An Exploratory Study of Enterprise Architecture Practices in Malaysia

Rafidah Abd Razak, Universiti Utara Malaysia, Sintok, Kedah, Malaysia *rafidah@uum.edu.my*
Assoc. Prof. Dr Zulkhairi Md. Dahalin, Universiti Utara Malaysia, Sintok, Kedah, Malaysia *zul@uum.edu.my*

Abstract

This study was an exploratory investigation of the practice of the enterprise architecture (EA) in private and public enterprises in Malaysia. The Zachman Framework was used to evaluate the practice of EA in these enterprises. Ten enterprises from public and private sector participated in the study. Multiple sources including interviews, documents and survey were used as the data sources of the study. The findings presented in this paper were exploratory in our attempt to gain an insight of the EA practices in Malaysia. The paper would give the general outlook of the current practices of EA in Malaysian enterprises.

1. Introduction

Enterprise architecture establishes a comprehensive understanding of an enterprise's core business processes and defines the technology that supports and optimizes them [1, 2]. The increasing size and complexity of the implementation of information systems, it is necessary to use some logical construct for defining and controlling the interfaces and integration of all of the components of the system [3]. It is insufficient for enterprises to work on any area in isolation, given the extend to which IT is imbedded in business processes, product and services, within a fast-changing environment [4].

It is necessary for enterprises to define EA to enable an integrated vision and global perspective of the enterprise information resources; to enable the discovery and elimination of redundancy in business process; to having information systems that reflect common goals and performance measures for all managers, to encourage cooperation within enterprise; and to become the bridge between the business and IT domains [5-9].

However, not much is known about how many of the managers can disparate between the need and actual practice of the EA in the enterprise, and how many of them realize that a well-documented architecture is a logical organization of information pertaining to their business rules, objectives, strategies and strategic goals. One study reveals that knowledge on EA is very poor among the enterprise management in Malaysia [10]. Due to this reason, we became aware that it would be meaningful to explore the situation itself in order to gain an insight into actual EA implementation in Malaysia.

2. Purpose of the Study

This study was an exploratory investigation of the practice of the EA selected private and public enterprises in Malaysia. The Zachman Framework was used to evaluate the practice of EA in these enterprises.

3. The Zachman Framework

The Zachman Framework for EA is considered to be a classic work on the concepts of information systems architecture. The framework proposes a logical structure for classifying and organizing the descriptive representations of an enterprise, in different dimension, and each dimension can be perceived in different perspectives.

The Zachman Framework was developed taking into consideration of all participants involved and identifies six aspects of architectures to focus about enterprise with five levels of models representing different development views. The views begin with the planner's perspective, followed by the owner's perspective, the designer's perspective, the builder's perspective and the subcontractor's perspective. Each of the leveled view corresponds to the six aspects of the architectures, i.e. data, function, network, people, time and motivation [6, 11].

4. Enterprise Architecture

Enterprise architecture was ranked near the top of the list of most important issues considered by CEOs and CIOs in 2004 [12]. Enterprise architecture appears to be concentrated in developed countries with the USA ranked the top in 2005 [13]. This is followed by the UK, Canada, Netherlands and Australia, with India and Singapore are improving their EA activities most significantly.

Enterprise architecture is beginning to gain acceptance in Malaysia with the establishment of Malaysia's Chapter for the International Association of Software Architecture (IASA) in 2002. Enterprise architecture is also being observed to becoming more popular among enterprises based on the keen interest on the subject and the overwhelming participation among key IS players in workshops and seminar on EA organized by professional training and consulting companies [14].

5. Research Methodology

The study follows the qualitative research method and case study as the inquiry strategy. [15] suggests that qualitative research is exploratory and researchers use it to explore topic been research.

An in-depth study using multiple case study method was used to collect empirical evidences for the study. Purposive sampling was used in selecting the enterprises for the study. They were short listed from a list of private and public enterprises. They were contacted to ensure their acceptance and commitment. The respondents of the study were those who are involved in EA either directly or indirectly, from top management to system analysts. Multiple sources including interviews, documents and survey were used as the data sources of the study.

The data collection protocol incorporates procedures and general guideline that should be followed in conducting the data collection phase of the case study. The design of the data collection protocol were divided into 4 tasks; preparing case study questions, training the case study team, determining the person to be interviewed and initial scheduling of field visit. The case study protocol was constructed to ensure consistency across multiple cases.

Interviews were recorded and transcribed, and then the scripts were returned to the interviewees to ensure validity of responses. Documentation such as annual reports and related materials were also analyzed. Survey questionnaires were distributed to key user representatives for cross validation and consistency.

