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ENTERPRISE ARCHITECTURE: STRATEGY OF SMART VILLAGE DEVELOPMENT (VILLAGE SERVICES) USING TOGAF 9.2

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Abstract: The design of Smart Village Enterprise Architecture for village government systems serves to support sustainability in facilitating the creation of Good Governance in a Village Government. One significant role in achieving Good Governance in a village is Education. Education plays a crucial role in enhancing and developing Good Governance and the SDGs values of a village. The conducted research focuses on the design of Enterprise Architecture of the Smart Village concept, with a focus on Village Services' dimension that specifically targets Education Services in a village in the Special Region of Yogyakarta. The research method utilized the TOGAF ADM 9.2 framework. The focus domain in this study includes the preliminary phase, architecture vision, business architecture, data architecture, application architecture, technology architecture, opportunities and solutions, and migration planning for the Education service in the Pagerharjo Village Government. The research result is an Enterprise Architecture blueprint as a solution to the issues that occur in the Education service in the Pagerharjo Village Government, along with an IT Roadmap as a reference for the village government in project development. It is hoped that the recommendations provided can enhance the Education services offered by the Pagerharjo village, thereby aiding the Pagerharjo Village Government in improving its score for the fourth SDGs, Quality Education.

Keywords: Enterprise Architecture, Smart Village, SDGs, TOGAF ADM 9.2.

Abstrak: Perancangan *Enterprise Architecture Smart Village* pada sistem pemerintahan Desa befungsi mendukung *sustainability* dalam membantu terciptanya *Good Governance* di suatu Pemerintahan Desa. Salah satu peranan penting terciptanya *Good Governance* di suatu Desa adalah Pendidikan. Pendidikan memiliki peran penting dalam peningkatan maupun pembangunan *Good Governance* dan nilai SDGs Desa. Penelitian yang dilakukan berfokus pada perancangan *Enterprise Architecture* konsep *Smart Village* dimensi *Village Services* yang berfokus pada *Education Services* di Desa Daerah Istimewa Yogyakarta. Metode penelitian dilakukan dengan menggunakan *framework* TOGAF ADM 9.2. Fokus domain yang diambil dalam penelitian ini mencakup fase *preliminary phase*, *architecture vision*, arsitektur bisnis, arsitektur data, arsitektur aplikasi, arsitektur teknologi, *opportunities and solutions*, dan *migration planning* pada layanan Pendidikan di Pemerintahan Desa Pagerharjo. Hasil dari penelitian yang dilakukan berupa *blueprint Enterprise Architecture* sebagai solusi dari permasalahan yang terjadi pada layanan Pendidikan di Pemerintahan Desa Pagerharjo serta *IT Roadma*p sebagai acuan Pemerintah Desa dalam melakukan pengembangan proyek. Diharapkan, rekomendasi yang diberikan dapat meningkatkan layanan Pendidikan yang disediakan oleh Desa Pagerharjo, sehingga mampu membantu Pemerintah Desa Pagerharjo meningkatkan *score* nilai SDGs ke-empat, Pendidikan yang Berkualitas.

Kata kunci: Enterprise Architecture, Smart Village, SDGs, TOGAF ADM 9.2

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INTRODUCTION

The presence of the internet and the rapid development of technology can be optimally utilized in the implementation of e-Government, which is a concrete step taken in empowering the community through increased access to information, improved government services in the industrial sector, and improved government management that is more effective, efficient, and transparent in providing public services [1]. The effective utilization of e-Government can assist the government in building a good governance ecosystem [2]. The realization of e-Government programs varies; one is the Smart City program, an embodiment of e-Government implementation [3]. The Smart City concept aims to enhance the quality of urban society with the aid of information and communication technology, striving towards cities that are comfortable, safe, and happy [4]. This concept is often adapted according to the challenges faced in each region, spanning from District/City areas to rural areas [5].

