

Development Of Blueprint Enterprise Architecture In Academic Field Using Zachman Framework

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Abstract. *The Zachman Framework is one of the methods that can be used to design systems in a structured and comprehensive manner. This study aims to apply the Zachman Framework to design the academic system at SMA Al Kautsar Bandar Lampung, resulting in a blueprint that serves as a guide for system development. The research method involves mapping each perspective in the Zachman Framework, namely Planner (scope), Owner (business model), Designer (system model), and Builder (technology implementation). The findings indicate that the Zachman Framework ensures that all essential aspects of the system are considered, resulting in a structured enterprise architecture design that is efficient and meets stakeholder needs. Furthermore, this framework has proven effective in integrating data and synergizing business functions in the academic section, supporting optimal operations. The implications of this study suggest that the Zachman Framework can serve as an alternative solution for designing and developing an organized, directed, and easily implementable academic system, thus improving the efficiency of business processes in educational institutions.*

Keywords: *academic system, enterprise architecture, Zachman Framework*

1. INTRODUCTION

In the era of globalization, the role of Information Technology (IT) and Information Systems (IS) is very important in an organization or a company in running its business unit, where business strategy and IT strategy must run in harmony to realize the organization's effective and efficient running (Murti et al., 2017). A company or organization cannot run well without IT, because IT is one of the factors that determines the goals of an organization or a company can be achieved according to the predetermined target. The concept of creating information technology in an organization has the aim of being able to work efficiently on the computer used and get economic value, so that the output will bring many benefits to the organization itself (Rendra and Wasilah, 2015). Given the importance of using IT and IS in an organization or company in running its business, a well-organized IT infrastructure is needed to facilitate managing all IS and IT needs in a company or organization. Enterprise architecture (EA) is a logical organization of key business processes and IT capabilities that reflect the need for integration and standardization, operating models Enterprise architecture is a description of stakeholder missions that include information, functionality or usability, organizational location and performance parameters. EA is seen as a logical, comprehensive and holistic approach to defining, designing and implementing systems and system components simultaneously (Hasibuan et al., 2020). Enterprise architecture describes a plan to develop a system or set of systems (Yunis and Surendro, 2009). The scope of EA includes information architecture, business architecture, application architecture, and technology architecture

(Herliah, 2022). The design of EA at SMA Al Kautsar Bandar Lampung aims to produce an ideal ICT blueprint for the school. In order to produce an ideal ICT blueprint, a good method or framework is needed in compiling EA.

Enterprise Architecture is a descriptive representation (model) that is relevant to describe an enterprise and what must be produced to meet management needs (Supardi, 2016). The benefit of Enterprise Architecture is that it can be used as a reference or guideline when developing information and communication systems because enterprise architecture is a blueprint. Zachman's Framework for Enterprise Architecture provides a way to view and define a company formally and in a structured manner. This framework consists of a two-dimensional classification matrix built from a combination of several general questions (Widodo and Suharjito, 2017).

The advantage of this method/framework compared to others is its ease of understanding because it focuses on the organization in general and describes tools and methods independently. All components in this framework can be mapped to find the conditions that best suit the organization. In addition, this framework has a classification that allows the identification of all different parts of the IT infrastructure through various logical viewpoints, resulting in a larger list of components that can be analyzed more regularly, providing many best practices or real-world examples.

2. THEORETICAL STUDY

a. Enterprise Architecture

Enterprise Architecture is a framework that describes the organizational logic for business processes and IT infrastructure, reflecting the need for integration and standardization of the company's operating model. This operating model refers to the integration of business processes and the desired level of standardization in those processes to provide goods and services to customers (Petersen et al., 2019).

