Enterprise Architecture Design Using the TOGAF ADM Framework at SMAS Setia Budi in Sungailiat

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ABSTRACT

SMAS Setia Budi is a private school in Sungailiat that wants to improve the quality of its educational services by using information technology systems. In carrying out its business processes, schools have not maximized the information system architecture in accordance with the needs of school business processes that school has technology access and gaps. School has to do distance learning. Researchers found that school need to designing process changes with the system and optimizing system processes in academics, such as in terms of new student data collection, administrative and financial processes, problems with procurement of goods, and others. To help plan the development of information systems at SMAS Setia Budi, researchers designed a business architecture (enterprise architecture) using the TOGAF framework with the (ADM) method as a problem solving. In this study, an analysis of each phase in TOGAF was carried out, namely preliminary phase, vision architecture phase, business architecture phase, information systems architecture phase, technology architecture phase, and opportunities and solutions phase. The result of this study is to recommend blueprints, namely five application blueprint consisting of Academic Systems, Non-Academic Systems, School Procurement Management, School Financial Management, and School Data Management. Design is expected to be a benchmark for the development of information systems at the SMAS Setia Budi School and assist the school in carrying business processes in schools to be effective.

Keywords: Design, Enterprise Architecture, TOGAF ADM, High School, Blueprint

1. INTRODUCTION

The field of education is a place that provides learning to every student who comes to school. Education is also one of the influential areas in the use of information technology [1]. With this information technology, education will facilitate the learning process in schools [2]. However, there are things that must be considered such as a change in teaching, research, service, and infrastructure [3]. So that educational institutions will have their own challenges for how to implement information technology [4]. To achieve success, harmony is needed in applying technology that is beneficial to schools and also beneficial to teachers and students at school [5] [6].

The information system is not something that can be applied easily, in solving the problems faced by SMAS Setia Budi by designing an enterprise architecture system. One of the goals of implementing enterprise architecture is to create alignment between business functions and information technology or information systems and also enterprise architecture describes plans for developing a system or set of logically organizing systems for key business processes and information technology (IT) capabilities that reflect integration needs and standardization of operating models [7][8]. In this modern era, the need for technology, communication and information has increased and developed very rapidly [9]. The latest information that is happening

somewhere can be obtained easily, so that the existence of information technology today has helped the process of human life in carrying out daily activities. [10]. The development of this technology will certainly provide benefits in various fields of human life. Almost all human work has implemented the use of technology today. The role of technology in this modern era has brought the world into a more advanced and sophisticated era of globalization without us realizing it [11][12]. By describing the business processes carried out by SMAS Setia Budi in detail, it will assist in information system needs so that all aspects of business activities can become integrated, as well as increasing the business value and strategic advantage of SMAS Setia Budi. [13]. In SMAS Setia Budi on the island of Bangka who are starting to realize the importance of implementing information systems in the educational process provided [14].

SMAS Setia Budi was established in 1975 in the city of Sungailiat. The school is a private school that is under the auspices of the Setia Budi National Educational Institution Foundation (YPLNS). Setia Budi SMAS also has 'A' accreditation based on national education data or Dapodik 2022. Setia Budi SMAS has started implementing IS and IT, but this should not be a benchmark for the possibility that Setia Budi SMAS still has deficiencies in in terms of technology because schools have not maximized the use of information systems or technology such as the school website that they have still displays information about the school and then performs data processing related to new student admissions, preparation of teaching schedules and student schedules which are still being typed through word and also financial data that is still written manually by hand and have not used a special application for financial calculations [15][16]. This means that SMAS Setia Budi must design an information system development that is in line with the school's vision and mission and so that the business activities and information systems used are integrated. [17][18]. Contribute of this research are make an enterprise architecture for school by using TOGAF and help to create a blueprint for schools in developing systems.

This indicates that SMAS Setia Budi must design an information system development that is aligned with the vision and mission of the school by using enterprise architecture design using the TOGAF framework using the Architecture Development Method (ADM) as a medium for solving problems [19][20][21]. From solving existing problems at school, it is hoped that there will be applications that can be useful in the development of IS/IT at SMAS Setia Budi [22][23]. Implication of this research are expected to be able to provide input in the form of an application blueprint for the school, as well as applications that are expected to be useful in the development of IS/IT at SMAS Setia Budi. Schools can strengthen transparency and accountability in the management of information technology, as well as increase their ability to respond quickly to challenges and opportunities that arise in the ever-developing world of education.

