



Enterprise Architecture Design Using the Togaf Architecture Development Method (Togaf-Adm) Framework at The Library of SMAN 22 Jakarta

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Abstrak: Penelitian ini bertujuan untuk merancang cetak biru (blueprint) arsitektur enterprise untuk Perpustakaan SMAN 22 Jakarta guna meningkatkan kualitas layanan dan meminimalkan masalah operasional yang disebabkan oleh sistem manual saat ini, seperti seringnya kehilangan data. Perpustakaan, sebagai divisi utama di sektor pendidikan, saat ini menjalankan fungsi-fungsi seperti pendaftaran anggota, peminjaman, dan pengembalian buku, menggunakan metode tradisional. Perancangan arsitektur perusahaan ini diperlukan untuk menyelaraskan strategi bisnis dan teknologi informasi guna mendukung pengembangan di masa depan. Metodologi yang digunakan adalah kerangka kerja TOGAF Architecture Development Method (TOGAF-ADM). Penelitian ini secara spesifik menggunakan enam tahapan dari TOGAF-ADM: Fase Pendahuluan, Manajemen Persyaratan, Fase A (Visi Arsitektur), Fase B (Arsitektur Bisnis), Fase C (Arsitektur Sistem Informasi), dan Fase D (Arsitektur Teknologi). Setiap tahapan digunakan untuk menghasilkan cetak biru arsitektur yang komprehensif. Hasil dari penelitian ini adalah usulan cetak biru arsitektur untuk Perpustakaan SMAN 22 Jakarta, yang mencakup arsitektur saat ini (saat ini) dan target (target) untuk domain Bisnis, Data, Aplikasi, dan Teknologi. Cetak biru ini menawarkan visualisasi yang jelas mengenai keselarasan antara fungsi bisnis dan infrastruktur serta sistem Teknologi Informasi yang dibutuhkan. Kesimpulannya, rancangan arsitektur enterprise ini, khususnya usulan fungsi sistem informasi kepegawaian, dapat berfungsi sebagai referensi dan fondasi yang berharga untuk pengembangan informasi bisnis dan perencanaan strategi teknologi di masa depan pada Perpustakaan SMAN 22 Jakarta.

Kata kunci: Enterprise Architecture, Perpustakaan, TOGAF ADM, Sistem Informasi.

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Abstract: This research aims to design an enterprise architecture blueprint for the SMAN 22 Jakarta Library to improve service quality and minimize operational problems caused by the current manual system, such as frequent data loss. The Library, a key division in the education sector, currently executes functions like member registration, book borrowing, and returns, using traditional methods. The enterprise architecture design is necessary to align business strategies and information technology to support future development. The methodology used is the TOGAF Architecture Development Method (TOGAF-ADM) framework. This research specifically utilizes six phases of TOGAF-ADM: Preliminary Phase, Requirements Management, Phase A (Architecture Vision), Phase B (Business Architecture), Phase C (Information System Architecture), and Phase D (Technology Architecture). Each phase is used to produce a comprehensive architectural blueprint. The results of this study are proposed architectural blueprints for the SMAN 22 Jakarta Library, encompassing the current and target architectures for Business, Data, Application, and Technology domains. These blueprints offer a clear visualization of the alignment between business functions and the required Information Technology infrastructure and systems. In conclusion, the designed enterprise architecture, particularly the proposed personnel information system function, can serve as a valuable reference and foundation for future business development and information technology strategic planning at the SMAN 22 Jakarta Library.

Keywords: Enterprise Architecture, Libraries, TOGAF ADM, Information Systems

Introduction

An organization has an information system that must run well because it is in the interest of improving the business processes being carried out by the organization (Laudon et al, 2020). This system is critical as it influences data management components, transforming raw data into important and actionable information for organizational decision-making (Turban et al, 2021).

The SMAN 22 Jakarta library currently does not have guidelines for the use of information systems and technology. Some reporting systems are still done manually and there are several applications that still frequently fail. To overcome this problem, a paradigm is needed in planning, designing, and managing information systems called enterprise architecture (Susanto, 2022). Enterprise architecture is a blueprint that systematically and completely defines the company's current and desired conditions (Jordan et al, 2024).

The goal of enterprise architecture is to create a map of IT assets and business processes and a set of governance principles that drive ongoing discussions about business strategy and how that strategy can be expressed through IT (Monita et al, 2021). TOGAF ADM is a general method that contains a set of activities that represent the development of each ADM phase and the architectural models used and created during the enterprise architecture development stage (Purba et al, 2021).

The aim of this research is to optimize the use of information systems and information technology in every business activity in the SMAN 22 Jakarta Library through a design that suits the needs and resources of SMAN 22 Jakarta using the TOGAF framework.

Methodology

• Time and Place of Research

The time needed for researchers to obtain the required data is six months starting from September 2023 to March 2024. The research was conducted and carried out in SMAN 22 Jakarta.

• Data Collection Technique

The data collection technique used in this research is observation method, interview method, and literature study method.

• Design Method Preliminary Phase

In the preliminary phase, it explains how to carry out the design in the company concerned.

• Requirement Management

Requirements Management carries out needs analysis and creates documentation of user needs in the SMAN Library 22 Jakarta. The goal of this stage is to manage architectural requirements throughout the ADM phases by identifying, storing, and provide in this phase related enterprise needs.

Phase A: Architecture Vision

The architectural vision phase is the initiation phase of the EA development cycle which includes defining the vision and mission, organizational goals, organizational targets, and organizational business processes.

Phase B: Business Architecture

At this stage, define the initial conditions of the company's business architecture, then determine the desired business model or activities in accordance with the business scenario and analysis carried out in the form of the organization's business processes.

