

# Enterprise Architecture Planning for Balikpapan Environmental Services Using TOGAF ADM

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## ABSTRACT

Implementation of Enterprise Architecture (EA) is an integral part to ensure IT investments deliver values aligned with business strategy. The Balikpapan Environmental Services (Dinas Lingkungan Hidup - DLH) main task is compiling and implementing government affairs in terms of environmental field. Although DLH of Balikpapan already implementing IT to support and enhance the value of its business processes, there is a very limited alignment between business strategy and IT. TOGAF ADM framework is used to develop DLH's Enterprise Architecture. Based on the EA, there are 5 information systems that needs to be developed for maximum value and service by the DLH, specifically the Financial Information system, the Environmental Public Service Management System, and the Administrative Management System.

**Keywords:** *Architecture, TOGAF, information*

## INTRODUCTION

Organizations are starting to design digital value creation concepts. However, these means are very limited when it comes to deriving and implementing processes and IT services. In contrast to existing IT-based products, the new service logic requires a holistic process view. To optimize the value of the IT, methods and tools are needed. Enterprise architectures (EA) offers a well-proven solution for this challenge [1]. Implementation of EA is an integral part to ensure IT investments deliver values aligned with business strategy [2].

The Balikpapan Environmental Services (Dinas Lingkungan Hidup - DLH) is an institution formed from the merger of two regional institutions, the Environmental Agency (Badan Lingkungan Hidup - BLH) and the Parks and Cemeteries Cleanliness Services (Dinas Kebersihan Pertamanan dan Pemakaman - DKPP). The DLH's main task is compiling and implementing government affairs in terms of environmental field [3]. Currently, the DLH of Balikpapan has 2 applications to support its business process, which are the website of DLH of Balikpapan and website of Balikpapan Botanical Garden. Although DLH of Balikpapan already implementing IT to support and enhance the value of its business processes, there is a very limited alignment between business strategy and IT. To maximize value creation of IT implementation, DLH needs to implement EA. This research aims to develop enterprise architecture for the Balikpapan Environmental Services using TOGAF ADM framework.

## LITERATURE REVIEW

### Enterprise Architecture

Enterprise Architecture (EA) is an approach for managing the complexity of an organization's structures, business environments, and different information system, and for facilitating integration of strategy, personnel, business, data, and IT [6]. EA also defines the current and desirable states of an organization's process, capabilities, application system, data, and IT infrastructure and provides a roadmap for achieving this target from the current state [7]. The right EA approach can help organizations to become more successful in their IT investments[8]. Implementation of EA Service Capability and EA Governance has positive impact in IT-driven and business driven dynamic capabilities that lead to positive impact in project benefits. This lead to strong positive impact of Organizational benefits [2]. Some research on the EA implementation in government services has brought benefits for the institution. The first research on the implementation of EA in the Field of Conservation and Climate Change Control on Dinas Lingkungan Hidup (DLH) of West Java Province using TOGAF ADM and the second research about Optimizing Information Technology With Modeling Enterprise Architecture Areas Of Environment Polling Control Using TOGAF ADM On Dinas Lingkungan Hidup.

West Java Province. Both researches show that implementation of EA using TOGAF ADM can create an architectural blueprint that shows current and desirable state in business architecture, information architecture, and technology architecture that can be integrated into the IT Development Roadmap of the organization [4] [5].

**The Open Group Architecture Framework (TOGAF)**

TOGAF is an architecture framework that developed and maintained by The Open Group Architecture Forum. The first version of TOGAF, developed in 1995, was based on the US Department of Defense Technical Architecture Framework for Information Management (TAFIM) [9]. TOGAF provide guideliness and methodology to develop architecture namely Architecture Development Method (ADM).

