

TOGAF Utilization for Revolutionizing Enterprise Architecture at Labor Intensive Industry

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ABSTRACT

Labor-intensive industries face challenges in optimizing information systems and technology. Disconnected business processes cause scattered data and poor application integration. A structured approach is required to design an enterprise architecture aligning business and IT strategies. This study explores TOGAF implementation in a labor-intensive business in Jakarta, focusing on creating a more efficient architecture. The research provides design recommendations, including human resource management portal enhancements. Using TOGAF and UML, the study successfully created an enterprise architecture addressing business, application, data, and technology needs, improving departmental integration, overall business performance, and service delivery. It effectively bridges IT and business strategies.

ABSTRAK

Industri padat karya menghadapi tantangan dalam mengoptimalkan sistem informasi dan teknologi. Proses bisnis yang terputus-putus menyebabkan data tersebar dan integrasi aplikasi yang buruk. Pendekatan terstruktur diperlukan untuk merancang arsitektur perusahaan yang menyelaraskan strategi bisnis dan TI. Studi ini mengeksplorasi implementasi TOGAF dalam bisnis padat karya di Jakarta, dengan fokus pada penciptaan arsitektur yang lebih efisien. Penelitian ini memberikan rekomendasi desain, termasuk peningkatan portal manajemen sumber daya manusia. Dengan menggunakan TOGAF dan UML, studi ini berhasil menciptakan arsitektur perusahaan yang menangani kebutuhan bisnis, aplikasi, data, dan teknologi, meningkatkan integrasi departemen, kinerja bisnis secara keseluruhan, dan pemberian layanan. Ini secara efektif menjembatani strategi TI dan bisnis.

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INTRODUCTION

The implementation of information systems and information technology has become a crucial factor in achieving business success within an organization (Maghsoudi & Nezafati, 2023). Investing in information technology infrastructure is important for companies to manage all their information technology needs (K. Zhang & Bu, 2024). The significance of data integration in a

large-scale corporate environment, known as an enterprise, has been extensively explained in various literature (Zhu et al., 2024).

Delivering well-structured data within well-managed data resources is also a primary goal in developing an organization (Srinivasan et al., 2023). To achieve this, it is important to select the appropriate strategies and planning (W. Zhang et al., 2024). When designing the enterprise architecture (EA), it is important to adopt or develop an EA framework that suits the organization's needs (Atencio et al., 2024). The enterprise architecture depicts the plan for system development or a collection of systems (Anjaria, 2024). The logical organization of core business processes and information technology (IT) functions is reflected in the architecture, with the goal of achieving integration and standardization in operations (Guritno & Rahardja, 2011). Enterprise architecture, also known as EA, provides a mission overview involving stakeholders, particularly organizational leaders, encompassing information, functionality, organizational location, and performance parameters (Kotusev & Kurnia, 2021). Enterprise architecture designs the plan for system development or a collection of systems (Ulmi et al., 2020).

Similar research has been carried out in dealing with complex enterprise architecture migration planning and requires effective tools to manage change and minimize risks (Agievich & Skripkin, 2014). TOGAF can also be used in the adoption of cloud computing in government agencies that require careful strategic planning to ensure successful and efficient integration (Anggraini et al., 2019). TOGAF has also been used as a tool to help implement open IoT architecture in industry (Camatti et al., 2020). In addition, research on the need for enterprise architecture standards for digitizing the health system in Uganda has also been conducted (Wamema et al., 2023). Apart from that, there are problems regarding the digital transformation of road infrastructure management in Germany which requires a basic approach to enterprise architecture management (Werner & Lehan, 2023). TOGAF allows users to combine it with other frameworks or tools (de Oliveira et al., 2021). Previous research combined the IEC 62264 standard and the TOGAF framework for enterprise IT architecture design in the battery manufacturing industry (Oberle et al., 2022). Apart from that, TOGAF has been paired with ROCCA (Risk, Objective, Constraint, Capability, Assumption) in an effort to plan the adoption of cloud computing in government agencies (Anggraini et al., 2019). A flexible and agile enterprise architecture is critical for companies in the automotive industry to remain competitive and adapt quickly to change (Gonçalves et al., 2021). Process-oriented knowledge representation is an effective tool in improving requirements management in TOGAF-ADM, providing better and more efficient guidance (Kornyshova & Barrios, 2021). Various methods and frameworks can be used, such as the Zachman Framework, EAP, EAS, BEAM, TOGAF ADM, GEAF, etc. According to many studies discussing EA design, TOGAF ADM has been found to be an advanced approach that meets all EA development requirements, at 92% (Nyale & Karume, 2023). TOGAF ADM is also advanced and can be used depending on the organization's needs. TOGAF ADM is also a common methodological approach, allowing it to be customized to specific needs, such as integrating with other frameworks to produce organization-specific architecture (Kornyshova & Deneckère, 2022).