Phase C: Information System Architecture

This phase will discuss defining the data architecture and application architecture that will be proposed.

Phase D: Technology Architecture

This architectural technology phase defines the technological structure that supports the operations of the applications that have been modeled in the SMAN 22 Jakarta Library application architecture.

This stage defines the need for technology in processing data by determining technology candidates with the aim of selecting a technology platform in the form of hardware or software. The technique for identifying technology platform principles has 7 areas, namely operating systems

Result and Discussion

• Literature Review

At this stage, the collection and understanding of theories related to enterprise architecture are carried out as well as tools that can help in the research process such as value chains, stakeholder map matrices, and so on which are obtained from reference books, journals, theses, and websites as mentioned above. has been described in previous chapters.

• Observations and Interviews

At this stage, researchers collected supporting data related to the SMAN 22 Jakarta library, including:

- a. Profile, scope, vision, mission, and organizational structure.
- b. Conditions of ongoing business processes, data architecture, technology used, and existing infrastructure conditions.

• Preliminary Phase

1. Scope of Library at SMAN 22 Jakarta (What)

Based on the results of observations and interviews with the library section of SMAN 22 Jakarta and the Principal of SMAN 22 Jakarta, the library section is held by a person in charge appointed by the principal. The person responsible is responsible for managing the running of the library system.

2. Library Stakeholders at SMAN 22 Jakarta (Who)

Table 1. Involved Stakeholders

Role	Stakeholder		
	Headmaster	Library Staff	Student
Building an Architectural Vision	A,C,I	R,I	C,I
Building an Architecture Business	A,C,I	R,I	C,I
Building an Architectural Information System	A,I	C,I	C,I
Building Architectural Information Technology	A,I	C,I	C,I

3. Locations Researched (Where)

The location of this research is at SMAN 22 Jakarta, Jl. Kramat Asem, South Utan Kayu, Matraman, East Jakarta.

4. Research Time (When)

The research will be carried out for approximately 6 months, starting in August 2023, starting with determining problem identification, determining objectives, preliminary studies, business processes, data collection, data analysis, drafting recommendations, and ending with conclusions which are estimated to be completed in February 2024.

5. Enterprise Architecture Design Objectives (Why)

The aim of designing this enterprise architecture is to achieve good system integration so that business strategy and technology strategy in the SMAN 22 Jakarta library can be aligned.

6. How is Enterprise Architecture developed? (How)

The enterprise architecture design method in this research is to use the TOGAF ADM method which is a framework for enterprise architecture development. Adapting to the problem constraints, the enterprise architecture design for this research consists of the Preliminary stage, Phase A (Architecture Vision), Phase B (Business Architecture), Phase C (Information System Architecture), Phase D (Technology Architecture).

● **Phase A: Architecture Vision**

1. SMAN 22 Jakarta Library Profile

The SMAN 22 Jakarta Library is part of the Education Department of SMAN 22 Jakarta which has the function of managing the library at SMAN 22 Jakarta. Currently the library is managed by a library staff member who is under the principal’s duties ranging from managing books, registering library members, borrowing, and returning library books, as well as making reports about the library.

2. Vision and Mission of SMAN 22 Jakarta Library

From the results of interviews with library staff at SMAN 22 Jakarta, the vision and mission were obtained as follows:

1) Vision

"Making the library a support in the teaching and learning process according to curriculum developments"

2) Mission

- Providing library services for school users/community.
- Providing sources of information and knowledge that can support the success of teaching and learning activities in schools.
- It is a means for students to become skilled at lifelong learning and able to develop their thinking power so that they can live as responsible citizens.
- Improve supporting facilities for user services.

3. Purpose of SMAN 22 Jakarta Library

"Organizing library services to improve the quality of the teaching and learning process, develop interest and reading habits, and develop the independent learning abilities of students/school communities by activating the GLS (School Literacy Movement)."

4. Involved Stakeholders

Table 2. Involved Stakeholders

Stakeholder	Involvement
Headmaster	Provide direction regarding the overall expected architecture. Provide final decisions regarding the design of the enterprise architecture model. Receive report data related to book availability, book procurement, management of facilities and infrastructure, borrowing and returning books.
Library Staff	Provide direction regarding the design of business architecture models, data, applications, and technology in each section. Assist the school principal in making decisions regarding the design being made. Provide business information, roles, and responsibilities for each section. Provide information about business processes and library data needed for research. Manage library book collections. Providing report data on book availability, book procurement, management of facilities and infrastructure, borrowing and returning books.
Student	Provide relevant information for registering library members. Provide information related to borrowing books. Provide information regarding book returns.