Pattern-matching technique was used to analyze the data. Cross analysis of EA practice in the enterprises was mapped against the Zachman Framework to determine the extent of the practice.

6. Findings

Seven public and three private enterprises participated in the study. The enterprise's names are presented anonymously for reasons of confidentiality. In terms of size, the enterprise ranges from medium to large with numbers of employees from 200 to 7000. The enterprises in the study are situated in various cities in Malaysia. The enterprises profiles are presented in Table 1.

Table 1: Profile of the Enterprises

Case	Sector	# Employee	Respondent Job Title
A	Public	200	IS Officer
B	Public	500	IS Officer
C	Private	935	IT Manager
D	Public	7000	Deputy Director
E	Public	4000	System Analyst
F	Public	714	IT Officer
G	Private	1200	Vice President
H	Private	200	Senior Manager
I	Public	500	Director
J	Public	1300	Asst.General Manager

Case A
On the current practice of EA, the CASE A practiced in-house development and sometimes outsource to the third party. Following the Zachman Enterprise Architecture Framework, in DATA dimension, they used ERD and flow chart as a method or technique to capture the information requirement from manual form and work process. Basically, the methods used were based on meeting/discussion with user i.e. head and staff team for each department who involve in system development. In FUNCTION dimension, usually prototype is used to capture user specification and also used flow chart to capture the business process. As for the NETWORK dimension, they handled by them because they have expert people to in-charge it. For the PEOPLE dimension, they insisted that the management levels are the main categories of user involved in IT planning and there are no individual requirements that will be considered. Most of the requirements that are considered are of specific department's. The TIME dimension was however not addressed explicitly. For the MOTIVATION dimension, they incorporate business strategy parallel into IT planning.

Case B
On current practice of EA, the CASE B practiced in-house development. Following the Zachman Enterprise Architecture Framework, in DATA dimension, they used ERD and flow chart as a method or technique to capture the information requirement from manual form and work process. Basically the methods used were based on meeting/discussion with user i.e. head and staff team for each department who involve in system development. In FUNCTION dimension, they used flow chart to capture the business process. As for the NETWORK dimension, they appointed a consultant since 1999 when they started Electronic Government. For the PEOPLE dimension, the main categories of user involved in IT planning and there are no individual requirements that will be considered. Most of the requirements that are considered are of specific department. They apply different standards of security and user access level depending on the different responsibility and department function. The TIME dimension was however not addressed explicitly, but the Information System Officer demonstrated an example of E-DUN (DUN electronic system) which used time dependent to capture events of three times a year conference for the Chief Department. System showed that time dependent was incorporated as event triggers and exceptions as part of the business rules. For the MOTIVATION dimension, the institution stated that it consciously incorporates corporate business strategies into the IT planning.

Case C
On current practice of EA, CASE C practiced third party outsourcing. Following the Zachman

Enterprise Architecture Framework, the dimensions, DATA and FUNCTION, were outsourced. There was no in-house development being done. Basically, the methods used were based on discussion where they provide a specification and the outsourcing company proceeds with the development through a series of discussion. As for the NETWORK dimension, their network already established and they inherit them. They provided some documentation showing the network diagram of one of the department as an evidence of their network documentation. For the PEOPLE dimension, they affirmed that the management levels are the main categories of user involved in IT planning. Most of the requirements that are considered are of specific department. The TIME dimension was however not addressed explicitly. For the MOTIVATION dimension, it consciously incorporates corporate business strategies into their IT planning.

Case D
On current practice of EA, CASE D practiced in-house development. Following the Zachman Enterprise Architecture Framework, the DATA and FUNCTION dimensions were captured using several methods including conducting interviews and preparing requirement specification. The techniques used to capture the requirements are business flow and flow charts since most of the applications developed are host base using mini computers and COBOL. For web applications, the prototyping method was used. The NETWORK dimension was outsourced where the outsourcing company provides the network solutions. The PEOPLE dimension was controlled by them where the category of user involved in building the information architecture includes Operation Officers and Office Directors. There are 3 levels of user access requirements that are entry, update and validation. The TIME dimension was however not addressed explicitly. In the MOTIVATION dimension, they responded to the directives of upper management.

Case E
On current practice of EA, CASE E practiced outsourcing for almost all of its major applications. Following the Zachman Enterprise Architecture Framework, the dimensions, DATA, FUNCTION, and NETWORK were outsourced. Basically the outsourcing company provides a baseline solution as prototypes. The enterprise evaluates the prototypes and identifies additional user requirements and then outsources the customization tasks. The other two dimensions, namely PEOPLE and MOTIVATION were managed in-house. The board decides on IT personnel and user representatives involved with the outsourcing company. Categories of users involved include expert staff from the user departments, IT personnel and members of the board of management. This is helpful to provide accurate

user requirements and advice on policies and practices as well as requirements of the law. They also try to incorporate business strategies into their IT planning. The TIME dimension was however not addressed by the officers interviewed.