2. RESEARCH METHODOLOGY

2.1. *Framework of Thinking*

The method that the researchers will use at SMAS Setia Budi is the TOGAF ADM framework which is useful for designing enterprise architecture in order to create an information system blueprint at SMA Setia Budi. In the following figure is the frame of mind that researchers used to design the system at Setia Budi High School.

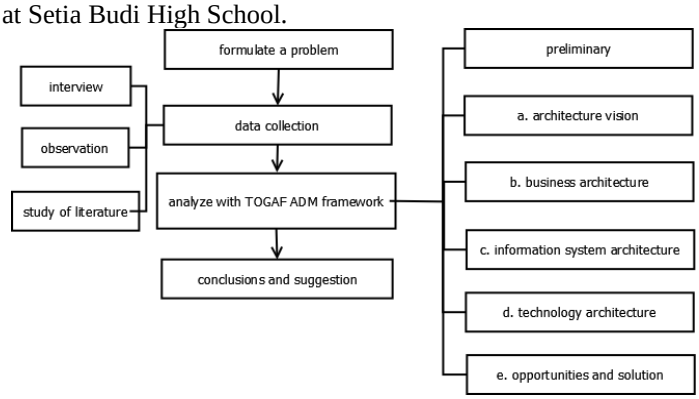

Figure 1. Framework of Thinking

2.2. *Design Method Using TOGAF*

In this study, for the enterprise architecture design method that will be carried out by researchers using the TOGAF ADM framework with the following stages:

1. Preliminary Phase: a phase that explains the initial preparations and activities that need to be carried out to achieve the direction of the business process towards the enterprise architecture model being developed. Activities carried out include preparing architectural capabilities, TOGAF customization plans and defining architectural principles. The preliminary phase is the preparatory phase where the principles of enterprise architecture will be defined which will be used in research at SMAS Setia Budi. At this stage it is carried out to identify the catalog or scope at Smas Setia Budi. The data was obtained from observations and interviews with parties related to SMAS Setia Budi.
2. Phase A: is the initial phase of ADM which aims to identify the vision of the organization's management regarding enterprise architecture capabilities which includes the process of assessing the organization's needs regarding the importance of enterprise architecture development, determining the scope of the enterprise architecture to be built, identifying stakeholders, and obtaining approval from management to develop enterprise architecture. Architecture Vision In this phase, architecture development will be carried out which discusses strategic mapping at SMAS Setia Budi. The data was obtained from the results of interviews conducted with parties related to SMAS Setia Budi.
3. Phase B: a phase that aims to define the initial conditions of the current business architecture. This is then continued with the development of business architecture targets which explain what business activities can be carried out to achieve business goals in accordance with the organization's business strategy. Business Architecture In this phase, a description of the current business processes will be carried out and a value chain analysis will be carried out, as well as a SWOT analysis.
4. Phase C: This phase is a combination of data architecture and application architecture. The goal is to develop target information systems (data and applications) that will be used by the organization. Data architecture emphasizes how data will be used to meet business process and service needs. Meanwhile, application architecture places more emphasis on planning application requirements and the application model to be designed. System Information

Architecture In this phase, we will discuss how the information system architecture will be used by SMAS Setia Budi. In this phase, we will define the data architecture and application architecture that will be used by SMAS Setia Budi. The data architecture will focus on the use of data for the needs of business functions, processes and services, while the application architecture will focus on the required software design. In this stage a system design and depiction of use case diagrams and activity diagrams will be produced.