5. Business process

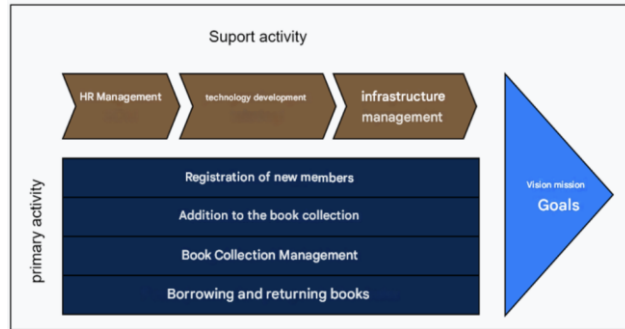


Figure 1. Business Process Value Chain

6. Solution Concept Diagram

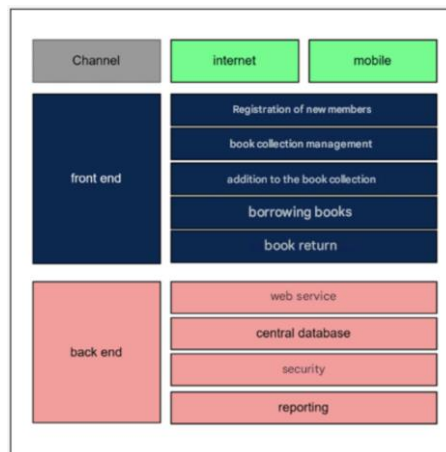


Figure 2. Solution Concept Diagram

- Phase B: Business Architecture

Current Business Architecture

1. Business Architecture for New Member Registration

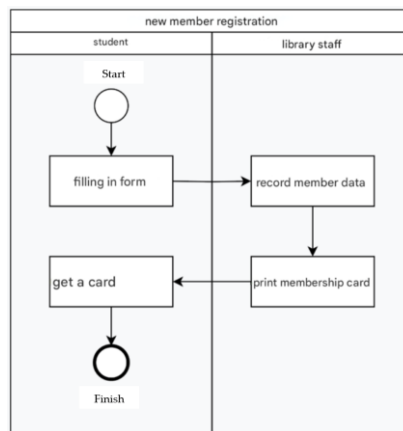


Figure 3. BPMN Diagram for New Member Registration

2. Business Architecture in Book Collection Management

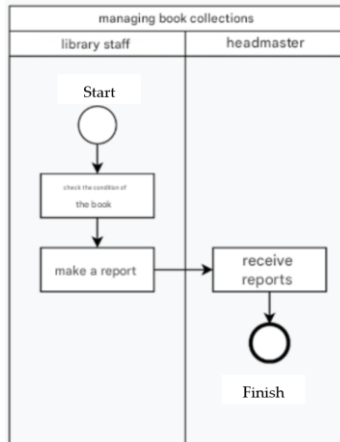


Figure 4. BPMN Diagram for Managing Book Collections

3. Business Architecture for Adding Book Collections

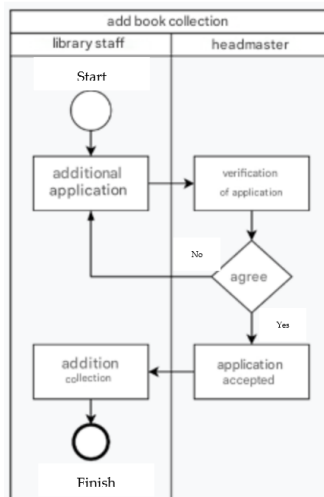


Figure 5. BPMN Diagram for Adding Book Collections

4. Business Architecture in Book Lending

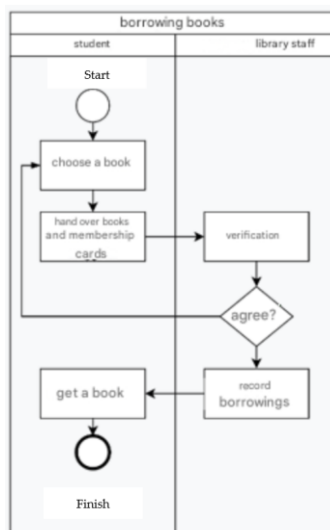


Figure 6. BPMN Diagram for Book Lending

5. Business Architecture on Book Returns

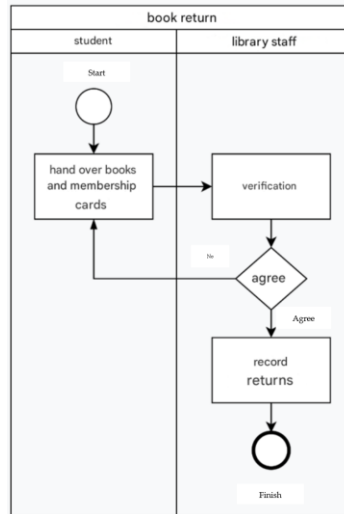


Figure 7. Book Return BPMN Diagram

- Gap Analysis

Table 3. Architecture Business Gap Analysis

Process	Present condition	Proposed Solution/Analysis	Expected Target
New member registration	The registration process still uses a manual system where students must take a registration form and submit it to the library staff	Creation of member registration applications	Prospective members can register directly in the registration system
Book collection management	In the process of making book management reports, manual notes are still used	Creating a book collection management application integrated with a database	Library staff can directly manage book collections that are integrated with the database
Addition to the book collection	Adding book collections currently uses a manual process where library staff record new books	Creating a book collection management application integrated with a database	Library staff can add book collections that are integrated with the database
Book borrowing	Book borrowing is recorded manually	Creation of a book lending management application	Staff can directly enter book loans into the application
Book return	Recording of book returns is done manually	Creation of a book return management application	Staff can directly enter book returns into the application