Enterprise Architecture, either in the context of Business Architecture or the architecture of an entity from a company's perspective has a clear overall business purpose and can involve one or more organizations participating in it. The context of Enterprise Architecture depends on: process, discipline, level, input, and output. To describe this context, terms such as contextual, conceptual, logical, physical, and operational are used (Soegoto, 2016). In addition, research also shows that there is a significant level of co-authorship grouping and a positive impact of the level of co-authorship on the dissemination of works on enterprise architecture.

b. Enterprise Architecture Planning (EAP)

Enterprise Architecture Planning (EAP) is a methodological approach used to design the overall structure of an enterprise with an emphasis on how data, applications, and technology are organized and used to build the enterprise information framework. EAP is a planning process that involves identifying business needs, analyzing existing architectures, and formulating implementation plans to achieve desired architectural goals. This methodology considers various aspects of enterprise architecture, including how data is stored, processed, and used, how applications are integrated, and how technology supports overall enterprise operations. Thus, EAP is an important foundation in ensuring that enterprise architecture can support the information and operational needs of the enterprise effectively and efficiently.

According to Steven H. Spewak, Enterprise Architecture Planning (EAP) is a methodology that emphasizes the use of the term architecture consisting of data architecture, application architecture, and technology architecture. EAP is not about designing business and architecture, but rather about defining business needs and appropriate architecture.

Therefore, EAP not only involves the planning stage which generally includes the definition of the required architecture, but also involves a support plan that details when the architecture will be run or implemented. In this context, EAP becomes more holistic by including the time aspect of architecture implementation as an integral part of the planning process.

In the Zachman framework structure, there is a model designed to visualize the relationship between company components and the architectural level that is the focus of stakeholders' attention. This model provides a clear understanding of the structure and relationship between enterprise elements that are relevant to those interested in Enterprise Architecture (Aytekin et al., 2020). The relationship between the Zachman framework and EAP lies in the effort to detail the two main levels in the Zachman structure. Thus, if placed in the Zachman framework, EAP will include the first row and the second row, which represent the planning and owner perspectives. Meanwhile, the aspects discussed in EAP will focus on the three columns in the Zachman framework, providing a clear picture of how enterprise architecture planning is integrated with the established framework, namely data, functions and information system architecture networks (Falahah and Rosmala. 2010).

c. Zachman Framework

The Zachman Framework is a method of classifying artifacts in Enterprise Architecture that has been widely accepted as a de-facto standard. The successful use of this framework has established its position as a leading guide in designing and managing enterprise architecture

effectively. This framework is praised for its uniqueness in the classification of architecture from an enterprise perspective (Kristanto, 2016).

The framework can be interpreted as a collection of thoughts, concepts, ideas, or assumptions used to structure and organize the thought process regarding a matter or situation. This framework can also be considered as a foundation of thought that helps group and structure the representation of a company, which is important for company management and further development. By using the framework, organizations can have a structured guide to understand and deal with various aspects related to the operation and development of the company.

The Enterprise Architecture framework is a 2 (two) dimensional classification system used to present a description of an enterprise. This classification is obtained through observation of various related objects. One of the well-known frameworks is the Zachman Framework, which was introduced by John Zachman in 1987 and later expanded and formulated by Sowa and Zachman in 1992. Each model of this framework articulates architectural entities into rows and their attributes into columns (Basir et al., 2018).

d. Relevant Research

In the context of using the Zachman Framework, there are a number of relevant studies that can provide in-depth insights into the benefits and implementation of this approach, including:

- 1) One of the relevant studies is the work of (Foorthuis et al., 2015), which highlights the benefits of enterprise architecture in providing a holistic view of the organization to balance various interests and solutions (Foorthuis et al., 2016). In addition, dynamic enterprise architecture capabilities have a positive impact on business and IT integration, as well as corporate process innovation.
- 2) In addition, new alternatives to enterprise architecture appear to be emerging, which can provide additional insights into innovative approaches to designing enterprise architecture blueprints (J. Lapalme et al., 2016). Meanwhile, a concrete example of the application of the Zachman Framework in planning enterprise architecture in a company, which can provide a useful perspective on the implementation of this framework (S. Herman et al., 2020).
- 3) According to research conducted by Janiasih, Sutedi entitled "Compiling the IT Master Plan for SMP Negeri 1 Tanjung Bintang Using TOGAF". IT management must carry out Information Technology Governance (IT Governance) as part of Corporate Governance or Good Corporate Governance (GCG) to ensure the provision of better IT services and

in accordance with business objectives. Organizational goals will be achieved if IT plans and strategies are implemented in a manner that is in accordance with the organization's established business plans and strategies (Janiasih and Sutedi, 2023).