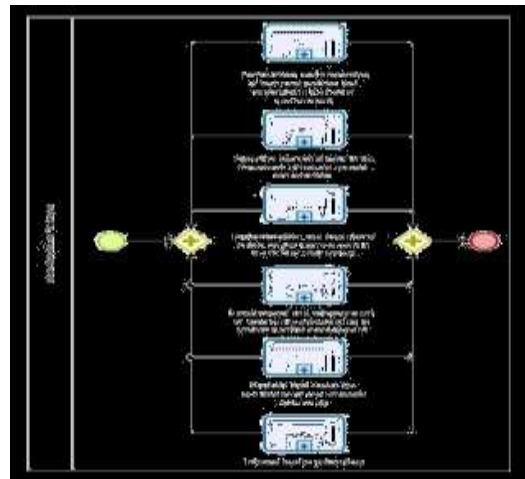
The ADM describes the ten different phase of EA development as a Generic Method. Its cycles start with Preliminary phase which prepares and initializes the EA management approach. After the preparation and initialization activities are performed, the scope of the EA management endeavor is defined within the Architecture Vision phase. Then based on the architecture vision, Business Architecture, Information System Architecture, and Technology Architecture are developed. After that gap analysis is performed to evaluate the difference between the current and target architecture. In the final phase namely Opportunities and Solutions, the transformation from the current to the target architecture are described [10]

**RESULTS AND DISCUSSION**

**Architecture Vision**

This section explains about organization’s goals which consist of vision and mission statement. It’s very important to write vision and mission statement. These purpose are to ensure alignment between business architecture, application architecture, and technology architecture with organization’s goals. The DLH’s vision is “The realization of a sustainable balance of economic and environmental development in the frame of “madinatul iman”, while the mission are

- Enhancing stakeholder partnerships in improving the quality of participatory environmental management.
- Realizing the preservation of natural resources, biodiversity and prevention of pollution of the environment.
- Improve environmental impact control, supervision and enforcement of environmental law.
- Developing institutions and the quality of professional apparatuses in environmental management.



**Figure 1** Main Bussiness Function

**Business Architecture**

Briefly, the general business functions carried out by the Balikpapan environmental office are formulating, arranging, monitoring, coordinating, fostering, improving and organizing the policies of the Balikpapan City Environmental Agency. The organization’s core business function can be seen in figure 1

Department of environment of Balikpapan has 6 core business function which consists of public service business function and internal business function. For the public service business function, this organization responsible for formulation and preparation of technical policies and strategies in the field of environment, supervise and coordinate in the framework of natural resource conservation, development and enhancement of community participation, non-governmental and private institutions in environmental management, implementation and organizer of public service improvement in the field of environment, evaluate and assess the application of environmental documents. The internal business functions are formulating government agency performance reports and formulating strategic plans.

The business function of the formulation and preparation of technical policies and strategies in the environmental field consists of several business processes. These are the issuance of the permit for groundwater drilling company (SIPPAT), terms of reference assessment, formulate data information policy, issuance of the permit for disposal of wastewater, the procedure for waste management with sanitary final disposal sites, issuance of the permit for the use of Balikpapan botanical gardens. The business function of supervising and coordinate in the framework of natural resource conservation consists of several business processes. These are the issuance of tree cutting permits and tree pruning cutting recommendations, environmental management field monitoring. The business function of development and enhancement of community participation, non-governmental and private institutions in environmental management consists of several business processes. These are cleaning service/waste retribution, B3 waste management for B3

waste storage activities, and management of complaints on environmental disputes. The business function of Implementation and Organizer of Public Service Improvement in the Field of Environment consist of several business processes. These are Procurement of Tree Seed Aid, Management of Transporting Garbage from a temporary disposal site to a landfill, Road and Environmental Cleaning Services, Construction of solid waste facilities and infrastructure. The business function to evaluate and assess the application of environmental documents consists of several business processes. These are the analysis of environmental impacts (AMDAL), environmental management plans (RKL), Environmental Monitoring Plans (RPL), Environmental Management Efforts (UKL), and Environmental Monitoring Efforts (UPL).