Proposed Business Architecture

1. Proposed New Member Registration Architecture

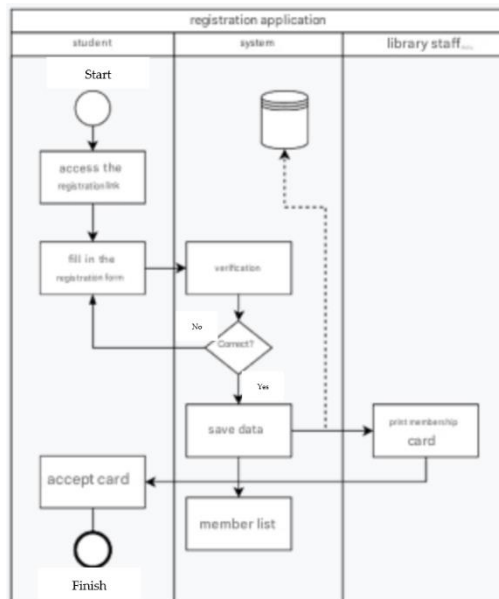


Figure 8. BPMN Diagram Proposed New Member Registration

2. Proposed Architecture for Book Collection Management

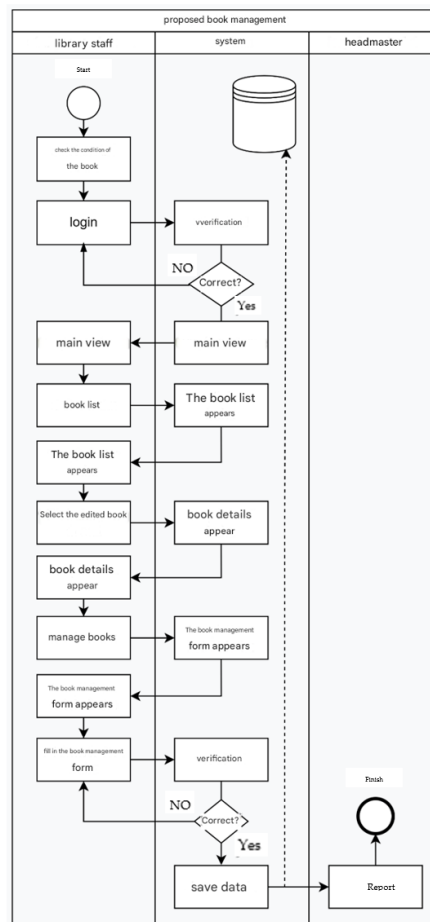


Figure 9. Book Collection Management Diagram

3. Architecture of the proposed addition to the book collection

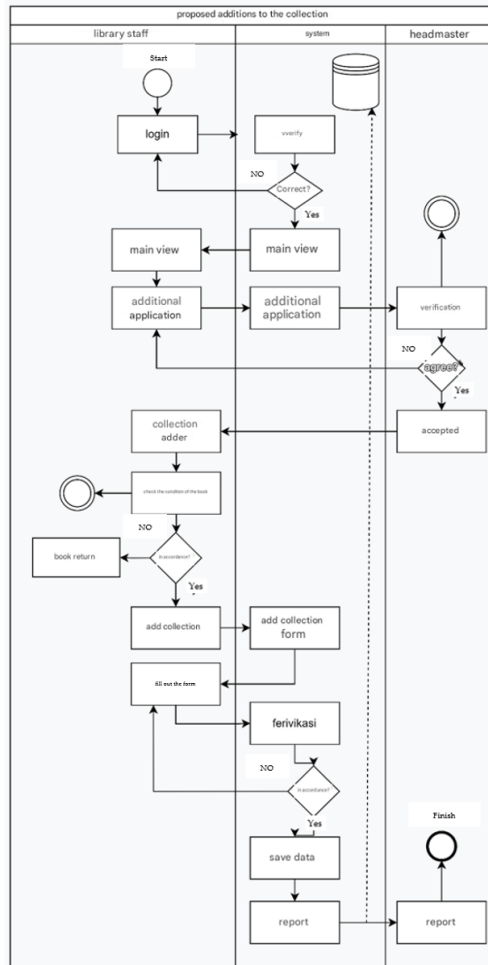


Figure 10. BPMN Diagram Add Book Collection

4. Architecture of the Book Lending Proposal

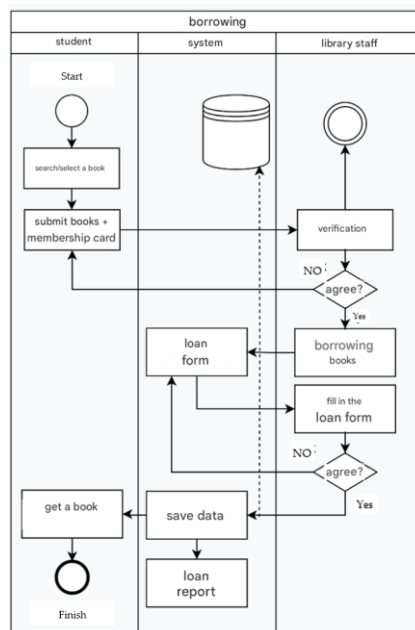


Figure 11. BPMN Diagram for Proposed Book Borrowing

5. Proposed Book Return Architecture

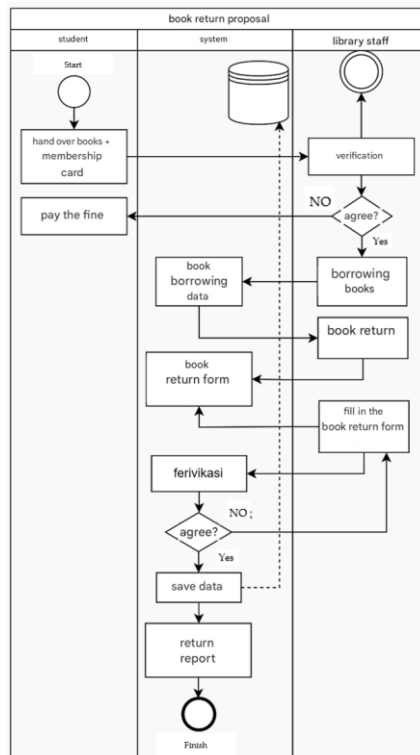


Figure 12. BPMN Diagram for Proposed Book Returns

- **Determining Organization (Actor Catalog)**

Table 4. Actor Catalog

No	Business process	Actor
1	Member registration	Students Library Staff
2	Management of library book collections	Library Staff Principal
3	Addition to the library book collection	Library Staff Principal
4	Book borrowing	Students Library Staff Principal
5	Book return	Students Library Staff Principal

• **Phase C: Information Architecture**

Data Architecture

1. Current Data Architecture

Table 5. Current Architectural Data

No	Business process	Data Entities
1	Library Member Registration	Data and information on library member registrants. Data and information on students registered in the library.
2	Library Book Lending	Library book borrowing data. Book loan report data for one month.
3	Library Book Returns	Library book return data. Book return report data for one month.
4	Book Collection Management	Library book collection data. Library collection report data for one month.
5	Addition to Book Collection	Data on additions to book collections. Data report on additions to book collections.

