INOVATOR
Jurnal Manajemen
pISSN: 1978-6387
eISSN: 2623-050X
Vol. 12 No. 1 Page 64-80 https://ejournal.uika-bogor.ac.id/index.php/INOVATOR

Information Systems Strategic Planning to Improve Elementary School Competitiveness

Ratna Mustika Dewi [1*], Putri Nastiti [2], Julius Galih Negara [3], Andi Wahyu Rahardjo Emanuel [4]
[1] Industrial Engineering, Universitas Atma Jaya Yogyakarta
[2,3,4] Information Engineering, Universitas Atma Jaya Yogyakarta
Jl. Babarsari No.44 55281 D.I. Yogyakarta, Indonesia

Info Artikel

Keywords:
TOGAF, Enterprise Architecture, Business Process School, SIBRO

ISSN (print): 1978-6387
ISSN (online): 2623-050X

Abstract

The development of technology is growing very quickly due to the shift in people's lifestyles. This makes it one of the main motivations of investors to be able to create a product as a solution to existing problems in line with the rapid development in the field of technology. The object of this study is elementary schools that have integrity in technological developments. The purpose of this study is to be able to map the Enterprise Architecture (EA) based on the analysis of school needs. The research consists of review focusing on the Internet of Things considering its architecture applied in the Elementary school context in SD Tumbuh 4 Yogyakarta In this case, EA is seen as a logical, comprehensive, and holistic approach to being able to define, design, and implement systems and system components simultaneously. One of the methods used is based on The Open Group Architecture Framework (TOGAF) framework. The stages carried out are Vision Architecture, Business Architecture, Data Architecture, Application Architecture, and Technology Architecture. The analytical tools used in this study are value-chain analysis and mission model canvas. The result of this study is in the form of a proposed application that supports business processes School The application that will be proposed is SIBRO Modification which will support the business process of SD Tumbuh 4 to be more efficient and effective.

Author Correspondence:
Ratna Mustika Dewi
ratna.mustika@mail.uajy.ac.id

1. Introduction

Today, information technology (IT) is an essential part of our lives and has fundamentally altered the way in which we perform daily tasks. The use of information systems in an organization's business processes greatly facilitates in creating efficiency and effectiveness for the company, so the use of information technology in businesses can create maximum advantage and be able to compete in a

Submitted: January-2023 Received: February-2023 Available Online: March-2023

global market that is already highly competitive. Whether it be in finance, production, construction, commerce, medical, travel, marketing, agriculture, the entertainment industry, education institution, etc., IT has completely transformed the ways in which these businesses are run.

According to the Indonesian National School Standards, schools are structural institutions that require continuous growth at all times, and the pattern of business processes in schools continues to evolve from simple business process patterns to complex business process patterns. Education is a significant factor in enhancing the quality of human resources. Schools contain business processes, which are defined as a series of activities that are interrelated and sequentially completed by humans or systems inside and outside the organization to achieve specific business goals. As academic institutions generate vast amounts of information through their teaching/research and administrative activities, and as this information must flow freely between departments, there appears to be a need to organize and manage this information thoroughly (1).

Implementation with the guiding model and make it a comprehensive view of the enterprise framework [2]. Based on [3], Information technology become an indispensable factor in a organizations, due to its growth, and with that, it is no longer a resource that aimed to automate day-to-day tasks in the business environment and started to play a more important role in terms of enriching the entire organizational process. The solution to the challenges that have been stated several times above, is good EA planning.

It is necessary for an institution oriented toward educational services to improve the quality and quantity of great institutional services. As a result, an examination of continuous improvement and improvement in business processes is required. Using the TO-GAF Framework technique, it is required to identify needs and current business processes based on the problems mentioned. Standard business processes are evaluated to maximize institutional performance in meeting the objectives of the assessment results, which may then be used to improve business processes. Based on [4], TOGAF provided methods and tools for assisting in the acceptance, production, use, and maintenance of an Enterprise Architecture. As information TOGAF was created before the 1990s by the US Department of Defense and the recent version, TOGAF 9.2, was released with additional updates and guidelines, in addition to removing obsolete content [8].