PT XYZ is the parent company of several subsidiaries operating in the garment and textile industry. PT XYZ itself has an information technology department responsible for developing technology-based products, including leave applications, business travel, attendance systems, and tracking company performance for decision support and benefiting its subsidiaries. Each project implementation is required to be carried out effectively and efficiently (Alkhatib, 2024). However, a problem has been identified where management struggles to track the performance of each employee, leading to plans for developing a new system for Key Performance Indicator (KPI) management. Another issue is the unequal use of information technology across different divisions, which can slow down the business processes. For example, the human resources division relies only on an online recruitment system through the website for registration, while subsequent stages need to be processed manually. Based on the identified issues, PT XYZ aims to align its business needs with its information technology. One possible solution is to design the appropriate

enterprise architecture to map the needs of each business function and how information technology can support them (Popescu et al., 2011).

This research has two objectives: a general objective and specific objectives. The general objective of this research is to develop enterprise architecture planning to align the activity strategy and Information Systems/Information Technology (IS/IT) strategy in PT XYZ. Meanwhile, the specific objectives of this research are as follows:

- To generate an enterprise architecture plan in PT XYZ that can help provide an overview of system integration, enabling smooth data exchange between departments.
- To generate an enterprise architecture plan that can provide PT XYZ with insights regarding investment in IS/IT development to yield positive feedback.
- To generate an enterprise architecture plan in PT XYZ that can help provide a more efficient overview of interdepartmental activities, thereby increasing productivity at PT XYZ.
- To analyse the needs and business processes required by PT XYZ.

RESEARCH METHODS

In this research, the research method used is the TOGAF Architecture Development Method (ADM). However, the author only implemented six out of the eight phases of TOGAF ADM. The last two phases in the TOGAF ADM framework were not utilized in this research as they require further authorization, approval, and coordination related to implementation and change management (Yustrilia, 2012).