These functions are assigned to a division. Although, the division may not perform all the business process in that business function. Some business processes are performed as a collaboration between more than one divisions. There are also business processes carried out by division outside of their business functions. There are six divisions in the Department of Environment of Balikpapan. These are Secretariat that carried out the function of evaluating and assessing the application of environmental documents, Sub Division of Finance that carried out function formulating RENSTRA and LKJIP. Sub Division of General that handle the business process of insurance permit for the use of Balikpapan Botanical Garden, Division of Environmental Management and Protection of Natural Resources, Division of Sanitation and Cleanliness, Division of Pollution Control and Environmental Damage, Division of Legal Arrangement and Environmental Capacity Enhancement.

### ***Information Architecture***

This section explains about data architecture and applications that organizations use to optimize it business function/process value.

### ***Data Architecture***

Data architecture defines the data entity used by business process/function. The relationship between data entity and business function/process (represented by division) in Balikpapan Environmental Services can be seen in table 1

**Table 1** Data Architecture

Business Function	Data Entity
Division of Secretariat	Draft Statement
	File and Completeness of SPPL
	SPPL Registration Letter
	File Complete Terms of Reference
	Final Reference Framework Repair Documents
	Draft Recommended Terms of Reference
	Application File AMDAL -RKL & RPL
	File for Improvement of AMDAL-RKL & RPL
	Final Document File AMDAL-RKL & RPL
	Application for UKP-UPL
	UKL-UPL file
	File for UKL-UPL Improvement
	UKL-UPL News Document
Division of Finance	Draft SK Tim Penyusunan RENSTRA Dinas
	Draft RENSTRA Dinas
	Draft Final RENSTRA
	Draft Agenda Penyusunan LKJIP
	Nota Dinas LKJIP

	Draft LKJIP
	Laporan Pelaksanaan Kegiatan LKJIP
Division of TLPSDA	Application for Tree Seed Aid
	SIPPAT Application Letter
	SIPPAT draft
	Request for Data Information
	Draft Information Data
Sub Division of General	Usage License of KRB
Division of Sanitation and Cleanliness	Task Distribution List
	List of Sweeping Locations
	Draft Letter of Assignment
	List of TPS Number and Location
	Draft Letter of Assignment
	Requirements file
	Application File
	Letter of recommendation
	Form File
	SKRD draft
	Draft Receipt
SSRD draft	

	STS Draft
Division of Pollution Control and Environmental Damage	B3 Waste Storage Place Permit File
	B3 Waste Management License
	Application for Permit for Disposal of Wastewater
	Permit for Disposal of Wastewater
	Tree felling application
	Logging File Minutes and Tree Pruning Felling Recommendations
	Vehicle Records and Amount of Waste Entered
	Note Vehicles with Empty Weight
Division of Legal Arrangement and Environmental Capacity Enhancement	Complaint Letter
	Report on Management of Environmental Disputes Complaints
	Coaching Notification Letter
	Business Assignment Letter
	Minutes of Coaching Results
	Follow-up Letter

### ***Application Architecture***

Application architecture defines applications that support organization business process/function. It consists of the applications that are used and the application that will be implemented/developed by the organization. The existing applications used by the DLH are Balikpapan

Environmental Services website and the Balikpapan Botanical Garden. Both websites are providing static information regarding the respective organization. The Balikpapan environmental Services also has several applications that will be developed and customized in near future, as can be seen in table 3

**Table 2** Application to be developed and customized

Information System Candidate	Description
Administration Management System	An Application that simplifies bureaucratic processes and administration of internal documents.
Balikpapan Botanical Gardens Management Information System	An application that facilitates the licensing process using the Balikpapan botanical garden. This application speeds up the licensing administration process and allows applicants to make requests online. applicants can also see the status of the application and see the usage schedule
Environmental Public Service Management System	An application that provides an easy application for AMDAL, UKL, UPL, RPL, RKL, SIPPAT, environmental dispute complain, and other environmental administration documents.
Road & Waste Management System	An application that handles the business of waste and road management processes such as sweeping the road, planting and pruning trees on the roadside, monitoring the capacity of temporary dumps, monitoring the amount of waste entering, managing hazardous waste and wastewater
Financial Information System	Managing funds and expenditure following government regulations

### ***Technology Architecture***

The technology architecture describes a technological infrastructure consisting of software and hardware that supports the operations of the organization's information architecture.

