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

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Abstract

In the era of the digital revolution, organizations must adapt to technology through Digital Transformation (DT). Previous research has found the importance of IT strategy and architecture as one of the key governance mechanisms for success. However, these findings have not been proven for small-scale banks. Therefore, this research aims to compile and design an enterprise architecture blueprint that can help DT BPRACo as an SMEs-scale bank. This research uses five stages of Design Science Research (DSR), namely problem explication, requirement specification, design and development, demonstration, and evaluation. Data was collected through semi-structured interviews validated by document triangulation and then analyzed using the TOGAF 10 framework, starting from the preliminary phase to migration planning. The results of the blueprint design were then incorporated into the BPRACo IT roadmap 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 achieve the success of their 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 technology 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 shown an evident influence of DT on organizational performance [6]. Subsequently, to address this issue, [21] conducted a study to measure the extent to which traditional and agile/adaptive ITG mechanisms influence DT and organizational performance. Their research provided insights into the hybrid ITG mechanisms that moderately impact DT while DT significantly influences organizational performance.

ITG within organizations is essential to ensure alignment between operations and strategic policies.

This requires an IT architecture encompassing technology, information, applications, and business processes [7]. Moreover, there is a research literature review focused on the case of DT at BRI [8] and continued with research by [9], who have found the importance of strategy and enterprise architecture as one of the key ambidextrous ITG for DT success in the context of banks and insurance in Indonesia. However, there is still a knowledge gap in the scale of SME banks.

Adopting appropriate Information Technology (IT) provides numerous advantages for Small and Medium enterprises (SMEs), including the potential to enhance efficiency and productivity [10]. DT of SMEs can be done by using IT to improve public services through faster and more accurate data and information management [11]. Based on research by [12], 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 [12].

This study focuses on 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 [13]. "Bank Perkreditan Rakyat" (BPRACo) is an Indonesian banking institution that conducts its business and operations conventionally and cannot provide payment traffic services [14].

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 [15]. 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 [16], [17]. 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 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 [18]. BPRACo needs design and recommend an IT architecture solution to improve the effectiveness and efficiency of its operations and achieve DT success.

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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 [19]. EA can design and create artefacts for business process modelling, enabling the integration of business and IT strategies for implementing DT [20]. The Open Group Architecture Framework (TOGAF) is an EA framework developed through collaborative efforts within the community [21]. 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 [21].

This research will focus on developing EA for DT UMKM BPRACo using the TOGAF 10 framework and aims to answer the following 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 IT roadmap based on TOGAF 10 prioritized for the digital transformation of BPRACo SMEs? This aims to produce an EA blueprint and IT Roadmap that can guide BPRACo SMEs and other similar organizations in achieving DT success.

2. RESEARCH METHODOLOGY

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 [22].

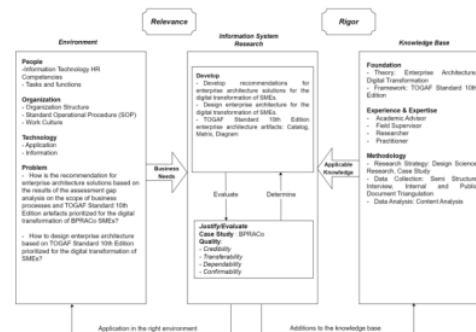


Figure 1 Conceptual Model (Adapted from DSR Hevner [22])

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 [22]. This conceptual model can define the problem, identify relevant factors, and form

relationships between elements to facilitate understanding of the core problem.