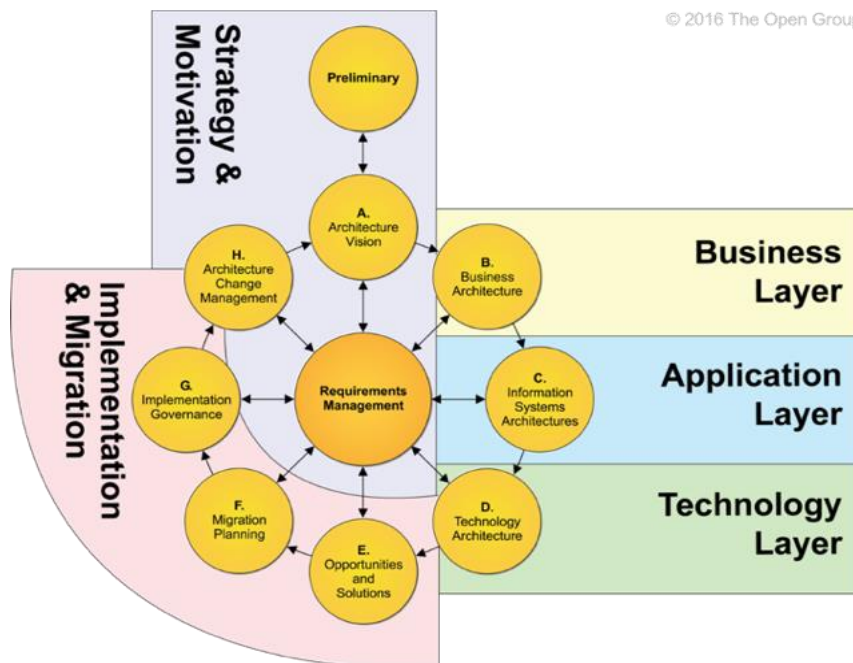


Figure 1. Architecture Development Method Process (Widyaningsih, 2014)

The TOGAF Architecture Development Method (ADM) provides a proven and iterative method for developing the architecture needed by an organization. ADM is the result of universal collaboration and consists of a series of activities that describe the progression of each ADM phase, as well as the architecture models used and created during the enterprise architecture development process (Suprpto & Wella, 2024). The principles of enterprise development using the TOGAF ADM methodology consist of the following three parts (Dumitriu & Popescu, 2020):

- a. Enterprise principles, which support business decision-making across the organization or company, ensuring alignment with established strategic objectives.
- b. Information technology principles, which guide the use of information technology resources across the organization or company, ensuring the adoption of appropriate technology that meets business needs.
- c. Architecture principles, which involve the development and implementation of organizational or company process architecture. These principles are influenced by the organization or company's plans, strategies, market factors, systems, and technologies, aiming to achieve optimal integration and high performance.

RESULTS AND DISCUSSION

Preliminary Phase

In this phase, the process of determining the scope of the Enterprise Architecture takes place, involving stakeholders to describe the process. Additionally, relevant architecture principles are identified, and the selection of the TOGAF ADM framework and tools is made. The objective of identifying the scope of the Enterprise Architecture is to understand the main functions related to the organizational unit that is the primary focus, in this case, the Human Resources division. In the case of PT XYZ, a garment company, the vision and mission have been explained in the previous chapter. To create a design, suitable design principles are required. Table 1 is the design principles for PT XYZ.

Table 1. Architecture principles

#	Principle Category	Principle Name	Description
1	Business Principle	Employee Organization	Developing an organization by designing the structure and relationships between the tasks that must be carried out by the company's stakeholders including the process of developing the company's human resources
		IT-based HR Operations	Implement technology and applications that can support the process of managing and operating human resources in the company
		Business Continuity	Human Resources operational activities must continue even though there are disruptions or problems with the applied technology and applications
		Legal Compliance	All employees in the company must comply with applicable laws and regulations.
2	Data Principle	Data is an Asset	Data is an important asset for the Human Resources division that needs to be managed properly and kept confidential.
		Data can be Accessed	Data can be accessed by interested parties or have access rights at PT XYZ in general, the Human Resources division in particular to carry out its functions.
		Reliable Data	The origin and quality of the data have been guaranteed, so that the data can be used effectively by the authorities.
		Data Security	Data security is needed to protect data from unauthorized parties.
3	Application Principle	Application Independence	The application to be implemented can operate on various platforms.
		Easy of Use	Ease of use of the application is needed to facilitate the continuity of business processes.
		The Need for Development	The application is able to respond to changes in business requirements that may occur.
		Application Security	Application security is needed to control access rights and data communication flows in it.

#	Principle Category	Principle Name	Description
4	Technology Principle	Technology Utilization	Implement data-based technology and applications that are used to support the Human Resources process, especially the Operational function and support the changes that occur.
		Integrated Technology	Having technology that is interconnected between divisions so that it can support the operational processes of Human Resources.
		Technology Security	Technology security is needed for business continuity, such as network and server security in the company. So that technology should be used based on procedures.