### ***Hardware Configuration***

Below the existing hardware infrastructure that is used by Balikpapan Environmental Services.

**Table 3** Hardware Configuration

Hardware	Specification
Server and PC	ASUS Desktop PC K31AD-ID008T (18.5 Inch, Core i3, 2 GB, 500 GB, Win 10)
PC (Laptop)	Laptop Asus X441MA-GA011T N4000 RAM 4GB HDD 500GB
Switch	SRW224G4-K9-EU Cisco Small Business Managed Switch 24 Ports
Router	CISCO Wireless N VPN Router CVR100W LINKSYS Wireless-G Router [WRT54GL-AS]
Access Point	TP-LINK 300Mbps Wireless N Outdoor Access Point EAP110-Outdoor

**Software Configuration**

Below the existing software infrastructure that is used by Balikpapan Environmental Services.

**Table 4** Software Configuration

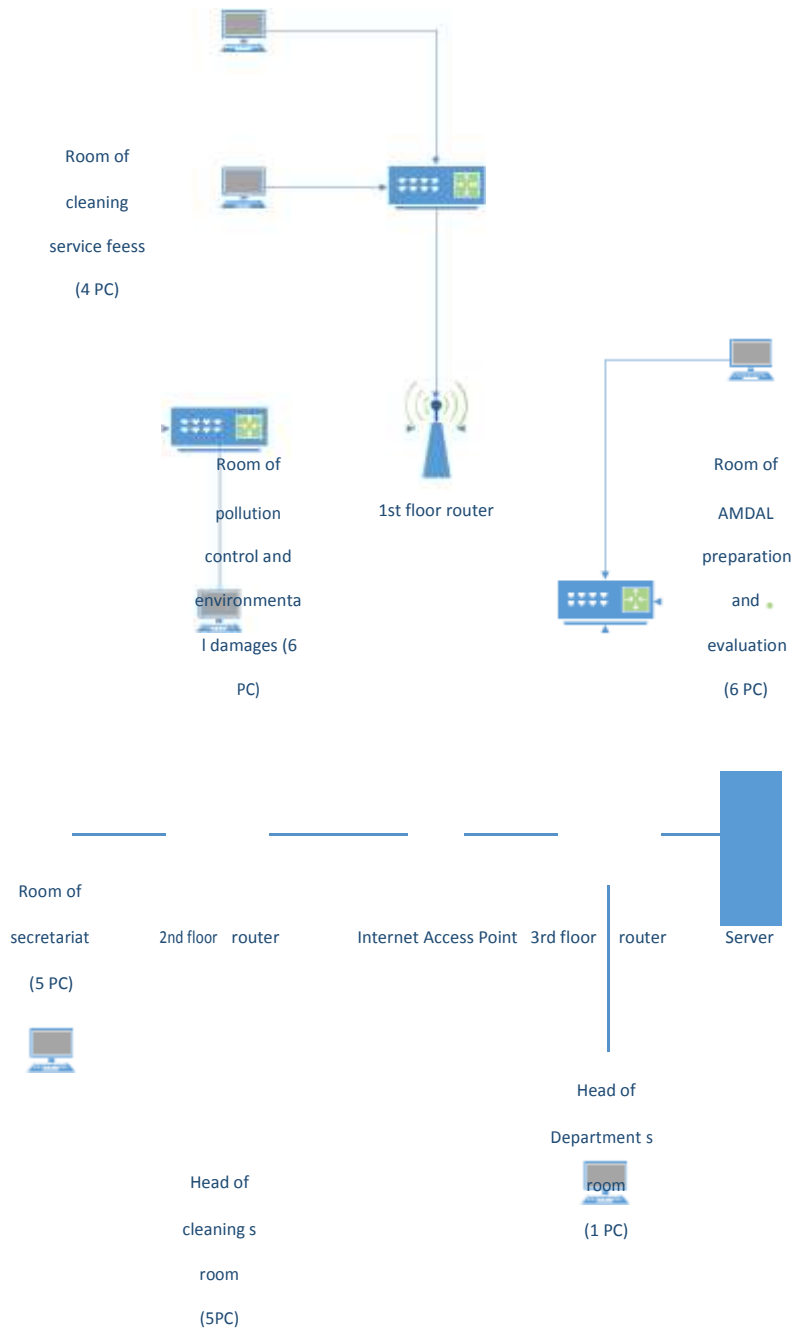
Software	Specification
Webserver	Apache MySQL
DBMS	MySQL, Oracle
Operating System	Windows 7