2. Proposed/Future Data Architecture

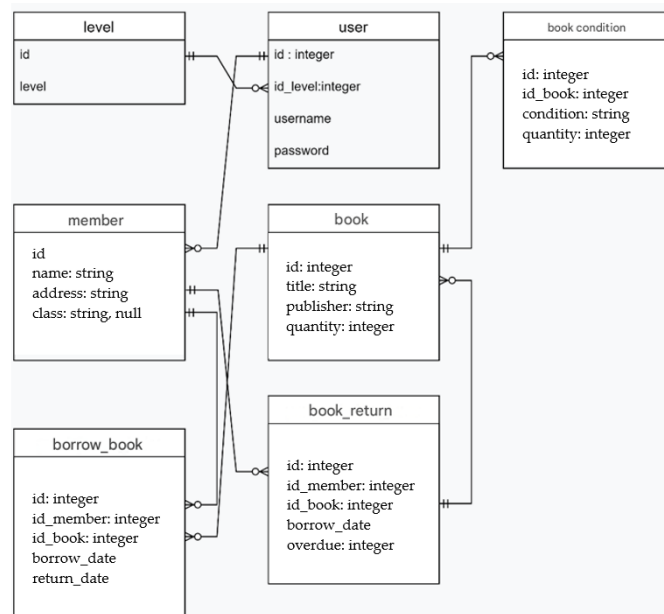


Figure 13. ERD Proposed Data Architecture

Table 6. Proposed Data Architecture

No.	Table	Attribute	Function
1	Level	Id : integer Level : string	To determine member access rights.
2	User	Id : integer Id_level : integer Username : string Password : string	For application login.
3	Member	Id : integer Name : string Address : string Class : string (null)	To store member and library staff data.

No.	Table	Attribute	Function
4	Book	Id : integer Title : string Publisher : string Quantity : integer	To store library book collection.
5	Book_Condition	Id : integer Id_book : integer Condition : string Quantity : integer	To describe the condition of the existing book collection (e.g., good or damaged).
6	Borrowing	Id : integer Id_member : integer Id_book : integer Borrow_Date : date Return_Date : date	To store book borrowing data.
7	Return	Id : integer Id_member : integer Id_book : integer Return_Date : date Overdue : integer	To store book return data.

Application Architecture

1. Application Portfolio

Table 7. Application Portfolio

No	Application Name	Application Function
1	New Member Registration	To integrate the new member registration process with member data.
2	Book Collection Management	To integrate the management of book condition, the book collection list, and book collection reports.
3	Book Collection Addition	Integrated management for adding new book collections with the book collection list and the book collection report.
4	Book Borrowing	Management of book borrowing integrated with the book borrowing list and book borrowing reports.
5	Book Return	Management of book returns integrated with the book return list and book return reports.

2.



Figure 14. Use Case Diagram of Proposed System

Table 8. Actors and Access Rights

No	Actor	Access Rights
1	Student	Registration, borrowing, and return.
2	Library Staff	Book list, manage book collection, add book collection, member list, print card, book borrowing reports, and book return reports.
3	School Principal	Book list, member list, and reports.

