# Designing Enterprise Architecture: Case Study of the Ministry of Energy and Mineral Resources

Yova Ruldeviyani, Evita Wisnuwardhani and Yudho Giri Sucahyo
Faculty of Computer Science, Universitas Indonesia, Jakarta, Indonesia

**Abstract:** The Ministry of Energy and Mineral Resources (MEMR) is a government institution that has the task of conducting affairs in the field of energy and mineral resources to assist the President in running the state government. Eventhough the role of Information Technology (IT) is increasingly important, MEMR still has no guidance in planning and implementing IT solution. Each unit design and implement their own IT solutions without considering integration to other units. As a result, MEMR faces variety of IT implementation. This study aims to map the current condition of MEMR and recommend the architecture design that fit to MEMR. The framework used is The Open Group Architecture Framework (TOGAF). Data were collected through documents of MEMR and also interviews and Focus Group Discussion (FGD) with units in MEMR. The results of the study are the architecture principles of MEMR that include business principles, application principles, data principles and technology principles and also pattern of solutions and roadmaps based on the proposed architecture principles.

**Key words:** Energy and mineral resources, enterprise architecture, roadmap, TOGAF, MEMR

## INTRODUCTION

The Ministry of Energy and Mineral Resources (MEMR) is a government agency that is subordinate and accountable to the president of the republic of Indonesia. MEMR has a unit to manage Information Technology (IT), named center of data and information technology (Pusdatin) under the general secretary. Based on the regulation of EMR Minister No. 22 years 2013 concerning organization and work flow, Pusdatin has the tasks of data and information technology management and analysis and evaluation of EMR data. In implementing its duties as intended, pusdatin has the following functions:

- Coordinating an integrated data management of EMR
- Preparing technical policy formulation, plan and program data management, analysis and evaluation of strategic data as well as IT systems of EMR
- Implementing data management, analysis and evaluation of strategic data as well as IT systems of EMR
- Monitoring, evaluating and reporting on the implementation of data management, analysis and evaluation of strategic data as well as IT systems of EMR
- The administration of Pusdatin

In carrying out its duties and functions, Pusdatin plan, build and maintain IS/IT assets of MEMR. However, MEMR still has no guidance in planning and implementing an IT solution, so that each unit thinks IT solutions required by themselves.

**Literature review:** Enterprise Architecture (EA) is an attempt to do the analysis, design, planning and implementation of solutions for an organization to successfully run a business strategy (Kurniawan, 2013). The advantages of EA according to some sources are as follows:

- Reduce the cost of IT including the development and maintenance costs. This is because EA helps organization control the investment only to the things that are needed, so it becomes not excessive (Ross at al., 2006; Obitz and Babu, 2009)
- Improve IT responsiveness, so that the planning and implementation can be done well (Ross at al., 2006; Kappelman at al., 2008)
- Increase the satisfaction of management, because IT is implemented to meet the needs of business (Ross at al., 2006; Rouhani et al., 2013)
- Increase the outcome, among others with better operational, customer intimacy, leadership, the ability to compete with competitors and open a new target market (Ross at al., 2006; Obitz and Babu, 2009)
- Integration and standardization, so that a component can be used together or repeatedly (Bui, 2012; Drews and Schirmer, 2014; Ross at al., 2006; Obitz and Babu, 2009)

**Corresponding Author:** Yova Ruldeviyani, Faculty of Computer Science, Universitas Indonesia, Jakarta, Indonesia
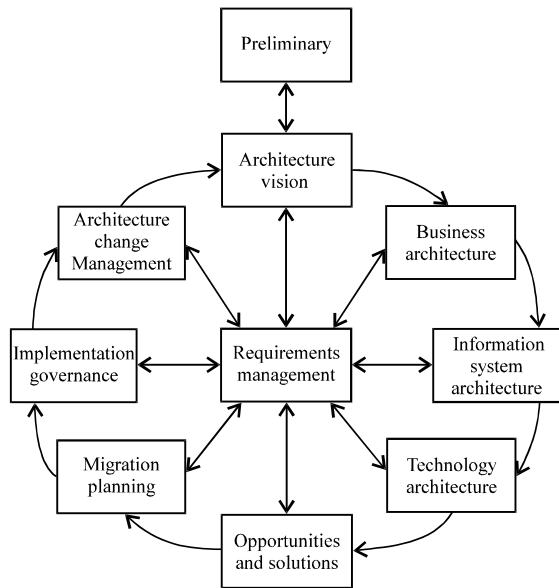
Fig. 1: The eight phases of ADM

