

Enterprise Architecture Information System Planning for the Procurement of Goods and Services

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Abstract— The objective of this research is to support the operational and investment activity for company efficiency, transparency, rivalry, affordability, quality of goods, and services procurement system in Regional Cleaning Company of Bandung or PD. Kebersihan Bandung. With the implementation of the TOGAF ADM applied in this system development as an architecture framework for goods and services procurement process in PD. Kebersihan Bandung, the process begins with requirement planning until the final of all activities to acquiring the Goods and Services. As a result, the system provides an improvement of company performance and presents an effective organization in accordance with a good governance of company for related party. The system adapts the situation and condition that applied in the Company. Presently, the procurement process performed by Logistic Division of PD. Kebersihan Bandung with conventional method. Consequently, the e-procurement information system needs to be evaluated to improve the performance and time efficiency, effectivity, transparency, and accountability in expenditure requirement. This information system will support the company business performance. E-procurement information system design requires an architecture framework to avoid the organization from a conflict between technology and information infrastructure and the business requirement for goods and services procurement. With the implementation of the TOGAF ADM in the design of information systems for procurement of goods and services in PD Cleanliness City of Bandung, it is expected that the company have a framework in accordance with the company's vision and mission.

Keywords—Enterprise Architecture, E-procurement, TOGAF ADM

I. INTRODUCTION

The rapid development of information technology in this era and high competition of companies in improving their business process to be better are common phenomenon in business. These companies compete to make or use information system, which supports the performance of company for long term. However, the change of information system can be an obstacle in a company due to the migration to a new system, so the data from old system will be replaced.

In this case, one of the causes is lack of a careful planning for the use of information system. A careful planning by considering several aspects of perspective, starting from the vision of a company to build a system, defines the business process and technology, which will be used in the company.

Regional Cleaning Company of Bandung City (PD. Kebersihan) is an institution established by government of Bandung with main task and function to provide the cleaning service in managing waste for realizing clean city and giving contribution to the regional income [1]. PD Kebersihan consistently develops its performance in waste management of Bandung by focusing on service improvement to customers and effectivity improvement for internal process to realize the company business comprehensively. Related to the effectivity of internal process in the company, it is important to develop a strong business relation that is mutually beneficial with its partner. One of the examples is the use of information technology into a process in the procurement of goods and service. In implementing the procurement of goods and service, PD. Kebersihan does not yet have architecture and the use of certain framework. The current use of information technology only meets the needs of department or division. Besides, in running the business, company still uses a manual method, namely Microsoft Office application for bookkeeping.

The existing problem based on the introduction above is the absence of architecture framework to build information system for the procurement of goods and service in PD. Kebersihan. Based on the background, the researcher formulates a problem on how TOGAF ADM method can provide an architecture framework and explaining it systematically to build information system in the procurement of goods and service that is in accordance with requirements from the company. In this research, the researchers used a TOGAF ADM methodology as reference in planning the enterprise architecture of business process. The purpose of this research is to provide recommendations for designing an electronic procurement information system planning to improve the quality of public services.

II. METHODS

A. *Electronic Goods and Service Procurement*

Electronic procurement (eProc) is the implementation of goods and service procurement using the electronic network (internet or intranet) or Electronic Data Interchange (EDI) [2]. The World Bank refers to e-procurement. In the case of governance, as the electronic government procurement or e-GP which is the use of information and communication technology, internet in

particular, by the government in implementing the relation of procurement with the suppliers to get goods, works, and consultation service which are required by the public sector [3]. Palmer (2003) stated that e-procurement is the technology designed to facilitate management of the whole activities of goods procurement via internet, including the whole aspect of procurement function as supported by several communication types electronically. [4]

B. TOGAF

TOGAF is an architecture framework which supports acceptance, production, use, and maintenance of enterprise architecture. The fundamental aspect with the support of good, practical model process can be reused for a set of the existing architecture assets. TOGAF is developed by The Open Group Architecture Forum. The first version of TOGAF was developed in 1995. TOGAF 9 was published in 2009 [5].

C. TOGAF ADM

TOGAF Architecture Development Method (ADM) shapes the core of TOGAF and method to reduce enterprise architecture in an organization more specifically, which will result in the contribution from several architecture users. ADM includes the determination of architecture framework, development of architecture content, transition, realization setting from architecture. ADM is an important feature which allows organization to define the need management, such as business, information system, and technology architecture to be in line with target and need of business [6]. TOGAF ADM is a flexible method which can certify several modeling techniques used in designing, since this method can be adjusted to the change, while need during the designing process can state obvious vision and principle about how to develop enterprise architecture; the principle is used as size in assessing success from the development of enterprise architecture by organization [7]. Stage Diagram in TOGAF Architecture Development Method (ADM) is shown below Fig 1.