- 4) According to research conducted by Anton Catur Atmoko, Sutedi entitled "An Enterprise Architecture Plan for Balai Riset dan Standarisasi Industri Bandar Lampung" EA is an architectural model for mapping business structures in depth and providing clear specifications that function to coordinate and supervise business parts to achieve goals (C. Atmoko and Sutedi, 2021).

Previous studies have shown that the implementation of Enterprise Architecture greatly helps business processes as well as the process of running the system because each process has a unique architectural design to facilitate application creation or development.

Previous studies have found that Enterprise Architecture helps classify various business processes and data processing, so that each step of the system built minimizes data loss or unused data. Therefore, Enterprise Architecture can be used in several studies that aim to improve data flow from input to output, so that the processed data can be tracked from start to finish.

3. RESEARCH METHODS

In this section, a blueprint enterprise architecture planning for information systems in the academic field at SMA Al Kautsar Bandar Lampung is prepared by applying the Zachman approach. In this process, various aspects related to the structure, process, and technology that will be used in the development of the information system will be studied. In applying the Zachman approach method, it is necessary to conduct an in-depth analysis of the unique needs and characteristics of the academic environment at SMA Al Kautsar Bandar Lampung. In addition, planning must also consider the standards and regulations that apply to information management in the educational environment.

The Zachman framework is not a methodology for developing Enterprise Architecture, but rather a framework for categorizing Enterprise Architecture artifacts. The use of the Zachman framework can help in determining the extent to which a methodology covers all aspects of Enterprise Architecture or which aspects are covered by the methodology. The Zachman framework for Enterprise Architecture consists of 6 (six) columns and 6 (six) rows. In the context of developing Enterprise Architecture, the Zachman framework provides systematic guidance in identifying, organizing, and grouping artifacts related to Enterprise Architecture.

At the data collection stage, two methods are used, namely:

- a. Direct observation to the research location (observation) is a method used to directly see data related to the material needed in compiling the research, such as studying documentation, organizational goals and structures, business processes, and existing information technology policies. This method allows researchers to gain a deep understanding of the context and conditions being studied.
- b. Interviews or Q&A with officials or employees at Al Kautsar High School, Bandar Lampung who are involved in the field of Information Technology (IT) or with parties related to the research is a method used to obtain direct information from competent and experienced sources related to the research topic. Through this direct interaction, researchers can gain deep insight into the implementation, policies, and challenges related to IT in the educational environment of Al Kautsar High School, Bandar Lampung.

This study refers to the Enterprise Architecture Planning (EAP) methodology, with the object of research being the main activities at SMA Al Kautsar Bandar Lampung. Data obtained from data sources will be processed following the stages of the EAP methodology, producing a conceptual model of data, applications and technology as a blueprint required by the Senior High School. This model will be a reference and guide in the development of an integrated information system in the future, to be more structured and on target.

4. RESULTS AND DISCUSSION

a. Business Architecture of School

School business plans usually emphasize the facilities that will attract students to enroll, but this is a little different in some schools, especially private schools. Private schools do not pay much attention to their business processes, and the school business structure is usually as described below.