The Open Group of Architecture Framework (TOGAF) is a framework that is most widely used to compose an EA (Rais and Pecinovsky, 2014). The methodology used in TOGAF architecture named Architecture Development Method or commonly abbreviated as ADM. ADM is an iterative methodology in developing EA, because it starts from identifying current conditions, developing the architecture necessary, to managing the implementation of EA (Edward *et al.*, 2014; Rouhani *et al.*, 2013). ADM is composed of three phases as follows:

- Preliminary that is the preparation of composing EA
- ADM cycle, divided into eight phases shown in Fig. 1
- Requirement management that is the identification for the need of iterative ADM phases

## MATERIALS AND METHODS

This research was conducted through the following steps:

- Identifying the IS/IT problems at MEMR in general
- Literature study
- Preliminary that was the preparatory stage including primary and secondary data collection through interviews and review of the strategic plan and regulation. This stage produced architectural principles which were divided into four, namely business principles, data principles, application principles and technology principles

- Identifying architecture vision
- Identifying business architecture
- Identifying information system architecture
- Identifying technology architecture
- Identifying migration planning withdrawal conclusions and suggestions

## RESULTS AND DISCUSSION

Through interviews and focus group discussions, statements shown in Table 1 are obtained.

**Interviewees statement table**
**Statement:** There are no regulations/policies governing e-Government. No guide/standardization in determining an IT solution, so as to create an integrated e-Government and allow the public information service fast, precise and accurate. Utilization of IS/IT is essential for the work program of MEMR involving multiple parties such as EMR and public sector companies. The use of IS/IT that has been running can accelerate the process of public services and facilitate the work. Several processes are still done manually. All the work is planned based on IT in the future. IT human resources is lacking. IT assets management (applications, data, server) carried out by each unit separately. Many important data stored, such as investment licensing, complaints or auctions, need to be secured. Data collected by unit are often given with different formats. Application development standards are needed for easy maintenance and integration. The need for single sign on. Insufficient bandwidth. Server and backup mechanisms are not available yet. Based on Table 1, determined MEMR's architecture principles are as follows:

- Business principles: business process automation, continuity of public services and the use of common applications
- Data principles: sharing, ease of access, same meaning and secured
- Application principles: ease of use, standardization and single sign on implementation
- Technology principles: bandwidth conformance with the workload, availability of backup and centralization of server procurement in Pusdatin so the unit does not have to think about the procurement and maintenance of the server

The next step was to make an architecture vision. Based on architecture principles and strategic plan of MEMR, it can be identified a stakeholder power grid as shown in Fig. 2.

Table 1: Business arhitecture gap matrix

| Baseline business architecture | Targeted business architecture | Business gap analysis |
|---|---|---|
| There still exist process done manually | All job is based on IT | Need automation for manual process |
| Applications were developed by each unit separately | Common application is developed by Pusdatin | Listing application to be analyzed by Pusdatin |
| Public service application never down for days | Public service application can not down for a long time | - |

Table 2: Application arhitecture gap matrix

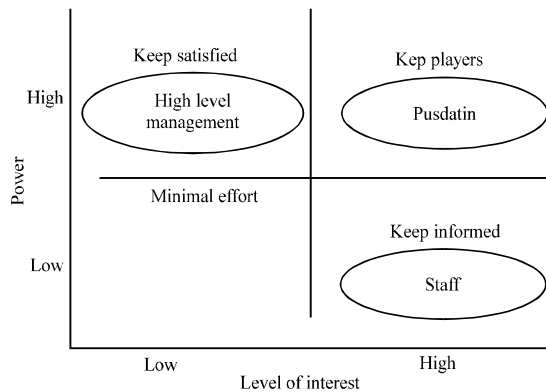| Status | Total application |
|---|---|
| Upgrade | 22 |
| Remove | 20 |
| New | 3 |
| Keep | 11 |