5. Phase D: This phase aims to create a target technology architecture that you want to build using the Technology Portfolio Catalog to determine the type of hardware and software technology candidates required. Apart from that, in this phase it is also necessary to study alternatives that can be used in selecting technology. Technology Architecture In this phase, the preparation of the technology architecture design at SMAS Setia Budi will be carried out. This design includes the preparation of hardware and software proposed in the system blueprint. The design of the technological architecture is obtained from observing the technology that has been used, then it is proposed according to the technological requirements for the development of the proposed system.
6. Phase E: This phase focuses on defining the benefits obtained from enterprise architecture which includes business architecture, information system architecture, and technology architecture that have been created in phases B, C, and D. This stage is the basis for stakeholders to select and determine the architecture that will be implemented in organization. Opportunities and Solutions What is done in this phase is conducting a gap analysis related to the business architecture, data, software, and technology used. This step will also provide information on what opportunities will be obtained at SMAS Setia Budi when the planned system has been implemented into a business process system.

3. RESULTS AND DISCUSSION

In this chapter, the researcher will discuss the stages of designing enterprise architecture at SMAS Setia Budi using the TOGAF ADM framework with the following points: preliminary phase, architecture vision, business architecture, information system architecture, technology architecture, and opportunities and solutions.

3.1. *Preliminary Phase*

The Preliminary Phase is a phase that includes preparatory activities or the preliminary phase which contains identifying the elements of the framework and architectural principles involved and required to fulfill the enterprise architecture. Where in this phase there is preparation for designing enterprise architecture at SMAS Setia Budi. It is better to know the strengths, weaknesses, opportunities and threats that exist at SMAS Setia Budi. Therefore, the researchers conducted a SWOT analysis at the school which was carried out by interviewing the teachers at SMAS Setia Budi. The following is a SWOT analysis and a SWOT matrix strategy at SMAS Setia Budi.

a. Strength
    1. The human resources of the teaching teachers at SMAS Setia Budi have met the qualifications in their respective fields of study.
    2. Have a website in promoting school and school learning.
    3. Have an achievement every year in carrying out inter-school competition activities.
    4. Have scholarships for students who cannot afford.
b. Weakness
    1. Limited funds in developing school facilities.
    2. There is no achievement on an international scale.
    3. Lack of IT technology in schools
c. Opportunities
    1. Having public trust in quality education.

2. There is trust from various partners who work together.
3. Technological advances in assisting business processes in schools.

d. Threats
1. Public schools have a monthly fee that is quite cheap compared to private schools.
2. There is good school information from the community that there are the best schools.
3. Students who have just graduated from junior high school will look for public high schools instead of choosing private high schools.
4. Other schools have made technological developments in their schools.

e. SO Strategy
1. Carry out the application of learning and teaching with innovative technology.
2. Develop the interests and talents of students and female students

f. WO Strategy
1. The existence of technology to assist students in carrying out extracurricular activities.
2. Have high enough trust for the community to get people to recruit jobs in schools.

g. ST Strategy
1. Improving existing facilities at school.
2. Improving the qualifications of school teachers so that they can do better in learning.

h. WT Strategy
1. Improving technology in school management.
2. Add IT workers to help with school activities.

3.2. *Architecture Vision*

In the architecture vision phase, it explains about defining the scope of the organization's business objectives, identifying stakeholder map matrix, mapping business models, creating value chains and making Gap analysis of architectural vision and also gathering information needed related to the preparation of the architectural design to be made. Mapping this business model will be assisted by using the Business Model Canvas. This mapping will be explained with the SMAS Setia Budi Business Model Canvas. The following is the current BMC SMAS Setia Budi which can be explained as follows:

a. Customer Segments: Describes a group of different people or organizations that you want to reach, consisting of prospective new students who wish to enter Setia Budi High School, students who are students at school, and parents of students who are school trustees.
b. Value Proposition: contains the points offered from SMAS Setia Budi, namely having teachers and staff who meet the qualifications so teachers and staff already have their respective duties, implementing a curriculum in accordance with Indonesian standards, and having facilities to support student activities so students can express themselves with their own talents.
c. Channels: Describes how SMAS Setia Budi school communicates using Instagram, Facebook and Twitter.
d. Customer Relationship: Describe the types of relationships built with SMAS Setia Budi which consist of promoting schools through social media, doing school promotions by word of mouth, and conducting school visits.
e. Revenue stream: The income generated from SMAS Setia Budi comes from foundation funds and government funds.
f. Key Resources: Describes the most important assets owned by SMAS Setia Budi consisting of the Setia Budi foundation, teachers and staff, students, and school facilities.
g. Key activities: the main activities of SMAS Setia Budi are carrying out school learning and teaching activities, channeling student talents, and extracurricular activities.
h. Key Partnership: Resources outside SMAS Setia Budi are universities in Indonesia, and partners who work together.

i. Cost structure: The composition of costs or operational costs at Setia Budi SMAS school are teacher and staff salaries, costs for developing student talent, proposing new facilities, and proposing school goods.