Organizations must employ such tools for effective management, as they facilitate work and expedite decision-making based on correct data. Therefore, firms of all types can respond to market demands more quickly. In this article, a comparative analysis of the IoT architecture with the TOGAF framework was carried out, to align the business strategies in School, considering the visualization of convergent and divergent elements.

2. Research Method

The research consists of review focusing on the Internet of Things considering its architecture applied in the Elementary school context in SD Tumbuh 4 Yogyakarta. Data collection was carried out from September 2022 to December 2022. For the review, the method that use for collecting the data is an interview and focus group discussion with stakeholders, as principals, teachers and academic staff, IT divisions and others. The methods used are in accordance with the methodology and stages of enterprise planning. The Open Group Architecture Framework (TOGAF) framework. The stages carried out are Vision Architecture, Business Architecture, Data Architecture, Application Architecture, and Technology Architecture. The following provides a description of each step.

1. Architecture vision interprets the vision, mission, goals, and business strategy plan of an institution as well as current technological trends. In this step, we will dig deeper into information related to business processes in schools.
2. Business Architecture, that requires the definition of motivation and function, is necessary for the development of the architecture as a whole (Kaio Vasco). In this step, business architecture model will be made based on the identification of business processes at the Vision Architecture stage in the form of value chain analysis. In this stage, it is analyzed about Business requirements, Actor/role Catalog, Business Interaction Matrix, and Internal and External Analysis. The third step consists of two parts, which are Da-ta Architecture and Application Architecture.
3. Information System Architecture terdiri dari dua bagian, yaitu Data Architecture dan Aplication Architecture. This stage is carried out to describe the demand for information systems which include information architecture and data architecture to meet the needs of business organizations.
4. Technology Architecture is carried out to describe the proposed technology needed by the organization. The designed technology functions to run information systems that have been previously designed.

3. Results

TOGAF, in this study there are several discussions that are divided into 3 main parts, that is Identification of Vision, Mission, Objectives, and Internal Condition; Identification of the state of the organizational Architecture; Strategic Plan, and Portfolio.

a. Identification of Vision, Mission, Objectives, and Internal Condition

Preliminary: Principles Catalog

The Principle Catalog describes the principles contained in SD Tumbuh 4 associated with the EA domain. The description of the Principle catalog SD Grows four can be seen in Table 1.

Architecture Vision

In this phase, Identify the SI/IT strategy is carried out in this phase by interpreting the institution's vision, mission, objectives, and business strategic plan, as well as current technological trends, to define the SI/IT needed by the institution to support business processes. Based on Table 2. describes the mapping of the Vision, Mission, Goals, and Action Plan, which is a guide in implementing business processes in SD Tumbuh 4.

b. Identify the State of the Organizational Architecture

Business Architecture

This phase is used to analyze the business environment in the organization, which is then used to define SI/IT proposals that can support business processes

- Business Requirement
  A business requirement analysis is carried out in designing a business architecture, that was for improving the service (especially for parents)
- Actor/Role Catalog
  The role descriptions of the actors involved in the SD Tumbuh 4 business process are shown in Table 3.
- Internal Analysis
  The internal environment of SD Tumbuh 4 was analyzed using the Value Chain analysis tool, as shown in Figure 1 below.
  In addition, the internal environment of SD Tumbuh 4 was also analyzed using the Mission Model Canvas (MMC) analysis tool, as shown in Figure 2 below.

Information System Architecture

At this stage, identification of the current condition of the information system implemented in SD Tumbuh 4 is carried out

- Application Requirement
  The application requirement in SD Tumbuh 4 architecture are: It has an information system (website) that functions to access information regarding grades, payments, and student attendance; Have IT assets to be reviewed and used as material to produce an information system strategic plan for SD Tumbuh; There is updated data management; There is updated data management; No data duplication; Data can be accessed in real-time; Data security is maintained; Data can be available and used by parties who have been given access rights; A data

warehouse is available to integrate data on existing information systems and target information systems.

- Process Flow Diagram
  In the process in SIBRO, these processes can be mapped into a process flow diagram seen in Figure 3.