Case F
On current practice of EA, CASE F practiced in-house development and outsourcing. Following the Zachman Enterprise Architecture Framework, the dimensions, DATA, and FUNCTION were mostly outsourced. Basically, the outsourcing company working with the IT staff works together to provide a solution prototype. They then evaluate the prototype and identify additional user requirements, and then they outsource the customization tasks. The NETWORK dimension is controlled and maintain by the IT unit. For the PEOPLE dimensions, they decide on IT personnel and user representatives involved with the in-house development and the outsourcing company. Categories of users involved include experienced staff from the user departments, and managements. This is to provide accurate specifications of the user requirements. They also apply different standards of security and user access level depending on the system requirements. As for the MOTIVATION dimension, they incorporate its strategies into the IT planning, but its planning is still depending mostly on the budget allocation for that particular year. The TIME dimension was however not addressed.

Case G
On current practice of EA, CASE G practiced third party outsourcing. Following the Zachman Enterprise Architecture Framework, the dimensions, DATA, FUNCTION, and NETWORK were outsourced. Basically, the methods used were based on "gap analysis", where the outsourcing company provides a baseline solution as prototypes. They evaluate the prototypes and identify user requirements and outsource the customization tasks. The other two dimensions, namely PEOPLE and MOTIVATION are controlled in-house. The company also decides on IT personnel and user representatives involved with the outsourcing company. Categories of users involved include experienced staff from the user departments and members of the management. This is to provide accurate specifications of the user requirements and advice on policies and practices as well as requirements on security profiling. The business strategies also incorporate into the IT planning. This is necessary in order to meet the objectives and also the changes that are taking place in fulfilling the requirements of the business. The TIME dimension was however not addressed explicitly, but incorporated as event triggers and exceptions as part of the business rules.

Case H
On current practice of EA, CASE H practiced third party outsourcing and engaged the service of a

consulting company to build the EA blueprint. Following the Zachman Enterprise Architecture Framework, all the dimensions were outsourced except for the PEOPLE aspect. Requirements to capture the DATA, FUNCTION and NETWORK dimensions were carried out by the consultant. For this, the consultant carried out an Information Strategy Planning (ISP) study to build the blueprint. Once the ISP has been delivered and approved, the consulting company will carry out implementation of the blueprint particularly in developing the IS applications and databases. This is seen to fulfill the DATA, FUNCTION and NETWORK requirements. The PEOPLE, TIME and MOTIVATION dimensions were however not included, except for security and access level (PEOPLE aspect), where the company's IT Policy was being referenced.

Case I
On current practice of EA, CASE I practiced both internal expertise and third party outsourcing. Following the Zachman Enterprise Architecture Framework, the dimensions FUNCTION were outsourced. Basically, the outsourcing company provides guideline and a baseline solution as prototypes. The IT department then evaluates the prototypes and begins the actual development based on prototypes provided by the consultant and additional requirements from users. The other five dimensions, namely PEOPLE, DATA, NETWORK, MOTIVATION and TIME are controlled in-house. For the PEOPLE dimension, participation of IT planning involved IT personnel and user representatives. Categories of users involved include experienced staff from the user departments and members of the management. This is to provide accurate specifications of the user requirements and advice on policies and practices. For the DATA dimension, they use SDLC, prototype and ERD techniques to capture information. For the NETWORK dimension, they use network diagram to design the network of the organization. For the MOTIVATION dimension, the agency consciously incorporates business strategies into the IT planning. This is to meet the objectives and also the changes that are taking place in fulfilling the requirements of the state government. Finally, for the TIME dimension, they use sequence diagram technique to capture events requirement. They also use network card and firewall as security act to protect the organization system from hackers.