Indonesia applies the Nawacita concept in its state development, where the development is conducted from the Village Government unit [6]. Village development can be supported by implementing the Smart Village concept to integrate the Village Government administration using information technology, resulting in effective and efficient public service management [4]. The Smart Village concept aids in achieving the Sustainable Development Goals (SDGs) [7]. The Ministry of Village, Development of Disadvantaged Regions, and Transmigration (Kemendes PDTT) have adopted the SDGs into the Village Government system, forming Village SDGs with 18 goals focusing on sustainable development to enhance the value and welfare of the village community following Law Number 6 of 2014 on Villages, Kemendes PDTT [8].

Implementing the Smart Village concept in the education services in Pagerharjo Village, Kulon Progo Regency, Special Region of Yogyakarta, will influence the sustainable development of education quality and maintain or enhance the fourth Village SDG score, Quality Education. Moreover, implementing the Smart Village concept in education services can assist the Pagerharjo Village Government in effectively applying the principle of Good Governance due to their human resources' high competency and quality [9]. The implementation of the Smart Village concept certainly requires IT's role, which can be assisted by implementing the Enterprise Architecture framework that results in an output of a strategic IT mapping design packaged into a blueprint that can serve as a reference for implementing the Smart Village concept to improve education services in Pagerharjo Village. Enterprise Architecture serves as a bridge between stake-holder communication and IT function to enhance the alignment of business functions with information technology [10]. The architecture domains that encompass the design of Enterprise Architecture in implementing the Smart Village concept in Pagerharjo Village include business architecture, data architecture, application architecture, and technology architecture. The method used in the design of Enterprise Architecture is TOGAF ADM 9.2. TOGAF ADM is a method that uses an iterative system in managing the Enterprise Architecture Cycle as part of

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the core form of TOGAF standards [11]. TOGAF ADM 9.2 consists of several interconnected phases. The phases conducted in designing the Enterprise Architecture for implementing the Smart Village concept in the dimension of education services in Pagerharjo Village include the preliminary phase, architecture vision, business architecture, data architecture, application architecture, technology architecture, opportunities and solutions, and migration planning. The design result is hoped to be used as a reference for the Pagerharjo Village Government in improving ser-vices and maintaining or enhancing the fourth Village SDG score, Quality

METHOD

Conceptual Model

A conceptual model comprises a set of concepts used to study, understand, and explain the research system. The conceptual model of an information system depicts three main processes: the scope, information system research, and the basis of research science [12].

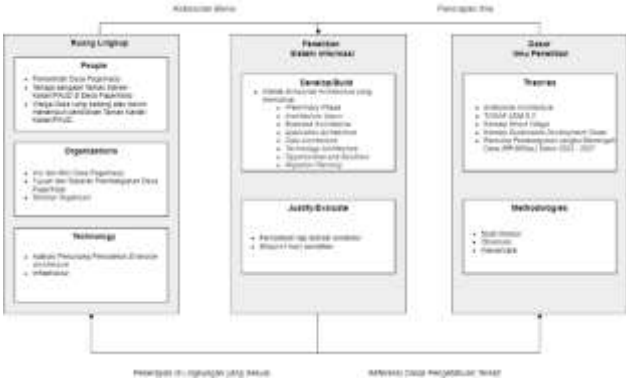

Figure 1 Conceptual Model

Data Collection Method

Data collection is performed to support the design process. The data utilized comprises two types, namely primary and secondary data. Primary data is acquired through interviews with relevant stakeholders and direct observation of the research object. Secondary data is obtained through various methods, such as literature studies and previous research related to Enterprise Architecture, SDGs, and Smart Villages.