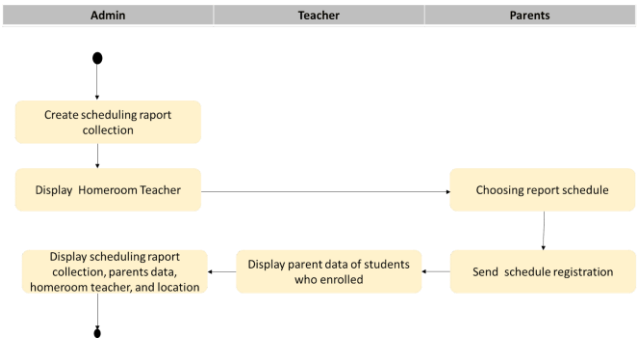

Figure 4. Process Flow Diagram

- Role/Application Matrix
  In making the system, there are several divisions of roles or roles with access rights to several systems owned by SD Tumbuh 4. The distribution can be seen in Table 5.
- Application/Functional Matrix
  At this stage, identification of the application and the functions performed by the application, the mapping results can be seen in table 6.

Technology Architecture

At this stage, identification of the current conditions of information technology implemented in SD Tumbuh 4 is carried out.

- Technology Architecture Requirement
  At this stage, identification of the current conditions of information technology implemented in SD Tumbuh 4 are: Providing qualified hardware to support the operation of information systems or websites (software), Adopt frameworks and Standard Operating Procedures (SOP) related to technology procurement, and Able to protect user information privacy through various steps, such as authentication and authorization.
- Technology Standard Catalog
  At this stage, the identification of the current conditions of the technologies that have been implemented in SD Tumbuh 4 is carried out. The standard catalog of these technologies can be seen in Table 8.
- Technology Portfolio Catalog
  At this stage, the description of the current conditions of the catalog portfolio catalog implemented in SD Tumbuh 4 can be seen in Table 9.
- Network Topology

In operation, the network and devices in SD Tumbuh can be represented by the topology picture in Fig 5.

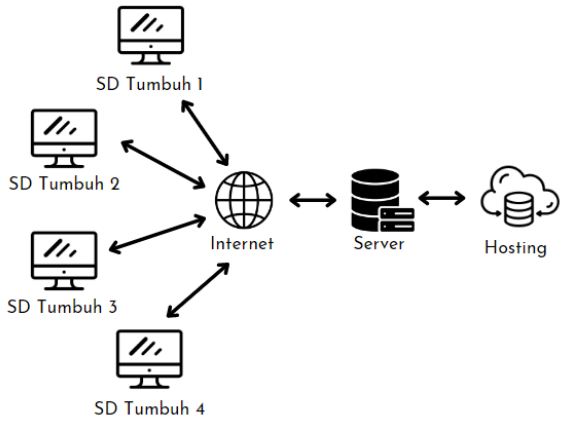

Figure 5. Network Topology

c. Strategic Plan and Portfolio

At this stage, defining the needs for information systems and information technology refers to the internal and external analysis of the business environment and documents on the organization's main tasks and functions

Information System Architecture

The purpose of this section is to define the information system requirements needed to support business processes. This section of the sub-chapter is a use-case diagram seen in Figure 6. The Entity Relationship Diagram (ERD) can be seen in Figure 7

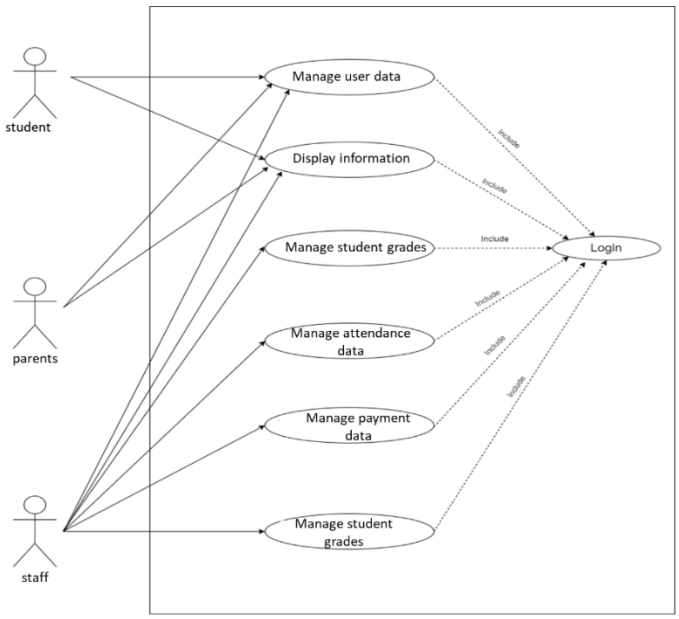

Figure 6. Use Case Diagram SIBRO (Modification)

The results of internal and external business analysis are then used to determine patterns of solutions and information system solutions that can later support business processes in the organizational environment. The results of the information system requirements analysis can be described in Table 10 as follows.