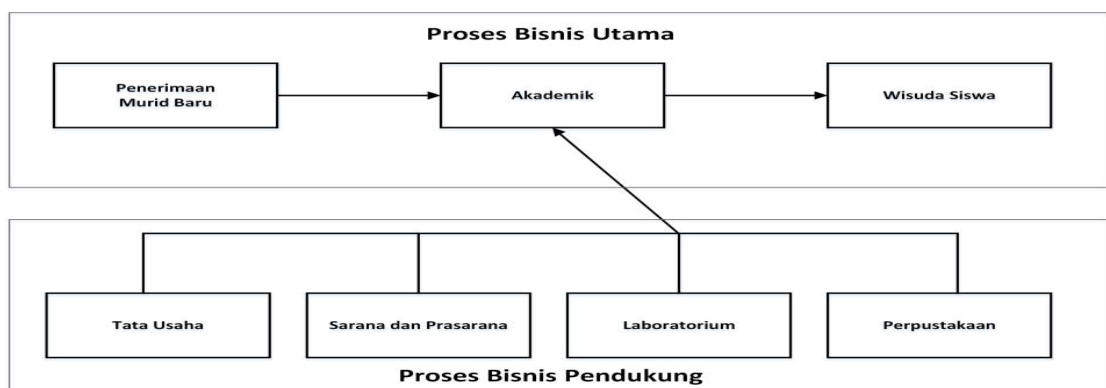


Figure 1. School Business Architecture

In the image above, the business process is divided into 2 parts, namely the main business and the supporting business. In the main business, there is a process of accepting new students, academics, and graduation (graduates). In this section, each prospective student is required to pay BPP and re-register, so that they can be considered official students at the school. Meanwhile, the supporting business process focuses on activities that aim to increase operational income that runs every month. This supporting business can also increase the appeal for prospective students, because with adequate facilities, parents are more confident in enrolling their children in the school.

This research will focus on the business process that takes place in the academic field, although other business processes also occur in the administration section. The academic section is responsible for verifying data that has been entered into the system, printing report cards, and validating student grades. This process aims to ensure the accuracy of academic data, as well as support the smooth administration of education at the school. In addition, the academic section also plays a role in maintaining the quality and integrity of information related to student development.

b. Data Architecture

The results of the analysis that has been carried out are the division of several data entities into several groups based on data architecture, namely:

Table 1. Al Kautsar High School Data Entities

Entity	Data
New Student Admissions	New Student Candidates Entrance selection requirements Entrance test schedule Entrance test process Test results New student re-registration
Academic Process	Academic calendar Teacher data Student data Lesson schedule Subjects Attendance Exam schedule Exams Grades Learning results Report cards
Student Release	Students graduated from school Students dropped out of school Students transferred schools Report cards Diplomas

Laboratory	Rules Practical Schedule Practice Inventory
Library	Member Book Type Book Borrowing Return Report
Facilities and infrastructure	Procurement Inventory Asset Report

Source: Processed by researchers 2024

This research will concentrate on the aspect of academic data process. The collected data will be categorized into the following table:

Table 2. Academic Data Entities

Entity	Data	Data Fill
Academic	Students	Name, NIS, place and date of birth, address, religion, parents' names, last diploma, birth certificate
	Subjects	Subject Name, Subject Code
	Schedule	Day, room, time
	Teachers	Teacher's main number, subject, address, telephone number, email
	Exams	Subject Name, Subject Code, time, room, grades, report card
	Schedule	Day, room, time

Source: Processed by researchers 2024

Academic data was previously stored in hardcopy files. However, through the design of enterprise architecture, this data will be taken from a centralized student admissions website. This way, every part of the school bureau that needs it can immediately get the data.

c. Technology Architecture

Technology architecture is the design of the technology that will be used in schools, such as the following network topology.