Fig. 2: Stakeholder power grid

From Fig. 2, it can be seen that stakeholder with low level of interest but high power was categorized as 'keep satisfied' that was high level management; stakeholder with high level of interest but low power was categorized as 'keep informed' that was staff and stakeholder with high level of interest and power was categorized as 'key player's that was pusdatin.

The next step was to get gap matrices of business architecture, information system architecture (data and application) and technology architecture. These matrices was produced by comparing current condition and targeted condition of MEMR. Business architecture gap matrix is shown in Table 1.

Application architecture gap matrix was done by mapping all application of MEMR to categories as: keep (means application will not be changed), upgrade (means application need to be upgraded), new (means application need to be build for that business process) or remove (means application need to be deactivated). Application architecture gap matrix, data architecture gap matrix and technology architecture gap matrix are shown in Table 2-4, respectively.

Table 3: Data arhitecture gap matrix

| Baseline data architecture | Targeted data architecture | Data gap analysis |
|---|---|---|
| Data spreads on each unit | Sharing | Need a data warehouse. Data traffic will be through web service |
| Data was handed in with different format | Same format for each unit | Need a documentation that explain data format |
| Application was often hacked so data was not safe | Data is safe from internal or external attack | Apply data security management |

Table 4: Technology arhitecture gap matrix

| Baseline technology architecture | Targeted technology architecture | Technology gap analysis |
|---|---|---|
| No firewall in General Inspectorate | Each unit has firewall | Need to build firewall in every unit |
| No backup server available | A backup server and automatic daily backup mechanism | Need backup server and automatic daily backup mechanism |
| No Data Recovery Center (DRC) | DRC needed as complement to DC | Need to build DRC |

After that, mapped the architectural principles to the proposed solution and drafted roadmap or long-term plans based on the target of business architecture, application architecture, data architecture and technology architecture are as follows:

- In the business area, it is proposed that MEMR strengthen the policy of e-Government through the development of the IT master plan, formed a committee of ICTs, carry out training in the field of IT and exercises oversight of IT on a regular basis so that no common application development in units
- In the data area, it is proposed that MEMR enforce the use of data warehouse and web service, set responsibility for IT security, set standards for information security and set standards for each unit of MEMR and EMR sector companies
- In the application area, it is proposed that MEMR make a standardization of application through IT master plan and implement the concept of single sign on
- In the technology area, it is proposed that MEMR build and maintain a Disaster Recovery Center (DRC) and supervise IT regularly so that no procurement and maintenance server in unit

**CONCLUSION**

This study aimed to make an enterprise architecture for Indonesia MEMR. The framework used was TOGAF by taking seven initial phases, i.e., preliminary, architecture vision, business architecture, information system architecture (comprising of application architecture and data architecture), technology architecture, opportunities and solutions and migration

planning. The next phases in TOGAF were not done in this study because it is not the authority of researchers but the authority of Pusdatin.

From the preliminary phase, it was obtained a general overview of MEMR. Then, architectural principles can be compiled which are divided into three business principles (automation, continuity and common application usage), four data principles (sharing, ease of access have the same meaning and safe), three applications principles (ease of use, standardization and single sign-on) and three technology principles (suitability bandwidth, availability of backup and centralized server procurement). In phase opportunities and solutions, it was proposed architectural solutions according to the gap matrices obtained from previous phases.

After that, the phase of migration planning, it was proposed strategy activities in order to achieve and maintain the condition of the architecture targeted which was preparing the IT Master Plan, forming a committee of ICTs, carrying out training in the field of information technology, incorporating the use of data warehouse and web service, setting responsiility for IT security, implementing the concept of single sign on, building and maintaining a Disaster Recovery Center (DRC) as well as supervise IT regularly.

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