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

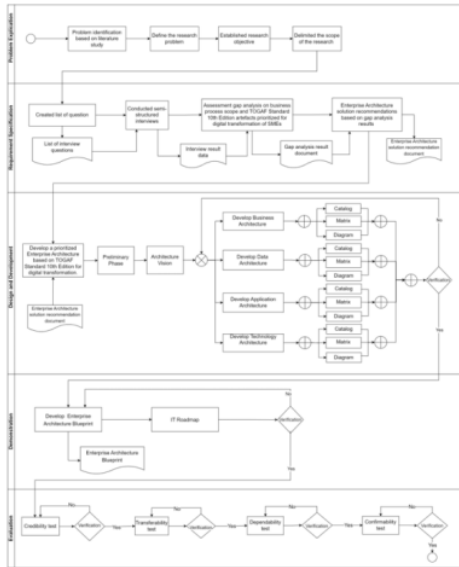


Figure 2 Research Process

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.

Table 1. Data Collection

Data	Data Resources
Primary Data	Semi-Structured Interview
Secondary Data	TOGAF Standard 10th Edition OJK Regulation No. 75/POJK.03/2016 on Information Technology Implementation Standards for BPR/BPRS. OJK Regulation No. 15/SEOJK.03/2017 on Information Technology Implementation Standards for BPR/BPRS. UU No. 4 of 2023 on Financial Sector Development and Strengthening (P2SK). Organizational Structure. Annual Report. Strategy Plan. Hardware and software documents. IT Implementation SOP. BPRACo Official Website.

Table 1 shows the data collection methods. This research uses semi-structured interviews because this method allows researchers to explore the organization's needs in-depth [23]. Semi-structured interviews with three representatives from BPRACo:

the IT Manager, IT Staff, and Business Staff. 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 [24]. 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 [24]. In addition, secondary data was collected through internal and public document triangulation to gain more information and a comprehensive understanding of the data.

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 [21].

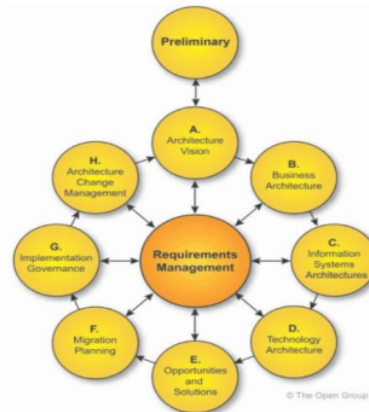


Figure 3 Architecture Development Cycle (From The Open Group [21])

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 [25] data processing and artefact development in SMEs can be done as follows:

Table 2 Analysis and Design of Artefact

Architecture Phase	Analysis and Design of Artefact
Preliminary	Define Organization Identify the Architecture Type. Select the Modelling Language
Architecture Vision	Identify Stakeholder

Architecture Phase	Analysis and Design of Artefact
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
Opportunities and Solution	Project Context Diagram
Migration Planning	Business Value Assessment IT Roadmap

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 as 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 3 is the principles catalog used in designing BPRACo architecture.

Table 3. Principle Catalog

Architecture	Principle
Business Architecture	Primacy of Princip
	Maximize Benefits to the Enterprise
	Business Continuity
	Service Orientation
	IT Responsibility
Data Architecture	Compliance with Law
	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
	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 capabilities and business value at a high level. The resulting artefacts are the value chain diagram, solution concept diagram, and business capability model.

Value Chain Diagram defines the activities carried out at BPRACo. These activities consist of primary activities and support activities. This research focuses on primary activity, namely operational

services and is supported by Information Technology. Figure 4 is a Value Chain Diagram BPRACo.

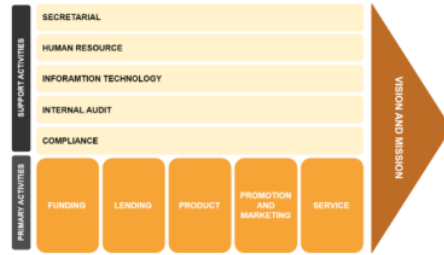


Figure 4. Value Chain Diagram

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 4 is a business capability model.

Table 4 Business Capability Model

	Business Planning	Market Planning	Vendor Management
Strategic	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 5 is a business service/function catalog of BPRACo operational services.

Table 5. Business Service / Function Catalog

Services	Business Process
Account Administration Service	Bank Account Registration
Credit Administration Service	Credit Application
	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 6 is the application/data matrix.