An overview of the proposed information system for business activities can be mapped in the organization's value chain, as shown in Figure 8 below.

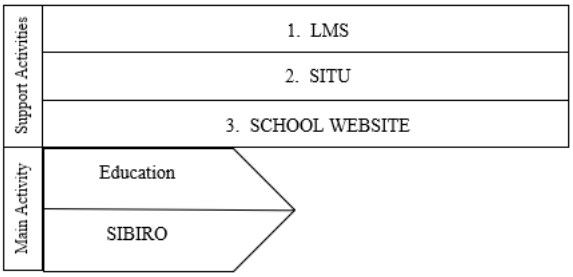

Figure 8. Organizational Value Chain

Proposed Technology Architecture

The goal at this stage is to determine the technology platform that becomes the environment for information systems to support business processes. The technology required is computer network technology to connect existing information systems and requires the addition of some hardware.

A general picture of the IS/IT gap in the organizational environment, an analysis is needed by looking at the two main components, namely information systems, and infrastructure. From the results of the current condition of the information system, a comparison can be made with the SI proposal, which can be summarized in Table 11.

Table 1. Principle Catalog SD Tumbuh 4

Principal	Description
Business Principal	• The enterprise architecture created must match the business function needs of SD Tumbuh 4 • The principles created should apply to every part of the SD Tumbuh 4. • Managing enterprise architecture must be easier and more efficient to improve business processes in SD Tumbuh 4.
Data Principal	• Data is well managed and ensures that the stored data is accurate and can be accessed anytime and anywhere. • The stored data is consistent and understandable to all users in the SD Tumbuh 4. • Data is protected and cannot be accessed outside the authority of SD Tumbuh 4.

Application Principal	• The application can run on various platforms so that the application can be quickly developed and operated correctly. • The architecture must be easy to use by users so that business processes in SD Tumbuh 4 can run well.
Technology Principal	• Architecture should be designed to facilitate change and future development. • Using standardized hardware, software, and platforms so that the data used is compatible and accurate

Table 2. Mapping the Vision, Mission, Goals, and Action Plan

Vision of the SD Tumbuh	The Mission of the SD tumbuh	Goals	Action Plan
Children grow and develop as learners with character, respect diversity, love the homeland and local wisdom, and show awareness as citizens of the world.	They are organizing inclusive education that develops children according to their respective potentials and needs.	Implementing education can accommodate and help various students with backgrounds and other characteristics.	They provide a variety of activities that students can participate in to encourage students' interests and talents, such as gamelan and nature lovers, as well as dance and ball clubs.
			Improving the quality of activities and education staff in order to provide the best teaching
	Provide learning that encourages children to appreciate religious, economic, social, cultural, and special needs diversity	Students become individuals who can appreciate differences and are intelligent so that they can live in society.	The school implements character-building programs to shape students' personalities and out-of-school activities such as Outing.
	Providing learning that encourages children to appreciate the wealth of the nation and local potential, love for the homeland, and local wisdom.	Implement government regulations regarding local/regional culture for relevant agencies, including schools.	All stakeholders, including students, celebrated a decade of the Yogyakarta Special Region Privileges Law by wearing traditional Javanese Yogyakarta clothes. The rules for the use of this clothing are contained in the Circular Letter of the Government of the Special Region of Yogyakarta Number 025/0100, dated January 4, 2022, concerning the Use of Javanese

			Traditional Clothing Yogyakarta in 2022.
		Establishing learning materials with the theme of local wisdom, such as Batik.	Providing 'Karawitan' lessons that teach Javanese cultures and other cultures in Indonesia. Engage students in activities related to learning materials. An example of Ambatik Dance by Mrs. Galih Puspita at the Inspiring Stage at the International Wellness Tourism Conference and Festival, one of the side events of the G20 Presidency agenda last August in Surakarta.
	Providing learning that prepares children as citizens of the world, open-minded, and actively contributing positively.	Carry out learning and self-development for students, not limited to academic matters and classrooms. However, learning and self-development activities prepare students to become whole human beings in society.	Involve students in contributing to commemorating international days. An example of International Literacy Day. Conducting field learning, student exchanges, or educators to open students' eyes to other sides of the world.