Value chain or (value chain) is a business process analysis that identifies the main activities and supporting activities of a business to find competitive advantages and disadvantages of the business.

a. Main Activity
   1. Inbound Logistic: This element consists of accepting new students from outside schools or secondary schools from Setia Budi Middle School.
   2. Operation: This element contains school learning that starts from 07.00 in the morning until 16.00 in the afternoon learning at school will be carried out in class and learning will be carried out by explaining the lesson and then the teacher will give assignments to students, this extracurricular activity is a mandatory student activity that must be followed by all students and students at SMAS Setia Budi.
   3. Outbound Logistic: This activity includes student exams at school by covering student exam preparation for both midterm exams (UTS), final semester exams (UAS), or national exams (UN), and preparing for graduation for students.
   4. Marketing & Sales: To develop the promotion of the SMAS Setia Budi school, it carried out promotions through social media, brochures, then held competitions between junior high schools (SMP) around the SMAS Setia Budi school which were held at the school.
   5. Service: Service activities at SMAS Setia Budi include providing services to alumni if desired, and student counseling services if students wish to do counseling.

b. Support Activities
   1. Firm Infrastructure: This element contains managing the school's budget and finances to be able to meet school needs, school buildings used for student learning, and school grounds that function for student activities at school to support student activities at school.
   2. Human Resource Development: There is teacher recruitment and training so teachers will be recruited and training will be carried out and will be training in their respective fields.
   3. Technology Development: In supporting the existing process, SMAS Setia Budi is assisted by the school's website which contains information about the school, Microsoft Office for making correspondence, and virtual classes to assist online learning in schools that are not covered in the morning.
   4. Procurement: In this process, procurement consists of providing school facilities, from computer labs, chemistry labs, biology labs, and all school-related needs.

3.3. *Business Architecture*

This phase will explain the development of business architecture to support an agreed architectural vision by defining the initial conditions of the business architecture, as well as determining the tools and techniques to be used. The purpose of this phase is to describe the things that need to be implemented by schools to achieve business targets.

a. Driver/Goal/Objective Bisnis

This section explains the relationship between drivers/goals/objectives in SMAS Setia Budi. The following is an explanation of the driver/goal/objective which will be shown in the Table 1.

Table 1. Driver/Goal/Objective Bisnis

Catalog	*Information*
Driver	*There is a need for better service in academic schools*

Goals	*There is an optimal process in schools consisting of academic functions, non-academic functions, school finance, school data collection, and procurement of school goods* *The functions carried out at SMAS Setia Budi can be more optimal* *There is an integrated system of all activities carried out in schools*
Objective	*Using enterprise architecture design to integrate business processes that run at SMAS Setia Budi* *Utilization of mutually integrated data to help accelerate the performance of the SMAS Setia Budi school in carrying out operations carried out at the school*

b. Target Business Architecture

This section will discuss the target business architecture at SMAS Setia Budi which will be prepared based on the analysis that has been carried out. In the target business architecture that has been proposed, most of SMAS Setia Budi's business processes will be assisted by an information system that can be integrated with one another.