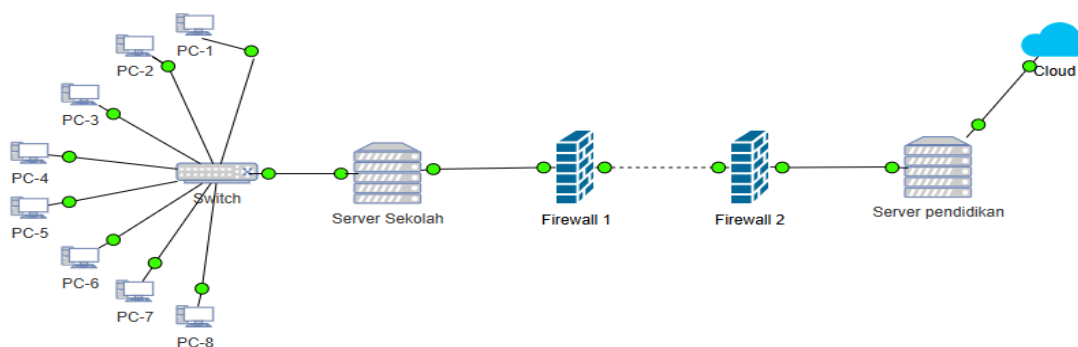


Figure 2. Network Topology

The network topology shown in Figure 2 provides a comprehensive overview of the current network at SMA Al Kautsar Bandar Lampung. By utilizing enterprise architecture technology, this study aims to make improvements and modifications to several parts of the network, including breaking down and updating existing components, as can be seen in the following figure. This aims to improve the efficiency and reliability of the school network.