Table 3. Actor/Role Catalog

Actor	Role
Students	Students who will use the facilities provided by the school
Parents	Parents/guardians can use the facilities and be actively involved in monitoring the development of children within the school's scope
Foundation	As steering committee
Teacher	Create a teaching system that matches the characteristics of students and the vision and mission of the SD Tumbuh
Tim Developer Website	Designing and compiling a website concept according to the characteristics of SD Tumbuh
Software Engineer	Work closely with your website development team to design, develop, manage, test, and evaluate website systems.
Principal	Formulating, developing, and establishing the vision and mission of the school, as well as improving the quality of SD Tumbuh
administration section	Prepare plans for administrative activities, coordinate administrative subdivisions such as finance, administration, and filing, and Prepare reports and evaluate the implementation of activities.

Firm Infrastructure Human resource management, facility planning that supports learning activities, financial planning for Tumbuh Elementary School				
Human Resource Management Recruiting employees in accordance with the required requirements, managing the administration of all employees SD Tumbuh 4				
Technology Development Recruiting employees in accordance with the required requirements, managing the administration of all employees of Tumbuh Elementary School				
Procurement Designing information systems needed by schools such as SITU and SIBRO				
Student Addition ▪ admission of new students in	**Educational Activities**	**Outbound Logistics** ▪ implement Midterm and	**Promotion and introduction of the school**	**Services** ▪ Provide a website for SD Grow.

each new school year ▪ School infrastructure booking	▪ Students learn new things while in school ▪ Provides CSIE	Final Examination. ▪ Producing graduates with integrity and able to live dynamically with cultural diversity	▪ Promoting through social media platforms and advertisements ▪ Entered the race. Participate in festivals	▪ SIBRO Services. ▪ SITU service. ▪ Online Counseling Services

Figure 1. Value Chain SD Tumbuh 4

Table 4. Mission Model Canvas (MMC) analysis tool

Key Partners	KEY ACTIVITIES	VALUE PROPOSITION	COSTUMER RELATIONSHIP	BENEFICARIES
students, parents/guardians, and partner institutions	Tumbuh school is able to provide a place to receive a comfortable and enjoyable education in accordance with the school's vision and mission supported by the facilities needed by students	The values in the school's mission and vision are inclusive, multicultural, educational Jogja spirit, and global outlook is the value that is delivered to students	Informing every change, development, and activities along with the details through the website and social media. Submissions are carried out in a "personal", safe, and organized manner.	Students and parents/guardians, prospective students and parents/guardians at Tumbuh Elementary School
	KEY RESOURCES		DEVELOPMENT	
	The resources needed by the tumbuh school are teaching staff and extracurricular trainers who are competent in the field of education and teaching and require quality human resources to be able to work		SIBIRO, website page for research	

	according to the roles and responsibilities that have been given	
MISSION BUDGET/COST		MISSION ACHIVEMENT/IMPACT FACTORS
Operational costs (labor salary costs, activity costs, etc.), renewal and maintenance costs for technology assets		Quality teaching, a curriculum that has integrated technology, an inclusive environment, and quality non-academic education.