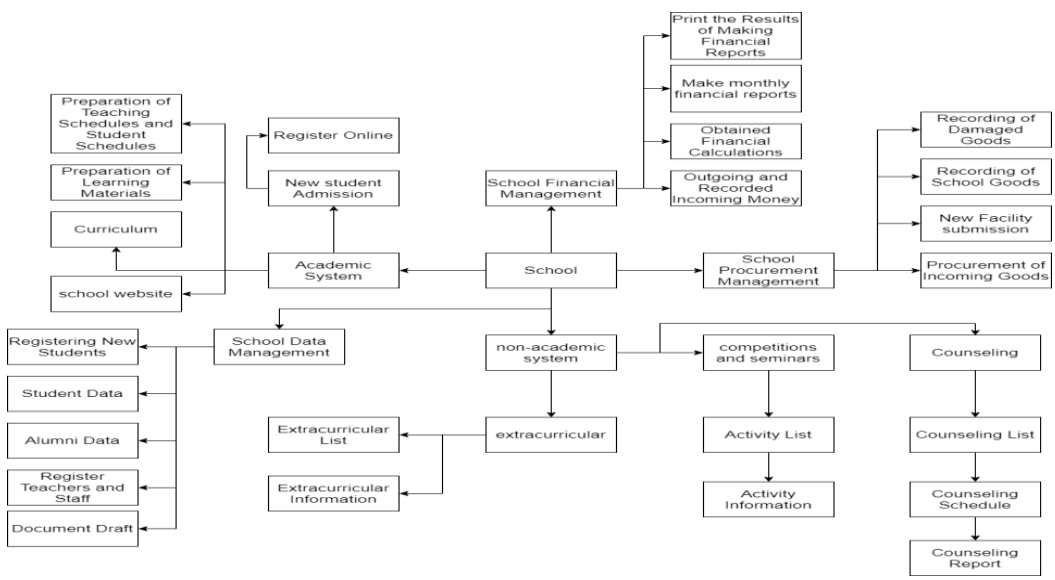

Figure 2. Target Business Architecture

In this business target, BPMN is made in the form of BPMN consisting of new student registration BPMN, curriculum BPMN, extracurricular BPMN, counseling BPMN, school financial management BPMN, school data management BPMN, and school procurement management BPMN. The following is the target business architecture which can be seen in Figure 2 Target Business Architecture at Setia Budi SMAS School.

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c. Application Architecture

This section will discuss the baseline at SMAS Setia Budi School and the application targets to be achieved from the analysis of the previous ADM TOGAF stages. In this section, a list of application portfolio catalogs will be shown, the role/application matrix is an illustration of the relationship between applications designed to run it in SMAS Setia Budi School. The following is a portfolio catalog.

1. Strategic. This section is an application that supports the existing business strategy at Setia Budi SMAS school. Included in this column are School Data Management and School Procurement Management. School Data Management because this application will assist the school in collecting existing data at school and in updating new documents. School Procurement Management in this application will assist schools in procuring goods and facilities at school and the application will also produce a sarpas report to assist school development.
2. High Potential. This section contains applications that have high potential to support the achievement of business success in schools. Included in this column is School Financial Management because this application helps in terms of recording school finances from incoming and outgoing money and finances at SMAS Setia Budi school in a more organized and recorded way.
3. Key Operational. In this section is an application that can function as the main process that occurs in schools. Included in this column is that the academic system in this system will have features for admitting new students and a curriculum for making subject matter and class schedules.
4. Support. This section is an application that functions to support business efficiency in schools. Included in this column is this non-academic system to support school business in collecting extracurricular data and this application also allows students to make a list of extracurriculars required by the school so students will take 1 extracurricular interest they are interested in and will develop students' talents at school. And in this non-academic system there are also school activities and students who wish to take part can register in the non-academic system application.

3.4. *Technology Architecture*

In Figure 3, the network topology proposed by SMAS Setia Budi can be seen the topology proposal for schools, where there are many additions such as adding 1 main switch for the school network so that it can be used as a single network path, for administrative assistants and student assistants who are also here using computers and adding printers as many as 4 in the waka room so each computer has a printer, there are additional servers as data storage, there is a firewall as well as protection for the school network. New students can view school information by means of a network connected to the internet.

