo mobile apps management, that can communicate with other applications.

3.6 Technology Architecture

Technology Architecture is a phase that contains the design of technology solutions or targets in technology architecture. The goal is to support data and application architecture to maximize services. This technology architecture consists of software, hardware, and network infrastructure at BPRACo. The produced artefacts include the technology standards catalog.

Technology Standard Catalog is an artefact that describes the ideal standard of technology use in BPRACo. This catalog consists of logical technology components that identify platforms. Then, there are physical technology components that identify technology components and standards. Table 9 is a technology standard catalog BPRACo.

Table 9. Technology Standard Catalog

Logical Technology Component	Physical Technology Component	
Platform	Technology Component	Standard
Application Server	Server	CPU E5-2407 0
	OS Server	Ubuntu
		Windows Server
		Window XP
Data Distribution	Database Server	MySQL
	Web Server	Apache
	Cloud	Google Cloud Platform
Security	Router	Router Cisco
	Switch	Switch Cisco
	Firewall	Firewall Pfsense
	Anti-Virus	Malware ClamAV
	VPN	Wide Area Network
Client platform		- VPN-IP
		- VPN Instant
		- Dial-Up
	Handphone	Android/IOS
	PC/Laptop	Desktop/Notebook

Logical Technology Component	Physical Technology Component	
Platform	Technology Component	Standard
	OS client	Android/IOS, Windows
Data	Mail Server	Gmail
Transaction	Internet	60Mbps
Integration	API	XML

3.7 Opportunities and Solutions

Opportunities and Solutions is a TOGAF ADM phase that aims to identify opportunities from the previous enterprise architecture design model. The results of the previous phase are the basis for creating opportunities and solutions.

Project Context Diagram is a diagram that describes the relationship between the project and external elements that affect the development of enterprise applications. The following Figure 8 and Figure 9 are project context diagrams of BPRACo mobile apps and mobile apps management.

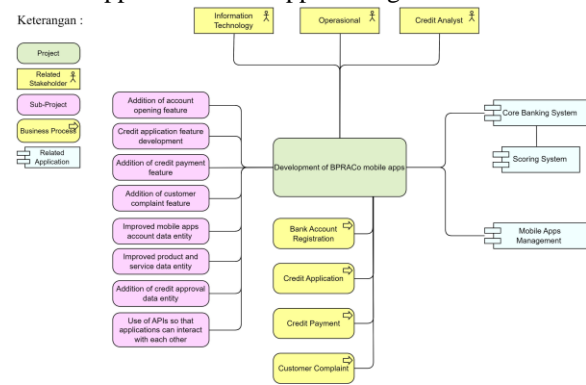


Figure 8. Project Context Diagram BPRACo Mobile Apps

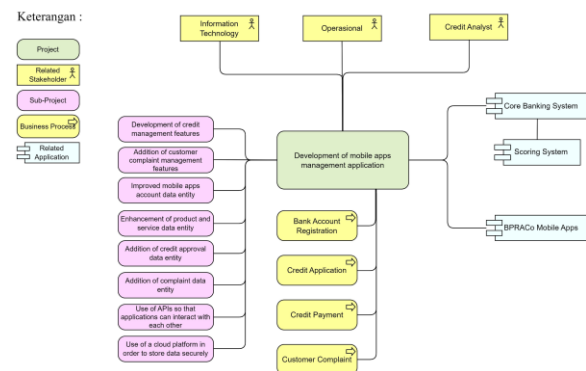


Figure 9. Project Context Diagram Mobile Apps Management

3.8 Migration Planning

Migration Planning describes the planning of the target architecture in detail so that it can be implemented properly in accordance with the company's objectives. There is a business value assessment and an DT Strategy for project implementation.



Figure 10. Business Value Assessment

Figure 10 show a business value assessment BPRACo. The business value assessment identifies and analyzes the potential business value and risks resulting from the proposed solution architecture by implementing the project.