Tabel 5. Role/Application Matrix

Application And Function	Foundation	Administrator	Teacher	Parents	Students
Modifikasi SIBRO	R	CRUD	C U	CRUD	-
SITU	R	CRUD	CRUD	-	-
LMS	R	CRUD	CRUD	-	R

Table 6. Application/Functional Matrix

Business Function (x) / **Application Function (x)**	**Mscheduling Raport Collection**	**Display Score**	**Display attendance list**	**Display Payments History**	**Display Status and Amount Payment**	**View a list of lessons**
SIBRO (Modification)	✓	✓	✓	✓	✓	✓

Table 7. Technology Standard Catalog

Category	**Standard (yang direncanakan)**
Office productivity tools	Ms. Office 365
Collaboration	Ms. Teams / Google Meet / Zoom
Communication	Ms. Teams, Zoom, Google Meet, WhatsApp, Line
Operating system	Windows dan MAC
System & network management	-
Software engineering	Knowing programming languages (Java, Phyton, PHP, etc.), *computer programming*, *software testing*, *software debugging*, *database* (SQL, Oracle, Cassandra, etc.)
Database	MySQL
Code Editor	Visual Studio Code
Web Server	Apache

Table 8. Technology Standard Catalog

Application	**Technology Component**	**Specification**
Portal Website School	Web server	Server Dell PowerEdge T40-Intel Xeon E-2224G 16GB ECC SSD1TB
SIBRO	Database server	MySQL
	Software	Office 365
	Code Editor	Visual Studio Code

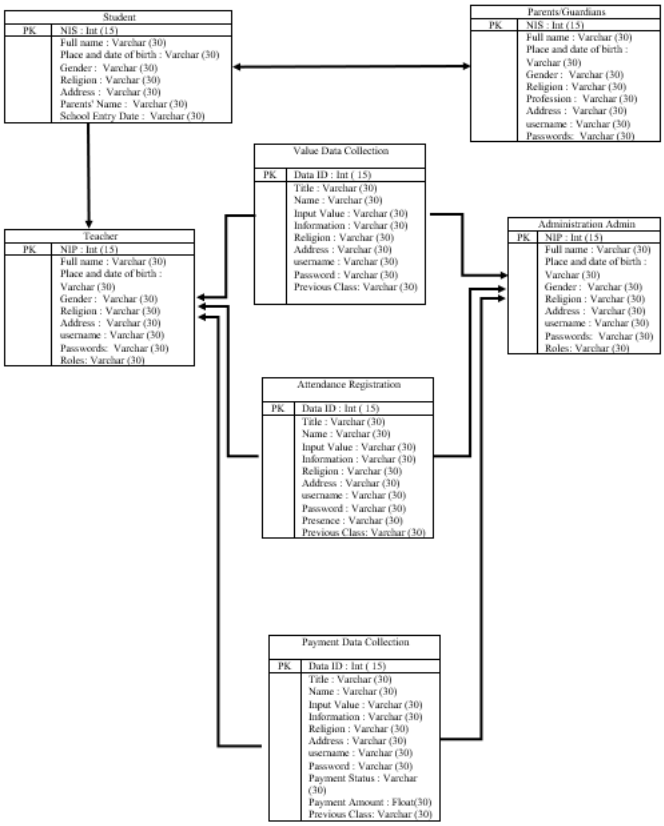

Figure 7. ERD SIBRO (Modification)

Tabel 9. SIBRO Information System Proposal (Modification)

Unit	Objective	Solution System Information
SIBRO (Modification)	Integrate databases related to SD Tumbuh 4 students. Thus, parents can easily access information about students with just one website.	Updating the SIBRO information system so that it can be used to access data related to SD Tumbuh 4 students. These data include grades, student attendance, student activity reports, school payments (SPP), and evaluations from parents for the school.

Tabel 10. Gap Analysis and Solutions

Unit	Business Objectives	SI Current Condition	Sistem Information Proposal
SIBRO	Integrate students' academic grades with parents and schedule offline meetings with homeroom teachers.	Not running optimally	SIBRO can become an Academic information system for parents by covering important information such as report cards, tuition fees, student activity reports, and evaluations from parents for the school to schedule offline report cards.

Table 11. Infrastructure Condition

Current Condition	Ideality	Gap
Distribution of report cards at SD Tumbuh 4 is still manual; appointments are made through SIBRO.	It is using a website that can make appointments without creating a new link every semester.	No system can provide this option.
Distribution of reports with traditional report cards.	Using E-Raport is more practical and efficient.	Need to improve training for human resources to be able to utilize technology.
Student attendance is shown on the report card, with the cumulative alpha, permits, and sick only.	Student attendance is indicated in the system with details, showing the student's status in each attendance.	No system shows student attendance in detail.