Case J
On current practice of EA, CASE J practiced in-house expertise (key person in the organization, end user and internal consultant). Following the Zachman Enterprise Architecture Framework, the dimensions, DATA, FUNCTION, NETWORK, PEOPLE, TIME and MOTIVATION were using the internal source. For the DATA dimension, they

use ERD, OO and Flow Chart techniques to capture the information requirement for the organization. This document was based on interaction with users which involves experienced staff from the user departments and members of the management. For FUNCTION dimension, DFD and Flow Chart as techniques are used to capture business process. To arrive to that document, they use the same approach applied in the DATA dimension. For the NETWORK dimension, the network diagram is used as a technique to design the network of organization such as public access database, the Organization portal, and client/user portal (requested by client). To come-out with this document, they use internal consultant to support the team in the process of designing the diagram. For the PEOPLE dimension, Categories of users involved include experienced staff from the user departments and members of the management, to provide accurate specifications of the user's needs. They also consider specific requirements and access level requirements from users based on job specification. For the TIME dimension, the Organization uses Time Dependent Process to capture event requirement. However, it is only used for certain activities/function and it was not addressed explicitly. Finally for the MOTIVATION dimension, they also incorporate business strategies into their IT planning for excellent business alignment, competitive advantage, resource management and technology architecture.

7. Discussions and Conclusion
The findings presented in this paper were exploratory in our attempt to gain an insight of the EA practices in Malaysia. The paper would give the general outlook of the practices of EA in Malaysian enterprises.

In terms of EA practice, the findings found that all ten enterprises conduct variations of EA, particularly in their planning level. The study reveals that some aspects of the framework were not addressed at all; whilst other aspects were addressed vary in terms of perspectives.

On the extent of EA practice based on the mapping of the Zachman Framework, most of the work focused on all dimensions except for TIME across all perspective. This may suggest that time factors may not be critical at the planning level, and perhaps due to its detailed characteristics which is more appropriate at a lower level of EA.

The study also found that most of the enterprises practice either in-house or outsource to third parties. None of the ten participating enterprise made reference to Zachman Framework or any other EA framework; this may suggest the idea of EA is relatively new to Malaysian enterprises.

8. Acknowledgement

9. References

[1] F. J. Armour, S. H. Kaisler, and S. Y. Liu, "A Big-picture Look at Enterprise Architectures," *IT Professional*, vol. 1, pp. 35-42, 1999.

[2] C. Emery, S. M. Faison, J. Houk, and J. S. S. Kirk, "The Integrated Enterprise: Enterprise Architecture, Investment Process and System Development," presented at Hawaii International Conference on System Sciences (HICSS-40), Hawaii, 2007.

[3] J. A. Zachman, "A framework for information systems architecture," *IBM Systems Journal*, vol. 38, pp. 454-470, 1999, 1987.

[4] Q. Hu and C. D. Huang, "Aligning IT with Firm Business Strategies Using the Balance Scorecard System," presented at The 38th Hawaii International Conference on System Sciences (HICSS '05), Hawaii, 2005.

[5] J. Hoogervorst, "Enterprise Architecture: Enabling Integration, Agility and Change," *International Journal of Cooperative Information Systems*, vol. 13, pp. 213 - 233, 2004.

[6] C. M. Pereira and P. Sousa, "A Method to Define an Enterprise Architecture Using the Zachman Framework," presented at ACM Symposium on Applied Computing, Nicosia, Cyprus, 2004.

[7] S. H. Kaisler, F. Armour, and M. Valivullah, "Enterprise Architecture: Critical Problems," presented at The 38th Annual Hawaii International Conference on System Sciences (HICSS'05), Hawaii, 2005.

[8] H. Jonkers, M. M. Lankhorst, H. W. L. t. Doest, F. Arbab, H. Bosma, and R. J. Wieringa, "Enterprise architecture: Management tool and blueprint for organisation," *Information Systems Front*, vol. 8, pp. 63-66, 2006.

[9] E. Niemi, "Enterprise Architecture Stakeholders - A Holistic View," presented at The Americas Conference on Information Systems, Keystone, Colorado, USA, 2007.

[10] R. Abd.Razak, Z. Md.Dahalin, R. Dahari, S. S. Kamaruddin, and S. Abdullah, "Enterprise Information Architecture (EIA): Assessment of Current Practices in Malaysian Organizations," presented at Hawaii International Conference on System Sciences (HICSS-40), Hawaii, 2007.

[11] S. H. Spewak and S. C. Hill, *Enterprise Architecture Planning: Developing a Blueprint for Data, Applications, and Technology*. USA: QED Publishing Group, 1992.

[12] J. Schekkerman, *The Economic Benefits of Enterprise Architecture*. Victoria, BC, Canada: Trafford, 2005.

[13] J. Schekkerman, "Trends in Enterprise Architecture 2005," Institute for Enterprise Architecture Developments (IFEAD) 2005.

[14] S. P. S. Seow, *The Zachman Framework for Enterprise Architecture - Finding Out More*. USA: The Analyst LLC, 2000.

[15] J. W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 2nd ed. United States of America: Sage Publications, Inc., 2003.