**Network Configuration**

The Department of Environment of Balikpapan implemented a tree topology in its network design. There were 3 floors with 1 router on each floor. All of them are connected through a network cable and form local area network (LAN) that is connected to the internet through

an access point on the 3rd floor. Each router is connected to personal computers and laptops through a wireless connection. The connection between the router and the devices made using coaxial cable network and wireless connection. The description of the network used by Department of Environment of Balikpapan can be seen in figure 2



**Figure 2** Network Configuration

***Opportunities And Solution***

This section provides opportunities and solution based on proposed information systems in the form of development priority and the scope of the information system that would be developed

***Development Priority***

There are 5 main factors that determine development priorities. These factors are the impact on customers or external entities, the impact on the quality of services or products, the reduction in business costs, the impact on internal customers, and the impact of process speed. Each criterion is then ranked based on the importance of the

performance impact for the company using a 7-10 scale. Then each criterion is assigned to the project using a scale of 0-10. After that, each criterion scale is multiplied by the project score and then the results are added. The sum results are then arranged based on the value. The greatest value refers to the highest development priority and the smallest value refers to the lowest development priority. [11]Score And Then The Results Are Added. The Sum Results Are Then Arranged Based On The Value. The Greatest Value Refers To The Highest Development Priority And The Smallest Value Refers To The Lowest Development Priority. [11]

***Develop Weighting Criteria***

The weight of criteria are showed in the table below

**Table 5** Weighting Criteria

No	Performance Criteria	Weight
1	External Customers	10
2	Quality of the service	7
3	Reduction of business costs	7
4	Impact on on internal customers	9
5	Impact of the speed of the process	8

***Priority Of Information System Development***

The information system development development priority can be seen in the table below.

**Table 6** Priority Of Information System Development

	Multiplier						
	Weight	10	7	7	9	8	
No	Information System Name	External Customers	Quality of the service	Reduction Of bussiness costs	Impact on internal customers	Impact of the speed of the process	Total Value
1	Financial Information System	10	9	7	10	6	350
2	Environmental Public Service Management System	10	9	5	9	7	335
3	Administration Management System	5	5	8	10	10	311
4	Balikpapan Botanical Gardens Management Information System	9	8	5	5	7	282
5	Road & Waste Management System	5	8	5	7	5	244

### ***Scope Of Information System Development***

In the scope of information system development is made to determine the features and who are the users involved in the use of operational information systems.

**Table 7** Scope Of Information System Development

No	Information System Candidate	Functional Requirement	User
1	Financial Information System	Manage financial reports	Division of Finance
2	Environmental Public Service Management System	Provide interface for proposing environmental related document Provide guideliness for proposing environmental related document Provide environmental document archieve for public Provide interface for environmental dispute Complain	Divison of Secretariat, Division of TLPSDA, Division of Legal Arrangement and Environmental Capacity Enhancement, Public
3	Administration Management System	Manage Report Archiving documents Track and Monitor Organization Goals	All Division
4	Balikpapan Botanical Gardens Management Information System	Provide interface for permit usage license of Balikpapan Botanical Garden Provide bussy calendar Provide usage history Provide visitor counter	Public , Sub Division of General
5		Managing daily schedule for sweeping Roads Mapping tree location on the roadside and	