After establishing the architecture principles, the next step is to identify the what, who, where, when, why, and how elements to design the enterprise architecture at PT XYZ. The objective of this step is to identify the objects involved in the architecture design. The identification of these elements helps in understanding the key components and factors that influence the design process. It allows for a comprehensive analysis of the requirements, stakeholders, locations, timing, motivations, and methods involved in the enterprise architecture design at PT XYZ. By considering these elements, a holistic and effective architecture design can be developed to meet the specific needs and goals of the organization. It can be seen at Table 2.

Table 2. Architecture driver

#	Driver	Description
1	What	Object: Enterprise Architecture Scope Description: Designing an enterprise architecture model
2	Who	Object: Maker and Person in Charge Description: a. Planning maker: Juan Richard Harmel b. Person in charge: Wella
3	Where	Object: Location of research object Description: Tangerang City, Banten, Indonesia
4	When	Object: Time from planning to completion Description: March-May 2023
5	Why	Object: Reasons for Making Enterprise Architecture Design Description: To maximize the use of information systems and information technology in every business activity at PT XYZ.
6	How	Object: Design Creation Method Description: Uses the TOGAF ADM framework.

Architecture Vision

In this phase, the definition of the Enterprise Architecture (EA) scope is done, represented in the form of a value chain diagram for PT XYZ. In this stage, the activities taking place at PT XYZ are identified and categorized into two categories: primary activities and support activities, which are interconnected within groups that depict their interdependencies. Figure 2 is the value chain diagram for PT XYZ.



Figure 2. Value chain diagram

Value Chain Analysis focuses on the system and how inputs are transformed into outputs that are purchased by consumers. Activities in all business processes are divided into two types, primary and support activities. Primary activities are directly related to the physical creation, sale, maintenance, and support of the product or service. Primary activities consist of: Inbound Logistics: all processes related to receiving, storing, and distributing internal inputs; Operations: transformation activities that change inputs into outputs that will be sold to customers; Outbound Logistics: activities that involve delivering the product or service to customers; Marketing & Sales: processes used to influence customers to buy the product offered; Service: activities related to maintaining the value of the product or service for customers after the purchase has been made.

These support activities provide support to the primary functions mentioned earlier. For example, procurement supports operations with specific activities, but also supports marketing and sales with other activities. Administration: These activities focus on filing and storing records, office correspondence, management of visits and telephone calls, internal communications, financial management, and other administrative tasks; Finance: These activities are related to the management of the company's finances, including credit control, investment, and asset purchases. This unit is also responsible for financial activities such as receipts, expenditures, recording, and reporting; Technology Information: This activity is related to the management and processing of information and the protection of the company's knowledge base; Human resource Management: This activity is carried out to show the extent to which the company has succeeded in recruiting, training, motivating, rewarding, and retaining employees. These support activities provide essential support for the company's primary functions and ensure that operations run smoothly and efficiently.

Business Architecture

At this phase, an analysis of the business processes that are currently running is carried out. The results of the gap analysis between PT XYZ's business and technology can be seen in the Business Architecture Gap Analysis in Table 3.

Table 3. Business architecture gap analysis

Target	Baseline					
	Recruitment	Training	KPI Management	Record Attendance	Manage Termination	New
Recruitment	Replace					
Training		Retain				
KPI Management			Retain			
Record Attendance				Retain		

Target	Baseline					
	Recruitment	Training	KPI Management	Record Attendance	Manage Termination	New
Manage Termination					Retain	
Performance Appraisal						A
Manage Promote						dd
						A
						dd
Manage Demotion						A
						dd
Manage Mutation						A
						dd

Based on the predetermined architecture vision, Table 3 is a gap analysis of each existing system or will be created to accommodate the architecture vision. The Recruitment System will be replaced with a new system, because the current system is an outsource system that is difficult to integrate with other systems. The Training, KPI Management, Record Attendance, and Manage Termination systems will be maintained and integrated between systems. In addition, there will be additional systems to accommodate the main functions of Human Resources, including: Performance Appraisal, Manage Promote, Manage Demotion, and Manage Mutation.