5. Conclusions and Suggestions

Conclusion

Information Systems became the founda-tion for the development of a modern organiza-tion [12]. Therefore, every organization needs to be supported by an information system archi-tecture design for the business development of its organization [13]. The object of this research is an elementary school in Yogyakarta. The re-search was conducted by designing an IS/IT strategic plan for schools. A strategic planning in IS / IT will be able to support the effective-ness and efficiency of business processes in schools. Optimization of business strategies can certainly be supported by IT strategies, for ex-ample the use of the SIBRO application. The study also proposed a system for improving a SIBRO application to access data relating to SD Growing 4. These data include report card scores, student attendance, student activity reports, school payments (SPP), and evalua-tions from parents for the school. The proposed strategy for the SIBRO application is also sup-ported by its proposed technology architecture. In addition, it also produces a list of which IT infrastructure assets need to be maintained and improved. Furthermore, to make a continuous research, the implementation of these strategic plannings can be considered for future research.

Suggestion

In the next research can add other phases on Togaf Adm that have not been im-plemented in this research.

6. References

F. Thaib and A. R. Emanuel, "Perancangan Enterprise Architecture UNIPAS Morotai Menggunakan TOGAF ADM," Teknika, vol. 9, no. 1, pp. 1-8, 2020.

J. G. P. Negara and A. W. Emanuel, "Enterprise Architecture Design Strategies for UGK Using TOGAF ADM.," In 1st Borobudur International Symposium on Humanities, Economics and Social Sciences, pp. 491-495, 2020.

J. A. Camatti, G. M. Rabelo, M. Borsato and Pelliciari M, "Comparative study of Open IoT Architecture with TOGAF for industry implementation," 30th International Conference on Flexible Automation and Intelligent Manufacturing, pp. 1132-2237, 2020.

K. d. Oliveira, E. C. Fernandes and M. Borsato, "A TOGAF-based framework for the Development of Sustainable Product-Service Systems," in 30th International Conference on Flexible Automation and Intelligent Manufacturing, Athens, Grace, 2020.

V. Goepp and M. Petit, "Insight From a Comparison of TOGAF ADM and SAM Alignment Processes," IFAC-Paper Online, vol. 50, no. 1, pp. 11707-11712, 2017.

M. Oberle, O. Yesilyurt, A. Schlereth, M. Risling and D. Schel, "Enterprise IT Architecture Greenfield Design Combining IEC 62264 and TOGAF by Example of Battery Manufacturing," in 4th International Conference on Industry 4.0 and Smart Manufacturing, Stuttgart, Germany, 2023.

P. Nastiti, A. Kesuma , M. A. Johannes and C. Immanuel, "Perencanaan Strategi Sistem Informasi untuk Mendukung Proses Bisnis Hotel XYZ," TEKNIKA, pp. 104-113, 2021.

The Open Group, TOGAF Standard Version, 2018.

A. Widjajarto, M. Lubis and U. Yunan, "Architecture Model of Information Technology Infrastructure Based on Service Quality at Goverment Institution," Procedia Computer Science, vol. 161, pp. 841-850, 2019.

R. A. Hermawan and I. D. Sumitra, "Designing Enterprise Architecture Using TOGAF Architecture Development Method," IOP Conference Series: Material Science and Engineering, vol. 662, no. 4, 2019.

E. Kornyshova and R. Deneckere, "A Proposal of a Situational Approach for Enterprise Architecture Frameworks: Application to TOGAF," Procedia computer Science, vol. 207, pp. 3499-3506, 2022.

D. Goerzig and T. Bauernhansl, "Enterprise architectures for the digital transformation in small and medium enterprises," in 11th CIRP Conference on Intelligent Computation in Manufacturing Engineering - CIRP ICME '17, Stuttgart, Germany, 2018.

E. Kornyshova and J. Barrios , "Industry 4.0 Impact Propagation on Enterprise Architecture Models," Procedia Computer Science, vol. 176, pp. 2497-2506, 2020.

M. Oberle , O. Yesilyurt, A. Schlereth, M. Risling and D. Schel, “Enterprise IT Architecture Greenfield Design Combining IEC 62264 and TOGAF by example of battery Manufacturing,” Procedia Computer Science, vol. 217, pp. 36-146, 2023.