Table 1 Data Collection Model

Data	Data Resources
Primary Data	Interview Data from the Pagerharjo Village Secretariat
Secondary Data	Pagerharjo Village Regulation No. 4 of 2022 Mid-Term Village Development Plan (RPJMDes) 2022 – 2027
	Organization and Work Procedure (SOTK) of Pagerharjo Village Government 2019 – 2025
	Law Number 6 of 2014 About Villages
	Minister of Village, Underdeveloped Region Development, and Transmigration Regulation of the Republic of Indonesia Number 21 of 2021
	The Open Group Architecture Group (TOGAF)

Analysis and Design of Artifacts

The analysis and design phase focuses on the architectural design aimed

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at the Enterprise Architecture framework using the TOGAF ADM 9.2 method, adjusted according to organizational needs. TOGAF framework consisting of 9 phases. Out of 9 phases, only 5 will be taken as the research framework, such as Preliminary Phase, Architecture Vision, Business Architecture, Information Architecture, and Technology Architecture. Table 2 contains an analysis of architectural domain adjustments in the Pagerharjo Village Government.

Table 2 Analysis and Design

Architecture Phase	TOGAF ADM Phase
Preliminary Phase	Preliminary Phase
Architecture Vision	Phase A: Architecture Vision
Business Architecture	Phase B: Business Architecture
Data Architecture	Phase C: Information System Architecture
Application Architecture	
Technology Architecture	Phase D: Technology Architecture

RESULT AND DISCUSSION

Preliminary Phase

The preliminary phase explains the preparation and initiation of design requirements to achieve strategies and business needs in Pagerharjo Village that align with its vision, mission, and objectives. The generated artifact is a principles catalog containing principles used in architectural design. Table 3 is the principles catalog used in the architecture design of the Pagerharjo Village Government.

Table 3 Principles Catalog

No.	Architecture	Principle
1.	Business Principles	Primacy of Principles
		Information Management is Everybody's Business
		Business Continuity
		Service Orientation
		Compliance with Law
		IT Responsibility
2.	Data Architecture	Data is an Asset
		Data is Shared
		Data is an Accessible
		Data Trustee
		Common Vocabulary and Data Definitions
		Data Security
3.	Application Architecture	Technology Independence
		Ease-of-Use
4.	Technology Architecture	Interoperability
		Technology Security
		Control and Maintenance
		Failure Backup

Architecture Vision

The Architecture Vision stage identifies the scope and stakeholders of the Pagerharjo Village Government to develop the Enterprise Architecture design. The resulting artifacts are the Value Chain Diagram and Solution Concept Diagram. The Value Chain Diagram describes the activities in the

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Pagerharjo Village Government, consisting of primary and secondary activities. The Solution Concept Diagram represents the proposed concept that will be implemented to support the Education sector's activities in the Pagerharjo Village Government.

Table 4 Value Chain

Value Chain		
Support Activities		
1	Human Resource Management	Training and Development of Employees
2	Policy Development	Village Government Regulations
		Special Region of Yogyakarta Regulations
		Legal Regulations
3	Technology Information Management	Data Information Village Governance
4	Financial Management	Village Income
Primary Activities		
1	Governance	Administration Civil Government
		Facilities and Infrastructure
2	Village Development	Education Services
		Health Services
3	Community Development	Culture and Religion
		Youth and Sports
4	Community Empowerment	Agriculture and Animal Husbandry
		Marine and Fisheries

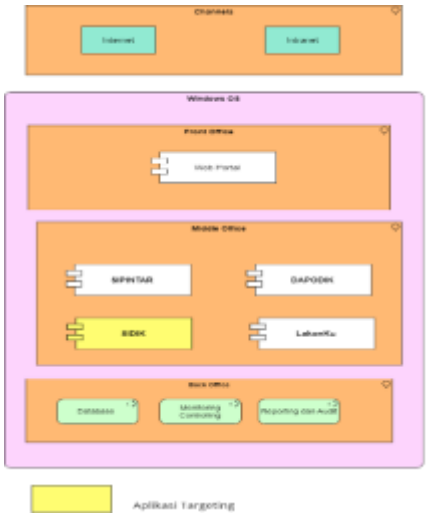

Figure 2 Solution Concept Diagram

Business Architecture

Business architecture is the design stage of business needs for the Pagerharjo Village Government's Education services to achieve goals, visions, and missions. The produced artifacts include business process targeting and a business services catalog. Business Process targeting proposes changes to the existing business process for more effective and efficient operation, leveraging IT to improve business processes. The Business Services Catalog is a catalog artifact containing proposed Education services based on the needs and functions of the Pagerharjo Village Government.