Information System Architecture

This phase determines how to build an information system architecture which includes the application architecture and data architecture that will be used at PT XYZ. PT XYZ requires several important application architectures, such as a web portal, a recruitment application, and an HR application. In designing the application architecture for PT XYZ, a tool called a use case diagram is used. The use case diagram is used to illustrate the actors involved in each application, the functions that can be performed by each application (use cases), and the interactions between actors and use cases within each application. Table 4 is an explanation of the application designs.

Table 4. Application design

Application Name	Functionality
PT XYZ Website	The design of the web portal application architecture will include functions that allow users to access information and services relevant to the company. Some of the use cases associated with web portals can include user registration, logging in, browsing information, sending requests or inquiries, and so on.
Recruitment Application	The design of the recruitment application will focus on activities related to managing the new employee recruitment process. Some use cases related to recruitment applications include job postings, registration of applicants, selection and interviews, assessment of candidates, sending of offer letters, and so on.
Personnel Application	The design of the personnel application architecture will include functions related to data management and processes related to employees in the company. Several use cases related to staffing applications include recording employee data, requesting leave, payroll, performance management, and so on.

Here is activity diagram for information system architecture (Figure 3).

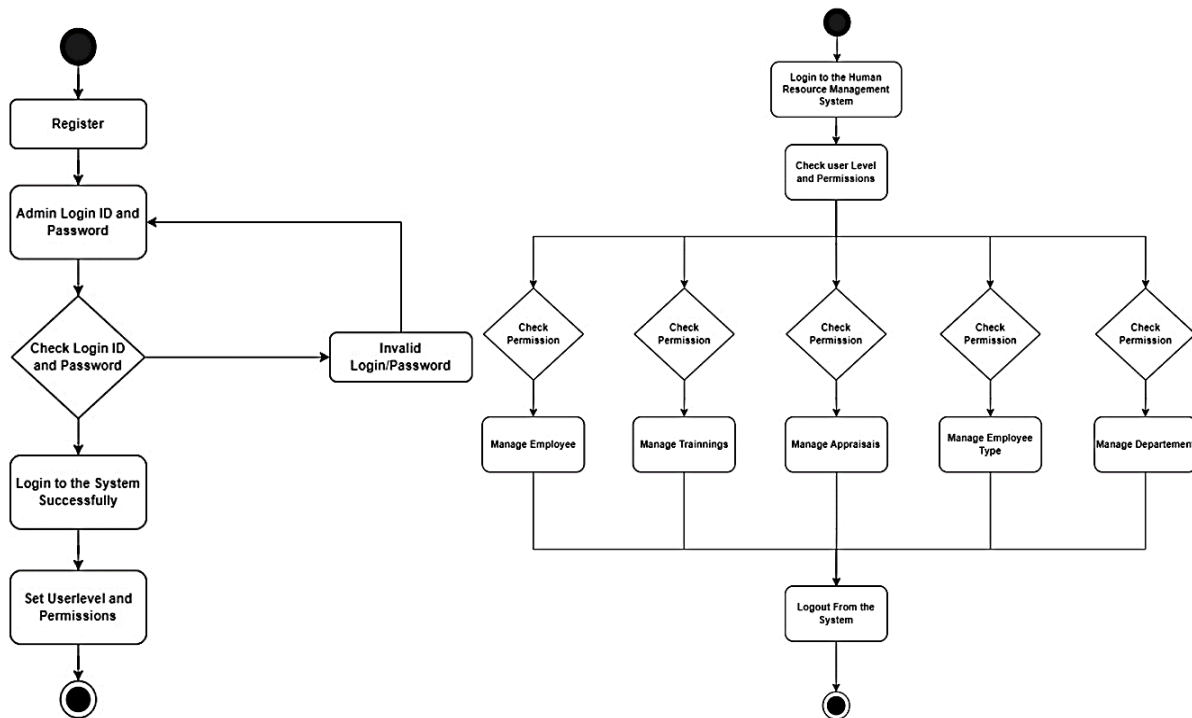


Figure 3. Login Activity and Activity UML Diagram Human Resource

The Activity Diagram illustrates the login process in the Human Resource Management System. The administrator can access the system by using their username and password. After a successful login, the user can perform various operations related to Employees, Training, Departments, Appraisals, and Employee Types. Pages such as Departments, Appraisals, and Employee Types have security measures, allowing only logged-in users to access them. This diagram helps explain how the login page functions within the Human Resource Management System. Within it, various objects related to Appraisals, Employees, Training, Departments, and Employee Types interact in a series of activities. Users will not be allowed to access these pages unless they have verified their identity.