	Road & Waste Management System	it age monitoring the capacity of temporary dumps in real-time monitoring the amount of waste entering in real-time managing hazardous waste and wastewater in real-time	Division of Sanitation and Cleanliness, Division of Pollution Control and Environmental Damage
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**CONCLUSION**

Based on the enterprise architecture, there are several opportunities to improve existing business processes. Opportunities are translated in the form of information systems as contained in the design of information systems architecture. There are 5 information systems that can be developed. Information system priorities are then arranged based on 5 criteria namely external customer impact, service quality, business cost reduction, internal customer impact, and process speed impact. Information systems that are highly prioritized for development are the Financial Information system, the Environmental Public Service Management System, and the Administrative Management System. Information systems that are not prioritized to be developed are the Balikpapan Botanical Garden Management Information System and the Road & Waste Management System.

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**REFERENCES**

- [1] D. Goerzig Und T. Bauernhansl, „Enterprise Architectures For The Digital Transformation In
- [2] Small And Medium-Sized Enterprises,“ In *11th Cirp Conference On Intelligent Computation In Manufacturing Engineering*, 2017.
- [3] M. Gloet, K. Frampton Und I. A. Someh, „Achieving Benefits With Enterprise Architecture,“
- [4] *Journal Of Strategic Information Systems*, Nr. 27, P. 139–156, 2018.
- [5] Dinas Lingkungan Hidup Balikpapan, „Gambaran Umum,“ 18 Agustus 2019. [Online].
- [6] Available: [Http://DLH.Balikpapan.Go.Id/Content/19/Gambaran-Umum](http://DLH.Balikpapan.Go.Id/Content/19/Gambaran-Umum).  
A. Maulana, I. Darmawan Und P. F. Alam, „Optimizations Information Technology With
- [7] Enterprise Using TOGAF ADM On Conservation Field And Control Of Climate Change Dinas
- [8] Lingkungan Hidup West Java Control Of Climate Change Dinas Lingkungan Hidup West Java,“
- [9] *E-Proceeding Of Engineering*, Bd. 5, Nr. 3, P. 7142, 2018.

- [10] S. N. Ayudya, I. Darmawan Und P. F. Alam, „Optimizing Information Technology With
- [11] Modeling Enterprise Architecture Areas Of Environment Polling Control Using TOGAF ADM On Dinas Lingkungan Hidup West Java Province,“ *E-Proceeding Of Engineering*, Bd. 5, Nr. 3, P. 7262, 2018.
- [12] Dinh Duong Dang; Samuli Pekkola, „Systematic Literature Review On Enterprise Architecture In The,“ *The Electronic Journal Of E-Government*, Bd. 15, Nr. 2, Pp. 132-154, 2017.
- [13] T. Tamm, P. Seddon, G. Shanks Und P. Reynolds, „How Does Enterprise Architecture Add Value To Organisations?,“ *Communications Of The Association For Information Systems.*, Bd. 28, Pp. 141-168, 2011.
- [14] L. Halawi, R. Mccarthy Und J. Farah, „Where We Are With Enterprise Architecture,“ *Journal Of Information Systems Applied Research* , Bd. 12, Nr. 3, Pp. 4-13, 2019.
- A. Josey, R. Harrison, P. Homan, M. F. Rouse, T. V. Sante, M. Turner Und P. V. D. Merwe, TOGAF® Version 9.1 – A Pocket Guide, Zaltbommel: Van Haren Publishing, 2016.
- [15] S. Buckl, A. M. Ernst, F. M. R. Ramacher Und C. M. S. , „Using Enterprise Architecture
- [16] Management Patterns To Complement TOGAF,“ In *Ieee International Enterprise Distributed Object Computing Conference*, 2009.
- A. Cassidy, A Practical Guide To Information System Strategic Planning, Boca Raton, Florida: Auerbach Publications, 2006.