a. Activity Diagram for New Member Registration

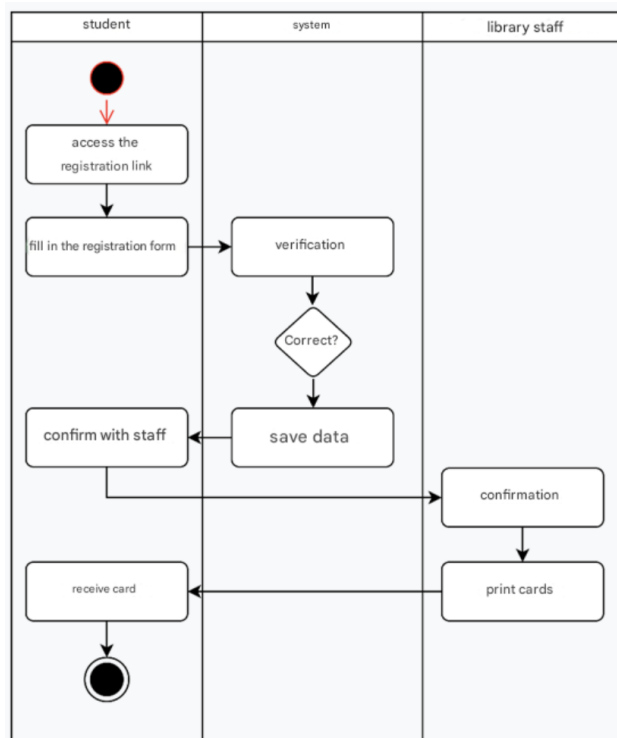


Figure 15. Activity Diagram for Proposed Member Registration

b. Activity Diagram Manage Book Collection

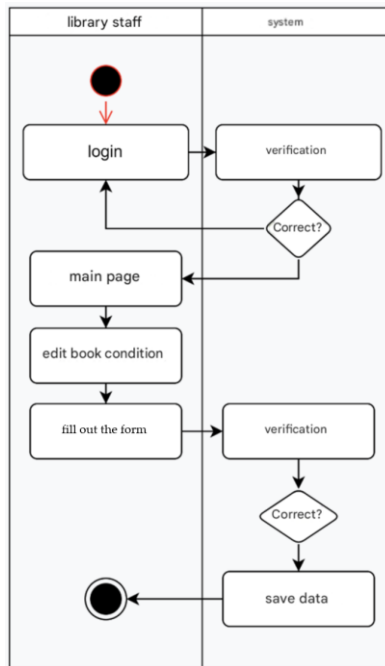


Figure 16. Activity Diagram Manage Book Collection

c. Activity Diagram Add Book Collection

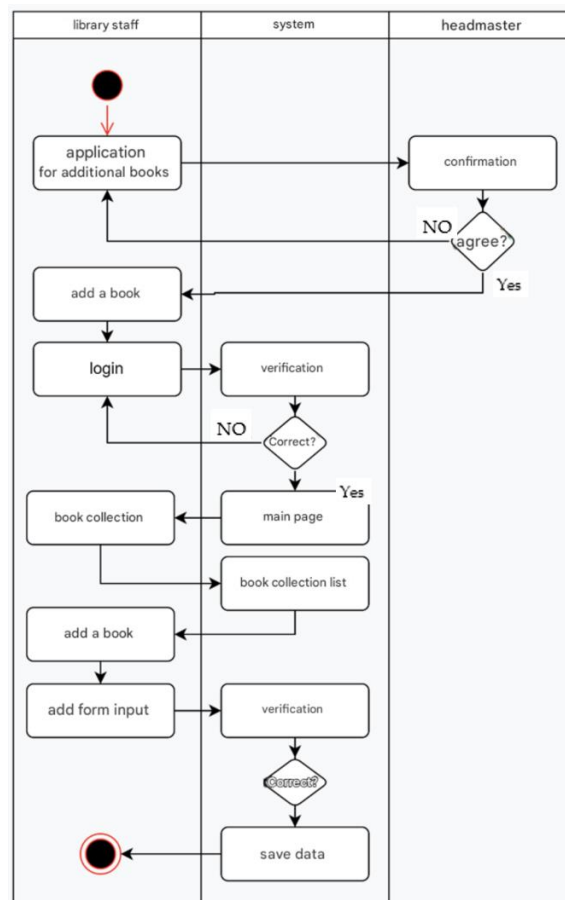


Figure 17. Activity Diagram Add Book Collection

d. Activity Diagram Book Borrowing List

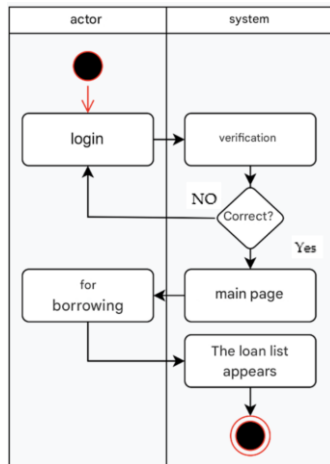


Figure 18. Activity Diagram Book Borrowing List

e. Activity Diagram Book Return List

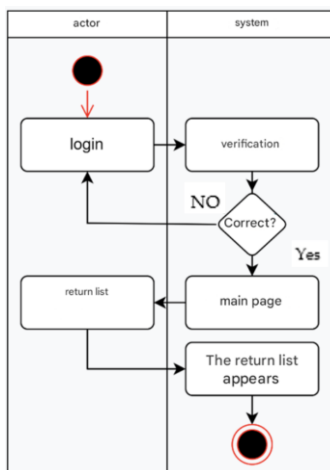


Figure 19. Activity Diagram Book Return List

f. Activity Diagram Book Collection List

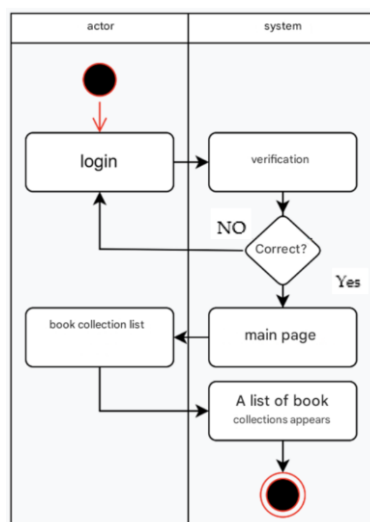


Figure 20. Activity Diagram Book Collection List

g. Activity Diagram for Borrowing Books

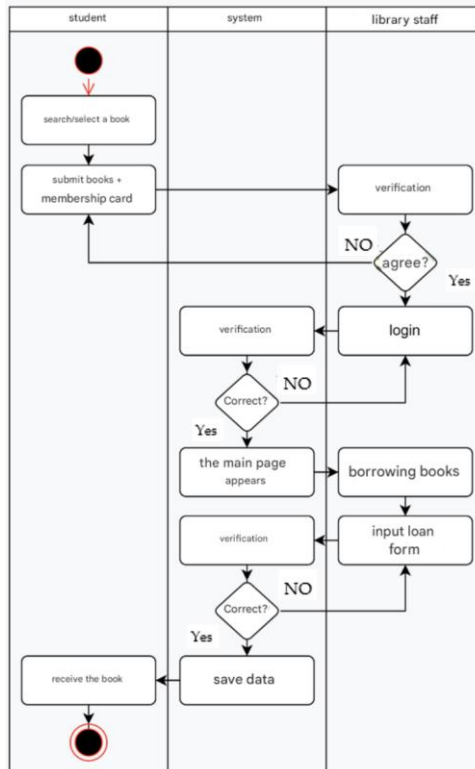


Figure 21. Activity Diagram for Borrowing Books

h. Book Return Activity Diagram

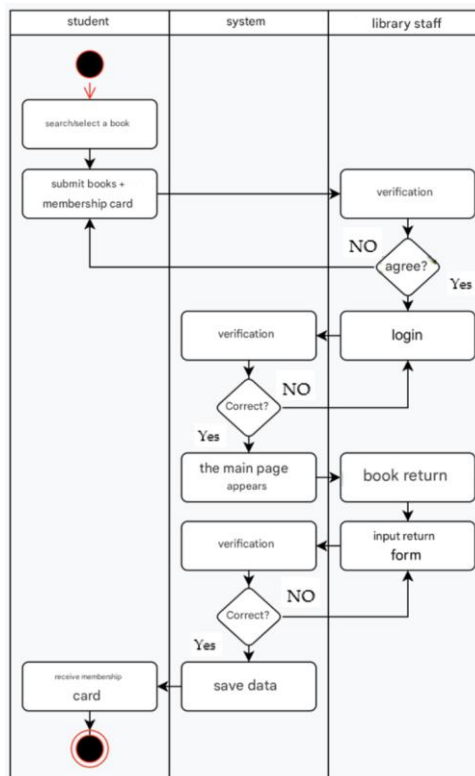


Figure 22. Book Return Activity Diagram

i. Library Report Activity Diagram

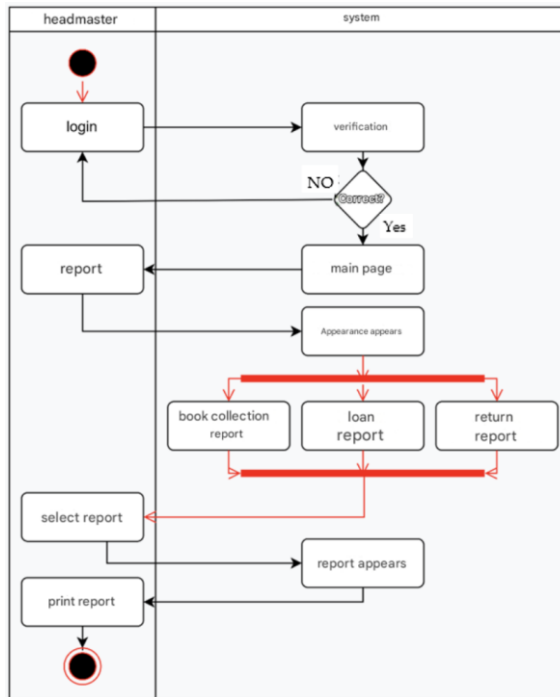


Figure 23. Activity Diagram Library Administration Report

• Phase D: Technology Architecture
 Current Technology Architecture

Table 9. Running Architecture Technology

No	Hardware	Software	Description
1	PC (Personal Computer)	OS (Operating System) windows 8	Library Section: 1 Pc School Principal Section: 1 Pc
2	Switch	-	1 switch for each section: Library and School Principal.
3	LAN Cable	-	1 LAN Cable
4	Printer	-	1 printer in the library section.
5	Internet Bandwidth	-	Speed up to 10 Mbps Unlimited.
6		MS. EXCEL	Used in data management.

Technology Architecture Gap Analysis

Table 10. Technology Architecture Gap Analysis

No	Current State	Desired Target
1	2 PCs	Add 1 laptop for backup purposes in case of PC failure.
2	Minimal PC specifications	PC specifications should be upgraded.
3	1 Printer	Add a printer due to the library building being separate from the principal's office, to increase efficiency during printing.
4	Has not utilized a library system application	A library information system that covers the required business processes.

Technology Architecture Improvement Proposals

a. Identify the Basic Principles of Architectural Technology

Table 11. Identify the Basic Principles of Technology

No	Type	Principle