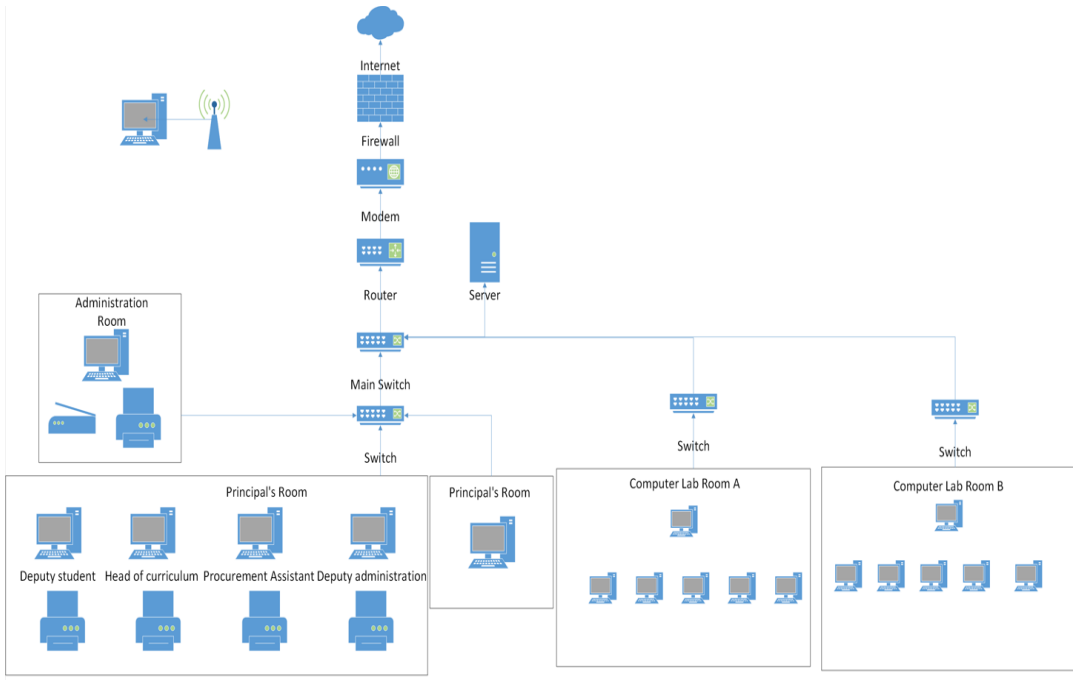

Figure 3. Target Network Topology

3.5. *Opportunities and solutions*

In this section an evaluation analysis will be carried out that focuses on architectural designs that have been made in the previous TOGAF ADM. In this phase will identify opportunities and solutions in the design that has been built. Business gap analysis, information system gap analysis, and technology gap analysis will be carried out. The following are provisions for making a gap analysis in the form of a matrix consisting of:

1. Placement of the current system components (baseline) is placed on the first row at the top of the matrix. Meanwhile, from the architectural component, the target is in the first column on the far left of the matrix. Give additional information "new" (new component) in the last line and then place it in the column of the current system component (baseline). Next, it will add "eliminated" (components to be removed) in the far-right column and placed in the target architecture component row.
2. If the current system component (baseline) is still in the target architectural component, then it is necessary to mark the intersecting space with the description "retain" (the old component will be maintained and will be reused).
3. If the current system component (baseline) gets a version development on the target architectural component, it needs to be marked with the description "replace" (the old component will be developed so that it becomes the latest version).
4. If the current component (baseline) is no longer used in the target architectural component, it needs to be marked with the description "remove" in the "eliminated" column.

In the information system gap analysis, it will explain the focus of the information system, in this case it will look at the current information system (baseline) and the information system that will be designed from the results of the enterprise architecture design.

In general, there will be several additional applications for SMAS Setia Budi. Initially, the SMAS Setia Budi information system used Microsoft Office and will be maintained but there will be developments in the performance of the system so that there will be an information system that is more structured and connected to one another. Based on figure 3 we get a proposed school architectural topology design which is adapted to the old system and the needs of the new system

and can be seen in Table 2. The following Table 2 is an analysis of the Setia Budi SMAS Information System Gap.

Table 2. GAP Analysis of the Setia Budi SMAS Information System

	Baseline		
	Microsoft Office	***Kelas Virtual***	***New***
Target			
Microsoft Office			
Virtual Class			
Academic System			
Non-Academic System			
School Financial Management			
School Procurement Management			
School Data Management			

Replace Retain New

In the technology gap analysis section that will explain the gaps in the information system, in this case, we will look at the current information system (baseline) and the information system designed from the results of the enterprise architecture design. In general, the use of technology at SMAS Setia Budi will be repaired or upgraded in terms of network infrastructure and some hardware. In order to be able to support the development of application design and can be useful for SMAS Setia Budi. The following analysis of the gap can be seen in Table 3 Analysis of the SMAS Setia Budi Technology Gap.