Table 6. 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

Application Component	Entity	Type
Mobile Apps Management	Customer	Master Data
	Mobile Apps Account	Master Data
	Products and Services	Transactional Data
	Credit Approval	Transactional Data
	User Management Complaint	Transactional Data
		Master Data
BPRACo Mobile Apps	Mobile Apps Account	Master Data
	Customer Account	Master Data
	Interaction History	Transactional Data
	Product and Service	Transactional Data
	Credit Approval	Transactional Data
		Transactional Data
Scoring System	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.

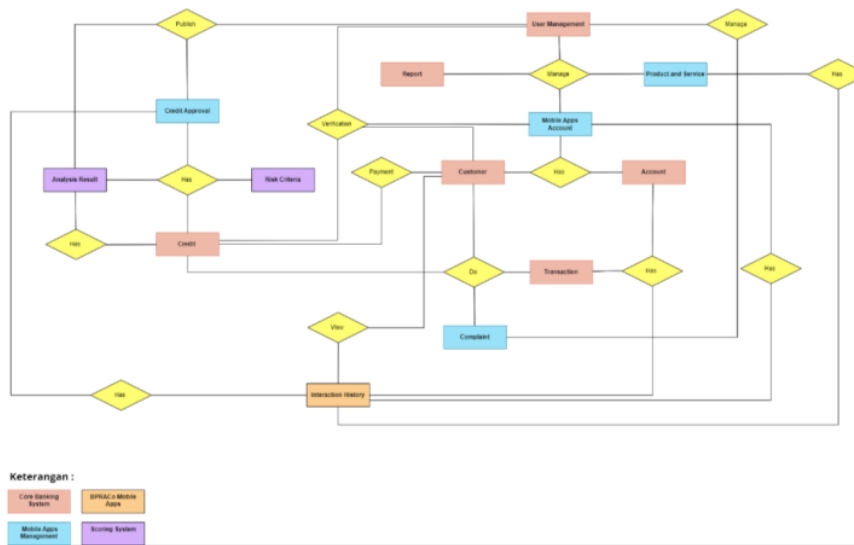


Figure 6 Conceptual Data Diagram

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 7 show an application portfolio catalog of BPRACo operational services.

Table 7. 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 performed by customers on mobile apps and are integrated with the core banking system.
BPRACo Mobile Apps	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.

Application Communication Diagrams are artefacts that describe the relationship between physical applications.



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 8 is a technology standard catalog BPRACo.

Table 8. 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
	Database Server	MySQL
	Web Server	Apache
	Cloud	Google Cloud Platform
Data Distribution	Router	Router Cisco
	Switch	Switch Cisco
Security	Firewall	Firewall Pfense
	Anti-Virus	Malware ClamAV
	VPN	Wide Area Network - VPN-IP - VPN Instan - Dial-Up
Client platform	Handphone	Android/IOS
	PC/Laptop	Dekstop/Notebook
	OS client	Android/IOS, Windows
Data Transaction	Mail Server	Gmail
Integration	Internet	60Mbps
	API	XML

3.7 Opportunities and Solution

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 IT roadmap 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 9 IT Roadmap

Proyek	Periode								
	2024		2025			2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Application development license submission to OJK	4	1	2	3	4	1	2	3	4
Development of BPRACo mobile apps									
Development of mobile apps management application.									

Table 8 show an IT roadmap that BPRACo can implement. The IT roadmap 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 IT roadmap for 2024-2026.

Summing up, this research can contribute to previous research in the context of the banking and insurance industry in Indonesia [7], [8], [9]. 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 [36]. 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 [8]. The research was continued by [9], discussing and finding the importance of strategy and enterprise architecture, one of the main 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 IT 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 significantly 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, describe the existing conditions and target BPRACo, which focuses on the company's operational services to produce a blueprint of several artefacts in the form of diagrams, matrix, and catalog. 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 IT roadmap 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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