Table 10. DT Strategy

Project	Period								
	2024		2025			2026			
	Q	Q	Q	Q	Q	Q	Q	Q	Q
	4	1	2	3	4	1	2	3	4
Application development license submission to OJK	█								
Development of BPRACo mobile apps			█						
Development of mobile apps management application.						█			

Table 10 show an DT Strategy that BPRACo can implement. The DT Strategy describes the work plan that will be carried out over the next three years to support the business strategy and meet the proposed architecture targets. The results of this EA blueprint design are then incorporated into the BPRACo DT Strategy for 2024-2026.

3.9 Discussion

This research can contribute to previous research in the context of the banking and insurance industry in Indonesia [7], [16], [17]. Previous research has shown the influence of agile-adaptive and traditional ITG mechanisms on the digital transformation of organizational performance in the context of the banking and insurance industry in Indonesia [7]. Furthermore, previous research discussed a case study of BRI as a large bank in Indonesia and identified the implementation of seven ambidextrous ITG mechanisms that influence the success of digital transformation [16]. The research was continued by [17], discussing and finding the importance of strategy and enterprise architecture, one of the key ambidextrous ITG for TD success. The research has broader implications by underlining the importance of

managing the strategy and performance of digital (exploration) and IT (exploitation) initiatives in digital transformation.

Concerning previous research, this study emphasizes the importance of DT strategy and architecture as one of the seven key ambidextrous that support digital transformation in BPR. A hybrid mechanism with the integration of traditional architecture on the backend system and modern digital architecture on the front end can help BPRACo improve business processes, products/services, and customer experience by utilizing the latest technology while maintaining the stability of the existing system. Gradually, BPRACo can adopt the latest technologies, such as mobile applications or digital platforms, that are increasingly important in improving customer experience and operational efficiency.

In addition, this research explores the use of a hybrid approach that combines microservices and middleware on the frontend system, which specifically helps BPRACo in dealing with data center infrastructure limitations. By utilizing microservices, BPRACo can divide the system into smaller and more flexible services. BPRACo services in this research consist of account administration service, credit administration service, and customer complaint service. As a microservice, it operates independently and only interacts with other parts of the application through APIs or middleware, which is important in maintaining efficient communication between microservices and facilitating system integration. Furthermore, using cloud service models through vendors or collaboration with the BPR community offers a more cost-effective and scalable solution, allowing BPR to address infrastructure challenges better. This hybrid mechanism approach can optimize organizational performance.

This research also contributes to the field by expanding insights into how flexible and hybrid enterprise architecture can support digital transformation in small financial institutions. The findings offer an architecture model that can be replicated and adapted to various contexts, thus guiding other financial institutions facing similar challenges. The research conducted not only provides practical solutions for BPR but also serves as a guide in implementing strategy and architecture enterprise as one of the key ambidextrous ITG to achieve digital transformation success for other small financial institutions.

4. CONCLUSION

Based on the results of this enterprise architecture research, the output is a blueprint that can be a guide for BPRACo to optimize the company's business processes to support operational efficiency with IT implementation. The framework used is TOGAF 10, starting from the preliminary phase to migration planning.

BPRACo operational service activities currently use the core banking system and scoring system applications. The company's business processes need to be improved through digital transformation to make it easier for customers to access banking services. Therefore, targeting design is required by applying information systems to target business processes by developing BPRACo mobile apps and mobile apps management. These applications support account, credit, and service administration activities. The development of BPRACo mobile apps is done by digitally adding and improving several services such as account registration, credit application, credit payment, and customer complaints. Then, the development of mobile apps management applications to manage administration and services performed by customers through BPRACo mobile apps and integrated with the core banking system. This application development aims to improve data quality to avoid redundancy and integrate it to manage it properly and centrally. Additional cloud technology and increased use of APIs are required to support this integration. This solution design will improve services to BPRACo customers.

The blueprint design's results were then incorporated into the BPRACo DT Strategy for 2024 - 2026. This research contributes to the knowledge base of enterprise architecture for DT in the context of BPR SMEs and provides practical implications for BPRACo and similar organizations to implement priority enterprise architecture artefacts that can help them achieve success in their DT journey.

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