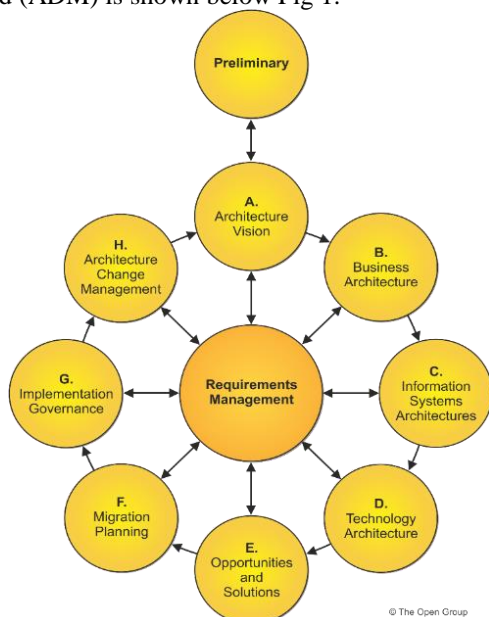


Fig 1. TOGAF Architecture Development Method (The Open Group 2009)

D. Research Design

This research used the quantitative approach by collecting data and analyzing the data from the interview in company. This analysis is a series of works by TOGAF in which it consists of nine stages in cycle [8]. However, in this research, analysis was conducted on seven stages only. The stages are Preliminary Phase, Architecture Vision, Business Architecture, System Information Architecture, Technology Architecture, Requirement Management, and Opportunities and Solution. The next stages (Migration Planning, Implementation Governance, and Architecture Change Management) were not discussed since the system implementation was in the form of report, so it was not known whether the application migration would be performed and implemented in the related organization, or there will be a change in management system.

E. Data Collection Technique

Data collection technique was performed by collecting primary data and interviewing informant. Interview was performed in face-to-face and through media/e-mail. Secondary data were collected from several resources, such as file, book, journal, and other literatures related to the problem to be researched [9].

F. Data Analysis Technique

Data analysis technique used in this research was narrative analysis. The result of analysis is elaboration of occurrence from the beginning of process to the end. With narrative analysis technique, the data were collected in narrative. Interview or open question is considered more suitable to encourage informant in revealing information [10].

G. Research Object

Research was conducted in PD. Kebersihan to obtain comprehensive understanding about framework of TOGAF, concept and stage of information system development, and blueprint related to the designing of information system in goods and service procurement in PD Kebersihan.

III. RESULTS AND DISCUSSION

A. Preliminary Phase

This stage is preparation in designing the enterprise architecture in PD Kebersihan. Scope of company, in the goods and service procurement, determination of architecture framework, architecture tool, and determination of architecture principle as follows [11]:

- a. Determination of scope in the procurement of goods and service includes as follows:
 - Management in procurement of goods and service;
 - Demand of end-user;
 - Management of partner or third party;
 - Administration management in procurement of goods and service.
- b. Determining architecture framework as follows:
 - Architecture Vision;
 - Business Architecture;
 - Information System Architecture;
 - Technology Architecture;
 - Opportunities and Solutions.

B. Requirement Management

This stage aims to identify issues in the company, adjusted to data requirement in ADM stages. Company issues are as follows [12,13]:

- a. Performance Analysis: Performance problem in PD. Kebersihan is incompatibility of information among field or units, so it needs to be matched again. Data search process in the completion of document for procurement of goods and service will hamper the activities of company.
- b. Information System: the use of manual calculation, the absence of detailed, complete information about document completion, account receivable, and other data. It causes mistake in the report to be given in the future, while confirmation and information cannot be given to partner or third party comprehensively.
- c. Economic Analysis: A long business process spends much cost, including paper, since the mistake in writing or correction requires new paper to be printed.

C. Architecture Vision

In this stage, analysis will be performed to know organization profile, stakeholder identification, and current condition of business architecture, which can be seen in the related stakeholder table [14, 15] and the Current Condition Identification table below (Table I).