1	Hardware	Can be used for future development. Based on the needs and goals of the information system.
2	Software	Easy to use. The operating system can support the information system to be developed. User access rights are available.
3	Communication Network Devices	Supports future business functions.

b. Defining the Principles of Architectural Technology

Table 12. Proposed Software Criteria

No	Software Type	Criteria
1	Server Operating System	Open source. Available and easy to update. Provides adequate utilities. Supports Graphical User Interface (GUI). Has a good level of security. Supports TCP/IP protocol.
2	Library Member Registration Application	User Friendly. Legal. Easy to update. Easy to maintain (maintenance process). Can be used on Windows operating systems. Can be accessed on low PC specifications. Can be accessed on employee cell phones.
3	Library Book Borrowing Application	User Friendly. Legal. Easy to update. Easy to maintain (maintenance process). Can be accessed by users via website. Can be used on Windows operating systems. Can be accessed on low PC specifications.
4	Library Book Return Application	User Friendly. Legal. Easy to update.

No	Software Type	Criteria
		Easy to maintain (maintenance process). Can be accessed by users via website. Can be used on Windows operating systems. Can be accessed on low PC specifications.
5	Library Book Collection Management Application	User Friendly. Legal. Easy to update. Easy to maintain (maintenance process). Can be accessed by users via website. Can be used on Windows operating systems. Can be accessed on low PC specifications.
6	Library Administration Reporting Application	User Friendly. Legal. Easy to update. Easy to maintain (maintenance process). Can be accessed by users via website. Can be used on Windows operating systems. Can be accessed on low PC specifications.
7	Database	Has database management capabilities. Can manage users. Can process data quickly and accurately. High level of security. Has adequate backup and restore facilities.
8	Programming Language	Object-Oriented Programming. Program syntax is easy to understand. Capable of processing large amounts of data.

Current Network Technology Architecture

The network infrastructure implemented in the library section of SMAN 22 Jakarta uses a bus topology. Bus topology is a network diagram that connects two or more computers serially using a main cable which is used as the center for the flow of data traffic.