Data Architecture

At this stage PT XYZ designs and manages the data structures needed in their business operations. By having a good data architecture, PT XYZ can integrate data from various applications and systems, thereby facilitating the flow of information between company divisions. The relation of database can be seen at Figure 4.

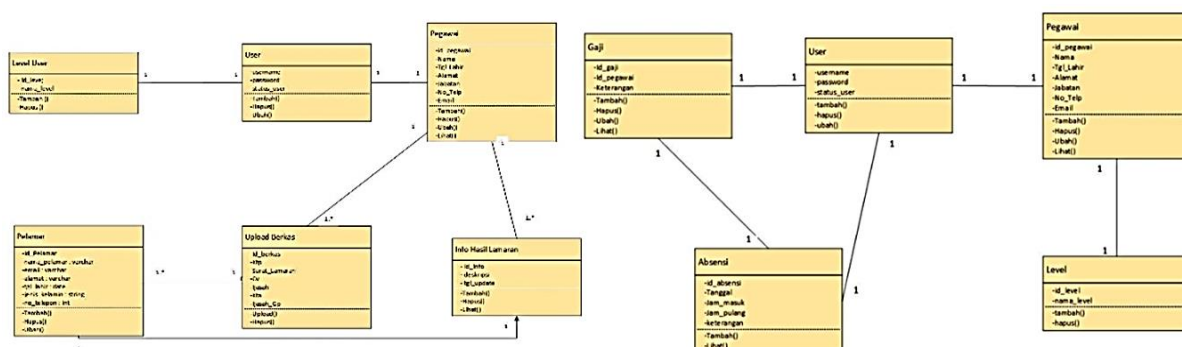


Figure 4. Recruitment and Personnel Application Data Architecture

In the application's recruitment data architecture, there are six interconnected classes. These classes are user level, user, employee, application result information, file upload, and applicant. The relationships between these classes are determined by multiplicity, which depicts how many instances of one class can be connected to instances of another class. In the application's

employee data architecture, there are five interconnected classes, namely salary, user, employee, level, and attendance. The relationships between these classes are also determined by multiplicity, indicating how many instances of one class can be connected to instances of another class.

Technology Architecture

The technology architecture phase aims to integrate the application components that have been defined in the application architecture with various technology components which include software, hardware, and network. Figure 5 is the network architecture of this research.