Table 3. SMAS Setia Budi Technology Gap Analysis

	Baseline			
	Windows 7	***MS.Office 2007***	***Network infrastructure***	***New***
Target				
Windows 10				
MS.office 2010				
Network infrastructure				
Server				
Antivirus				
Cloud				

Replace Retain New

This business gap analysis explains the business gap in this case by looking at the current business processes and processes. Explanation of the gap analysis can be seen in table 6 Business Gap Analysis of SMAS Setia Budi. In the business architecture section, it will provide several opportunities for SMAS Setia Budi, such as assisting in the business process of admitting new students to make it easier in the registration process, compiling a curriculum so that preparation is faster, extracurriculars assisting students in obtaining extracurricular information and registering extracurriculars, financial assistance school financial records so that there are no mistakes, procurement of goods or facilities to be more organized, school data collection for easier school data collection, drafting of documents, and school promotion so that schools are more widely known by the public.

Table 4. SMAS Setia Budi Business Gap Analysis

Baseline

Target	New student Admission	Curriculum-devel	Extracurricular	Finance	Procurement of goods or facilities	School registrar	Document drafting	School promotion
New student Admission								
Curriculum development								
Extracurricular								
Finance								
Procurement of goods or facilities								
School registrar								
Document drafting								
School promotion								

Replace

This section will discuss the proposed application road map as a guide used to design a business strategy. There are three parts to the road map that will be described, namely short term, medium term and long term. This division is adjusted to the needs that exist in SMAS Setia Budi. In the short term, there is an application for an academic system proposal, which is estimated to take around 7 months, for the medium term, there is a proposed application for school data management and school financial management for making this application, it takes about 9 months, and in the long term, there are non-academic systems and school procurement management for the estimated making of this application is around 1 year. Roadmap as a time frame for preparing research from start to finish. An overview of the roadmap will be drawn for the short-term using units of time per week where each month consists of four weeks. For the medium- and long-term use quarter units where in 1 quarter there are 3 months for 1 year. The following is a related short-term, medium-term and long-term design roadmap:

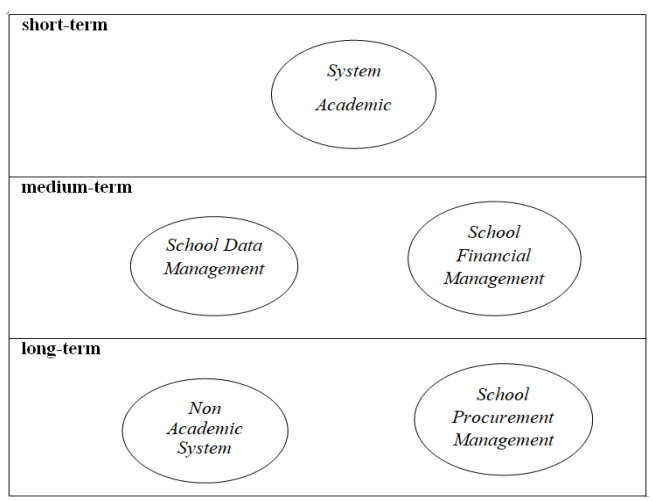

Figure 4. Overall Roadmap

For making this application 4 years 1 month. for the short term there is an application for an academic system proposal estimated to be made around 7 months, for the medium term there is an

application for a proposed school data management and school financial management for about 9 months, and in the long term there is a non-academic system and school procurement management for an estimated production time of around 1 year. For the target of designing SMAS Setia Budi so that there are information systems that are integrated or interconnected with one another.

4. CONCLUSION

From the results of the research analysis described in the previous chapter, the following conclusions can be drawn: Based on the results of research using TOGAF ADM, it can be seen that the process of activities at SMAS Setia Budi on Bangka island when implementing IS/IT will run more optimally, Some recommended applications Based on the research that has been done, there are 5 application blueprints, namely academic systems, non-academic systems, School Financial Management, School Procurement Management, and School Data Management. Then the resulting enterprise architecture design at SMAS Setia Budi makes information systems and business processes integrated with each other's data to achieve a goal.

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