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Table 5 Business Services Catalog

Services	***Business Process***
Development and Guidance Service for Teaching Staff	Training for teaching staff in Pagerharjo Village
Service Submission for Operational Management and Improvement of Facilities, Infrastructure, and Educational Tools in PAUD/TK/Reading Garden/Village-owned Library	Submission for the operational management
	Submission for the procurement of facilities and infrastructure and Educational Props
	Submission for the improvement of facilities and infrastructure of the Village-owned PAUD/TK/Library/Reading Garden
	Submission for procurement of the Library
	Submission for the procurement of facilities and infrastructure of the Library
Village Reading Garden/Library Management Service	Data collection on the number of children in each Pagerharjo hamlet
	Creation of Mobile Library schedule
	Execution of the Mobile Library activities in each hamlet
Scholarship Service for Underprivileged Students	Optimization of the Indonesia Smart Program Submission
	Data collection related to the number of underprivileged students

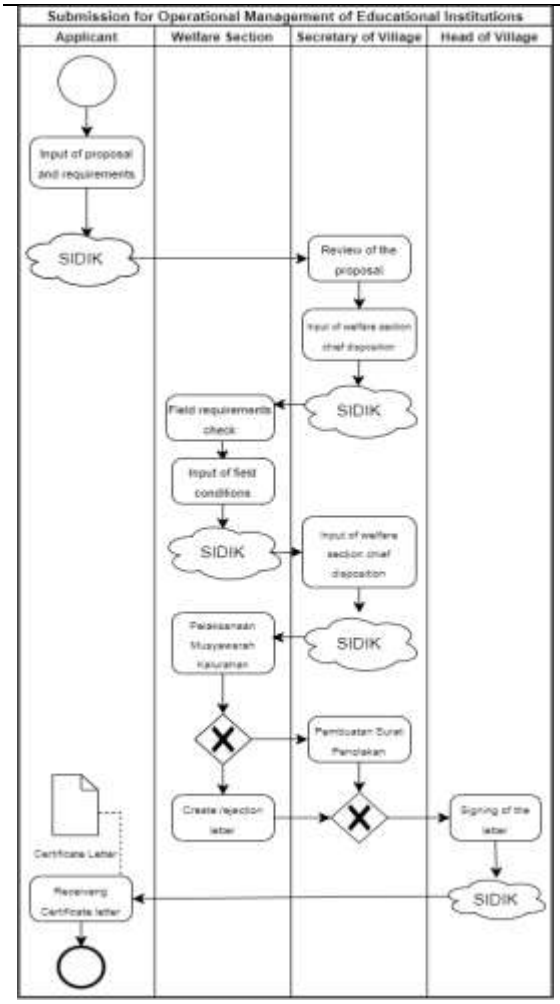

Figure 3 Submission for Operational Management of Educational Institutions

Data Architecture

Data architecture is the stage of defining the data that will be used in the design and development of Enterprise Architecture. The definition of data requirements consists of the types and sources of data needed to support Education services activities. The produced artifacts include the application/data matrix and data dissemination diagram. The Application/Data Matrix is a matrix artifact that defines data requirements

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supporting the Enterprise Architecture design for Education services. The Data

Table 6 Application/Data Matrix

Services	Data Entity	Data Entity Type
Submission for Operatioal Management and Improvement of Facilities, Infrastructure, and Educational Tools in Educational Institutions	Employee	Master Data
	Applicant	Master Data
	Certificate	Transactional Data
	Submission	Transactional Data
	Category	Master Data
	PAUD/Library Field Check Data	Transactional Data
	Facilities Submission	Transactional Data
	Payment Data	Transactional Data
	Receipt	Transactional Data
	Budget Plan Rejection	Transactional Data
Village Reading Garden /Library Management	Budget Draft	Transactional Data
	Library Manager	Master Data
	Book	Master Data
	Schedule	Transactional Data
	Broadcast	Transactional Data
Education Scholarship for Underprivileged students	Operator	Master Data
	PIP Submission	Transactional Data
	SKTM	Transactional Data
	SK PIP	Transactional Data
	DTKS	Master Data
	Student Data	Master Data