Future Network Technology Architecture

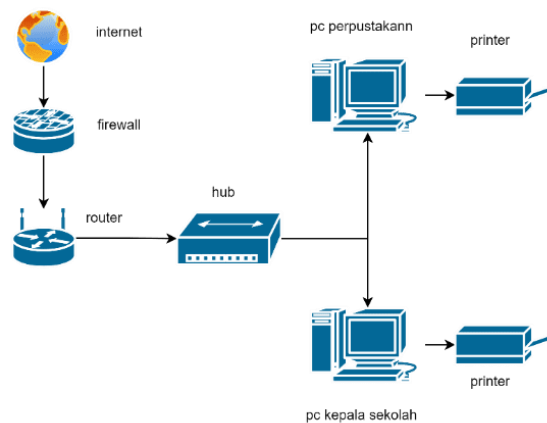


Figure 24. Proposed Network Architecture

Discussion

1. Enterprise Architecture Alignment using TOGAF ADM

The enterprise architecture design for the SMAN 22 Jakarta Library was developed using the TOGAF Architecture Development Method (ADM), which is recognized globally as an effective framework for aligning business and IT strategies (Purba et al., 2021). The core objective of this design is to achieve good system integration and align the business strategy and technology strategy within the library. This alignment is critical because the integration of systems directly influences the efficiency of data management and information retrieval within an organization (Hermanto & Supangat, 2018). The study focused on five phases of TOGAF ADM: Preliminary Phase, Phase A (Architecture Vision), Phase B (Business Architecture), Phase C (Information System Architecture), and Phase D (Technology Architecture).

2. Analysis of Business Architecture Gaps (Phase B)

In the current state, five core business processes—New Member Registration, Book Collection Management, Book Collection Addition, Book Borrowing, and Book Return—were found to rely heavily on manual systems. For example, new member registration still requires students to manually fill out forms, and book borrowing/return records are manually noted. Based on the Gap Analysis results (Table 3), the proposed solution involves the creation of a database-integrated management application. This finding supports the general theory of Enterprise Architecture, which emphasizes that process automation is essential to move from inefficient manual processes to integrated and streamlined digital processes, thus increasing staff efficiency (Nurrasyid & Putra, 2020).

Proposed Business Architecture: The proposed architecture (Figures 8, 9, 10, 11, 12) shifts the key activities:

- New Member Registration: Students will directly access a registration link and fill out the form online, eliminating manual form handling.
- Book Borrowing/Return: Library staff can directly enter loan and return data into the application, which is integrated with the database. This is expected to minimize errors and the risk of data loss associated with the current manual recording method.

3. Proposed Information Architecture (Phase C)

The design defines a detailed data architecture (Figure 13 and Table 6) and application architecture (Table 7 and Figure 14) necessary for the proposed system.

- Data Architecture: Key entities like Level, User, Member, Book, Book_Condition, Borrowing, and Return were established. Designing a clear relationship between these entities, as shown in the ERD (Figure 13), is crucial for ensuring data integrity and reducing redundancy, which is a primary goal of sound data architecture design (Lesnussa & Sitokdana, 2023).
- Application Architecture: Five core applications were identified to support the new business processes, including New Member Registration and Book Collection Management. The Use Case Diagram confirms that these applications centralize the

logical functions, allowing efficient management by the Library Staff and reporting access for the Headmaster.

4. Technology Architecture Recommendations (Phase D)

The gap analysis for the existing technology (Table 10) reveals that current hardware is minimal and the system lacks a dedicated application library.

The proposed solution includes:

- **Hardware Upgrade:** Increasing PC specifications and adding a laptop for backup.
- **Infrastructure:** The proposed network architecture (Figure 24) moves towards a more managed system using a Router and a Hub, improving upon the current bus topology to ensure a more stable and secure network infrastructure for the new system (Asmara & Sumitra, 2023).
- **Software Principles:** The proposed software must meet criteria such as being User Friendly, Legal, Easy to Update, and possessing High Security and backup/restore facilities for the database. These principles align with industry best practices for building sustainable and secure information systems in non-profit organizations (Darkel & Emanuel, 2023).

Conclusion

Based on the discussion and analysis of enterprise architecture planning using the TOGAF ADM methodology as a framework at the SMAN 22 Jakarta Library, the study successfully produced a comprehensive architectural blueprint. This blueprint regularly defines the future state of the library's information technology landscape by encompassing the company profile, business architecture, information system architecture, and technology architecture. The primary result of this planning analysis is an enterprise architecture that provides a strategic roadmap for information systems and information technology, which can be utilized by the SMAN 22 Jakarta Library to develop and align all information system architectures related to current business processes. Ultimately, the resulting blueprint offers a clear and integrated overview of the proposed library information system architecture, moving away from the current manual systems.

Based on the findings and the resulting blueprint, several key recommendations are proposed to ensure the success and sustainability of the enterprise architecture design. Firstly, the SMAN 22 Jakarta Library should prioritize the implementation of the proposed information system (applications for registration, borrowing, and return) as soon as possible to address the identified inefficiencies and data issues resulting from the current manual operations. Second, an infrastructure upgrade is essential, specifically by upgrading minimum PC specifications and adding backup hardware (laptops), to guarantee the stability and performance of the new information system. Furthermore, management must adhere strictly to the defined technology principles (e.g., User Friendly, Legal, Secure) during procurement and development to protect the investment and ensure the system supports future business functions. Finally, it is recommended that future research continue the TOGAF ADM lifecycle into the implementation phases (e.g., Phase E and G) to govern system development and ensure the successful deployment of the architectural roadmap.

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