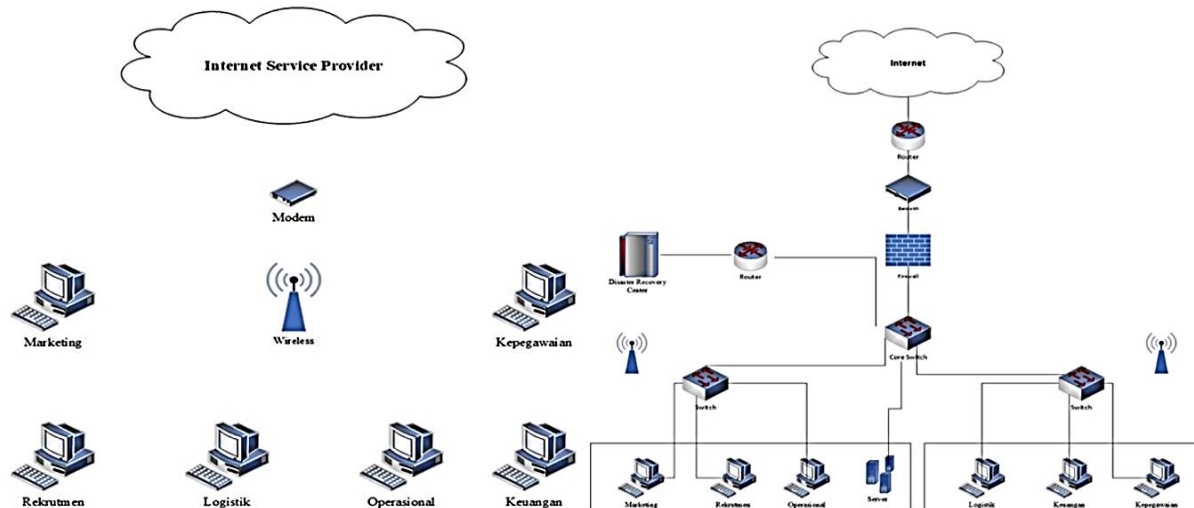


Figure 5. Old and New Network Architecture

Currently, PT XYZ still relies on paper-based data exchange. However, this system is considered inflexible and dependent on the availability of internet connection at the location. Therefore, the use of network technology is proposed, as illustrated in another diagram. In this diagram, two areas are interconnected using switches and wireless technology. The connection between the two areas is established through a firewall using bandwidth and can be connected to the server through a core switch. Additionally, a disaster recovery center is also included, where the two areas are connected via a router to perform data backup.

The Table 5 illustrates the priority implementation process in building a reference standard for human resource applications which has 3 priority measurement scales starting from high which has levels 8-10, Medium has levels 5-7, and for low priority has levels 1-4. The measurement aims to apply reference standards to human resource applications that can be completed according to research plans and expectations.

Table 5. Implementation priority

#	Functionality	Priority	Criteria
1	Recruitment Module		
	Career	7	Medium
	Check Applicant data	3	Low
	Fill in the employee recruitment form	5	Medium
2	Attendance Module		
	Apply for leave and overtime	8	High
	Manage absent data	6	Medium
	Do Attendance	2	Low
	Make a report	4	Medium
	Print Report	2	Low
3	Reimbursement Module		
	Claim reimbursement	7	Medium
	Apply cost planning	7	Medium
	Check the claim form	3	Low

#	Functionality	Priority	Criteria
4	Print report	2	Low
	Fill in the claim form	5	Medium
	Performance Module		
	Value of employee performance.	8	High
5	Grade	7	Medium
	Personnel Information Management Module		
	Employee data input	5	Medium
	Print Report	2	Low
	Edit employee data	3	Low

Based on previous research, the TOGAF framework provides support for companies to achieve their goals successfully by integrating different domains, including business, application, technology, and data, in enterprise architecture design. Gap analysis assists architects in mapping the current state (baseline) to the desired target in business, information systems, and technology architecture. In the context of PT XYZ, the implementation of TOGAF in designing enterprise architecture, particularly in the field of human resource management (HRM), involves modifying and creating new portals, aligning with the previous enterprise architecture design outcomes that also involved the development of several academic portals. During the architecture design process, various outputs are generated, such as catalogues, diagrams, and relevant tables for each phase. The use of standard methods like Unified Modelling Language (UML) greatly aids in designing enterprise architecture, and other standard methods are also utilized to produce outputs related to this research. Therefore, through the design of enterprise architecture using TOGAF, gaps in business processes requiring IT support can be identified, and design recommendations that can be implemented by the company are provided. This helps PT XYZ optimize the use of information technology in supporting their business processes, including human resource management.

CONCLUSION

The research highlights the benefits of using the TOGAF ADM framework in PT XYZ's Human Resource division. It enables the company to optimize HR management, improve employee experience, and enhance flexibility. The integrated architecture improves recruitment, training, development, and employee management, aligning with business needs and HR policies. The model also enhances employee experience by providing easy access to HR-related information, enhancing process transparency, and improving communication. Thus, the TOGAF ADM framework significantly enhances PT XYZ's HR management and adaptability to change.

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