TABLE I. RELATED STAKEHOLDER

Stakeholders	Involvement
President Director	Providing direction about the overall expected architecture Making final decision with the design of enterprise architecture model
General Director	-Providing direction, the design of business architecture model -Making decision related to the design of enterprise architecture model
Head of Logistics Department	- Providing direction about the design of business architecture model, data, application, and technology in every division - Supporting the director in making decision related to the design
Head of Finance Department	Providing business information, role, and responsibility as Head of the Division and every division below it
Head of Procurement section	Providing information about the process in procurement of goods and service, data, application, and technology in every division
Head of Treasury section	Providing information relate to the process of payment business as a result of procurement of goods and service, data, application, and technology in every division
Head of Procurement Affairs	Providing information related to process in the procurement of goods and service, data, application, and technology in every division
Head of Verification Affairs	Providing information related to process of checking document for procurement of goods and service before making payment as a result of procurement of goods and service, data, application, and technology in every division
Committee of Procurement Result Examination	Providing information related to business process as the result of procurement of goods and service, document, data, application, and technology in every division
Third Party/Partner	Providing information related to the offer for the procurement of goods and service based on the announcement by company, providing document based on applicable requirements

Based on the current conditions, there are two obstacles in the management of procurement of goods and services, namely the process of announcing the procurement of goods and services still using newspapers, and then the registration process for partners is still in the form of hardcopy. For more details can be seen in the table below (Table II).

TABLE II. CURRENT CONDITION IDENTIFICATION

Activity	Obstacle	Solution	Service
Management for Procurement of Goods and Service	Announcement process still uses the printed media, newspaper.	- The use/procurement of software and hardware to automate announcement process for procurement of goods and service - Development of the existing SOP adjusted to the information system which will be designed	Procurement of Information System for Procurement of Goods and Service
	Registration process for third party/partner is still manual, by collecting the documents in hard copy.	The use/procurement of software and hardware for registration process as third party/partner by providing form and uploading document based on type of goods and service	

Based on the table above, there is explanation that the business process in procurement of goods and service by PD Kebersihan still uses manual system, so it requires considerable process, time, and cost.

The analysis of value chain is categorized into main activity and the supporting activities [16]. In this analysis, the whole business activity in PD. Kebersihan is known, referring to result of identification and observation in the procurement process for goods and service. Value chain in PD. Kebersihan is in the procurement of goods and service as main activity, in which the company is committed to the activity in an effective, efficient, and open way. Figure of value chain is shown below (Fig 2).

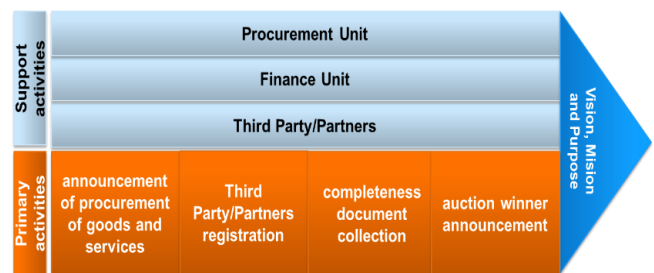


Fig 2. Value Chain

D. Business Architecture

Business Architecture develops the target of architecture business which describes the current condition of organization business architecture, development of the existing architecture; the next stage is gap analysis to compile strategy for realizing objective in business and the determined strategy [17]. For more clearly the Function Catalog table can be seen below (Table III).

TABLE III. FUNCTION CATALOGUE

Business Service/Function Catalogue			
Organization	Activity	Business Function	IS Service
PD Kebersihan	Procurement of Goods and Service	Procurement of goods and service electronically e-procurement)	Online announcement Online registration form Online document upload Online announcement for auction

Based on table above, it is explained that there are four business functions from the procurement of goods and service, namely announcement of procurement, registration of partner, collection of documents, and the announcement of auction for the chosen partner.

From business architecture analysis, Business GAP analysis was performed with the result as follows Business GAP analysis Table IV:

TABLE IV. BUSINESS GAP ANALYSIS

Category	Business Gap analysis Findings
People	Repeated process for checking document from third party/partner, by Division of Logistics, Finance, and Committee of Procurement Result Examination
Process	Business process which is not effective and efficient
Tools	Process which is not yet automated
Information	Information which is not yet integrated

E. Information System Architecture

A stage in which the developed information system architecture includes the data architecture and application architecture will be used by the organization. Data architecture and application architecture are explained in Entity and Component of Data Architecture and incoming application architecture table below (Table V and VI).

TABLE V. ENTITY AND COMPONENT OF DATA ARCHITECTURE

No.	Data Entity	Logical Data Component	Physical Data Component
1	Employee	Employee	ID_employee
2	Partner	Third party/partner	ID_partner
3	Department	Department	ID_department
4	Category	Category of Company	ID_companies
5	Procurement	Goods Service Method Work value Contract type Procurement stage	ID_items ID_items ID_method ID_ceilingvalue ID_contracttype ID_procurementstage

TABLE VI. INCOMING APPLICATION ARCHITECTURE

Information System Service	Component	
	Logical Application	Physical Application
Procurement of goods and service	Announcement for procurement of goods and service Registration of third party/partner Document collection Announcement of auction	e-procurement

Based on table above, it can be concluded that there are five data entities for procurement of goods, service, and e-procurement (electronic procurement for goods and service) which is suggested to be information system for the procurement of goods and service.