Application Architecture

Application architecture is the stage of defining applications according to the needs of the Enterprise Architecture design in the Smart Village concept of Education services. The produced artifacts include the application portfolio catalog and application communication diagram. The Application Portfolio Catalog is a catalog artifact providing data on existing and targeting applications used in Education services. The Application Communication Diagram is an artifact depicting a diagram of relations among applications and middleware

Table 7 Application Portfolio Catalog

Physical Application Component	***Description***
SIPINTAR	Provides information services related to the determination and distribution of the Indonesia Smart Program
DAPODIK	DAPODIK is a government-owned application that providing data collection services and supporting the management and analysis of education-related data.
LakonKu	LakonKu provides convenient online services that enable residents to handle various tasks related to birth and death registration efficiently
SIDIK	Education Management System in Pagerharjo Village incorporates specific modules that

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Physical Application Component	***Description***
	target different areas of education in Pagerharjo.

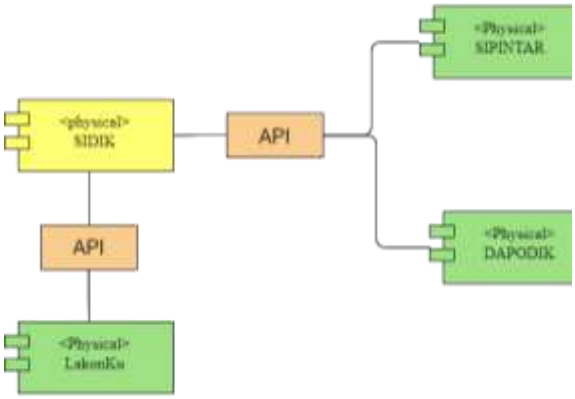

Figure 4 Application Communication Diagram

Technology Architecture

Technology Architecture is the stage of designing the technology infrastructure needed to ensure system security, scalability, availability, and integration between components run smoothly. The produced artifacts include the technology standards catalog which is documents the agreed standards for technology across the enterprise covering technologies, and versions, the technology lifecycles, and the refresh cycles for the technology. Technology infrastructure changes and improvements were made so that the implementation of the project on Education services could be perfectly realized.

Table 8 Technology Standards Catalog

Logical Technology Component	**Physical Technology Component**	
Platform	**Technology Component**	**Standards**
Server	Application Server	Apache Java
	Database Server	MySQL
	Switch Access	Mikrotic
		Handle switch and shared bandwith
		MAC address filtering
		Collision domain Segmentation
	Access Point	Ubiquiti Mess
	Router	Mikrotik CCR1036
	LAN	Eyota Network Patch
Security	Firewall	Windows Firewall
	Antivirus	Windows Defender
Client Platform	Laptop	Asus AIO P241
	PC/Monitor	LG Flatron E2260
	Printer	HP Deskjet Ink Advantage 1515 All-in-One Series

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Logical Technology Component	**Physical Technology Component**	
Platform	**Technology Component**	**Standards**
Performance and Availability	UPS	UPS 650VA
Backup and Recovery	Backup Server	Google Cloud Storage

CONCLUSION

The research conducted in the analysis and design of Enterprise Architecture using the TOGAF ADM 9.2 method on Education services in the Pagerharjo Village Government, Kulonprogo Regency, Special Region of Yogyakarta, resulted in a blueprint output that can be used as a reference for Pagerharjo Village to develop the Smart Village concept, particularly in Education services for the next four years. The Enterprise Architecture design comprises several stages and produces artifact outputs that can be solutions for the Pagerharjo Village Government in helping to develop Education services with the aid of information technology. The resulting blueprint is hoped to assist the Pagerharjo Village Government in improving service quality and increasing the fourth SDG index, Quality of Education.

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