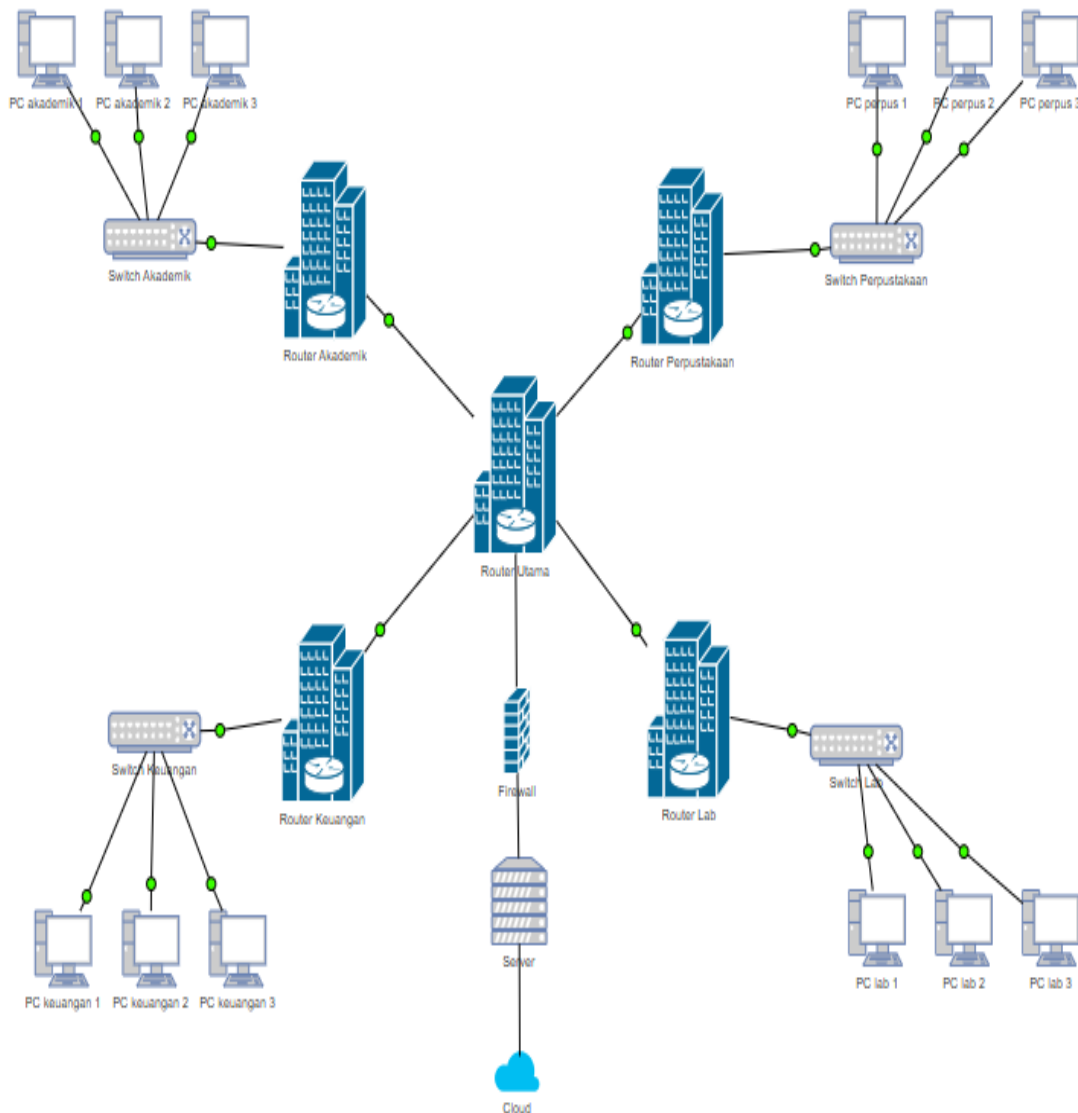


Figure 3. New Network Topology

In the planning of the new technology architecture, each part will have separate router access. The purpose of this arrangement is to simplify the maintenance process and improve the security system. With the separation of router access, network monitoring and management becomes more efficient, while the potential for disruption to the system can be minimized. This also allows for faster detection and handling of problems and focuses on certain parts, without affecting the entire system.

d. Initialization of Planning

The preparation of Enterprise Architecture at SMA Al Kautsar Bandar Lampung covers all aspects that support educational activities at this school, with the aim of producing quality education. Quality education starts from various activities carried out at school, including the teaching and learning process, facilities provided, extracurricular activities, marketing, and data management. Marketing is carried out through various channels, such as junior high schools, print media such as newspapers, as well as the dissemination of information through social media and communication with relatives. The registration process is carried out by students, which includes paying registration fees and taking the Academic Potential Test (TPA) and psychological tests. SMA Al Kautsar Bandar Lampung has various sources of information that support the smoothness and success of the business processes that run at the school.

The variable of perception of ease of use of this data consists of four indicators, which include: PU1, which states that the use of E-reports helps complete work faster; PU2, which indicates that work can be completed according to the specified target; PU3, which confirms that the use of the system does not take much time; and PU4, which indicates that value processing can be done automatically by the system. These four indicators illustrate how effective the system is in simplifying the work process, saving time, and ensuring that work is done on time and according to target.

In the frequency data of the perception variable of use, the majority of respondents strongly agree that the E-Rapor information system makes work easier, especially in inputting grades. This system utilizes the Value Chain concept to produce quality graduates, thereby increasing profits for schools that implement the concept. Value Chain analysis helps SMA Al Kautsar Bandar Lampung understand the series of values that contribute to the formation of quality graduates, starting from the registration process, learning, exams, to student achievement. The Value Chain consists of two types of activities, namely main activities and supporting activities.

5. CONCLUSION

The Zachman framework can be applied as an alternative to designing a system in the academic section at Al Kautsar High School, Bandar Lampung, producing a blueprint. This blueprint can be used as a reference by analysts, designers and programmers in further system development. The use of the Zachman Framework helps ensure that all important aspects of the system have been considered and documented properly, so that the development process becomes more efficient and focused.

The enterprise architecture design produced using the Zachman framework in the academic section is developed based on a blueprint that is adjusted to the perspective of the Planner (scope), owner (business model), Designer (system model) and Builder (physical technology). This approach is to ensure that every aspect of the architecture is considered properly, resulting in a system that is structured and in accordance with the needs of various stakeholders.

The Zachman framework can be used as an alternative to help provide solutions to problems at Al Kautsar High School, Bandar Lampung in integrating data and synergizing all business functions. This is reflected in the mapping of each perspective which is a documentation process of each activity to build and develop a system in the academic section. With this approach, Al Kautsar High School can ensure that all elements needed to support academic operations are well structured and can be integrated effectively.

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