F. Technology Architecture

Works in the stage of activity technology architecture are plan and development of the desired technology architecture with initial step of making list for technology suggestion that are described in the Incoming Application Architecture table and technology architecture design. For more details can be seen in the table below (Table VII).

TABLE VII. INCOMING APPLICATION ARCHITECTURE

No.	Hardware	Software	Description
1	Client PC	OS : Windows	Head of Procurement Department: 1 PC
2		Application: E-Procurement	Head of Procurement Affairs: 1 PC Total: 2 PC
3	Server	OS : Windows Database : SQL Server	Server Computer : 1 PC 1 database server
4	Switch	-	2 units
5	Router	-	2 units
6	Printer	-	Logistic department 1 unit Server 1 unit Total 2 unit

From the table above for technology architecture design can be seen from the image below Fig 3.

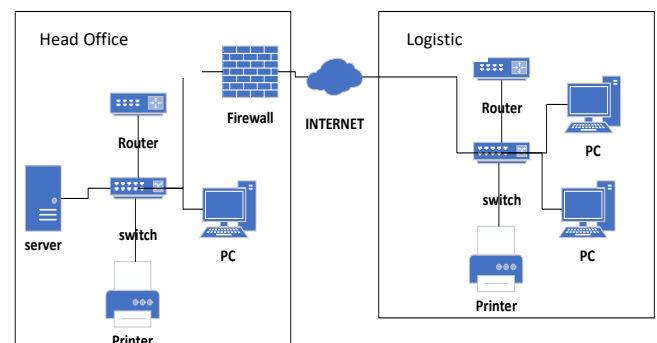


Fig 3. Technology architecture design

G. Opportunities and Solution

In this stage, initial step is identification of problem and solution as preventive action when there is a problem in

change based on the existing improvement suggestion that are described in the Identification of Problem and Solution in Business Architecture Table VII.

TABLE VIII. IDENTIFICATION OF PROBLEM AND SOLUTION IN BUSINESS ARCHITECTURE

Category	Finding	Solution
People	<ul style="list-style-type: none"> - Repeated process of document checking from third party partner by Logistic Department, Finance Department, and Committee - The absence of employee with skill in information technology to supervise and control technology system in the company 	<ul style="list-style-type: none"> - Recruitment of employees in the departments in need or skill in information technology and procurement of goods and service - Making main task and function in every position
Process	Business process which is not effective and efficient	Improving the business process which is not effective and efficient based on the planning of business process architecture by eliminating, integrating, simplifying, and automating
Tools	Process which is not yet automated	Making tools for facilitating automation in business process
Information	Some information which are not yet integrated and interoperable	Process of integration and interoperability of information and document of information flow related to enterprise architecture

Based on the aforementioned table, it is explained that database and application are requirements for the procurement of goods and service, while bandwidth capacity for internet needs improvement to run information system in a better way (Table IX).

TABLE IX. IDENTIFICATION OF BUSINESS PROBLEM AND SOLUTION IN DATA ARCHITECTURE AND APPLICATION ARCHITECTURE

Category	Finding	Solution
Unavailable data	Absence of main activity entity and support activity, including finance management and goods distribution	Making the whole in every business function of company, data entity which is known and study of data requirement in every field
New application	E-procurement application which is not available	Making the required application Developing Android application, which needs to be studied in detail first

Solutions from the stage of opportunities and solution are recruitment of employees with skill in information technology for procurement of goods and services, main task and function in every position, and improvement of business process that is not yet effective and efficient. For more details can be seen in the table of identification of business problems as well as solutions in data architecture and application architecture plus Identification of Business Problem and Solution in Technology Architecture table below (Table X).

TABLE X. IDENTIFICATION OF BUSINESS PROBLEM AND SOLUTION IN TECHNOLOGY ARCHITECTURE

Category	Finding	Solution
Technology Improvement	Bandwidth capacity which needs improvement since it is not enough to support Speed in processing data and transaction	Upgrading bandwidth capacity, to meet need for capacity of internet in company
Technology Making	Absence of hardware and software in every company, such as technology of Portfolio Catalogue	Procurement of hardware as required by the developed software

IV. CONCLUSION

Based on the results of the design of information system architecture for the procurement of goods and services, it can be concluded that there are four business functions and five data entities in accordance with business processes in the procurement of goods and services. In this case, the TOGAF ADM can be applied in designing the information system architecture of goods and services in PD Kebersihan and can be developed as needed by the company. The TOGAF phase does not cover all stages in the ADM cycle. Therefore, it can be developed in the last three stages in the ADM cycle, namely Migration planning, Implementation Governance, and Management of Architecture change. PD Kebersihan adjusted to the blueprint made previously can directly carry out this research.

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