Enterprise Information Architecture: Empirical Evidence To Support Zachman Framework In Malaysia

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ABSTRACT

The paper aims to describe findings based on a research study on current Enterprise Information Architecture (EIA) implementation in Malaysia. Ten enterprises from public and private sectors were chosen for case study analysis. The Zachman Framework was chosen as a guideline to assess the current practice of EIA in five of these enterprises. The study found that certain aspects of the framework were not addressed at all, whilst other aspects that were addressed vary in terms of the different perspectives. The paper highlights gaps in the current practice and provides recommendations and suggestions for enterprises to consciously embark on the EIA paradigm in order to better align the whole enterprise to the goals of the enterprise.

Keywords

Information Strategy, Enterprise Information Architecture, Enterprise Engineering, Zachman Framework   :

1.0 INTRODUCTION

Enterprise Information Architecture (EIA) is the art and science of structuring, organizing and, labeling enterprise information, so that they can better manage the business for competitive advantages. According to Zachman (1987), "with 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."   Therefore it is necessary to any enterprise to define enterprise information architecture 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 technical domains (Pereira & Sousa, 2004).

This study will investigate the existence of the enterprise architecture in private and public enterprises in Malaysia and assess the presence of the architecture and its practical use against the established guidelines and frameworks as expounded by the proponents of the enterprise architecture. Results of this study can be used by the government and private sectors to formulate new policies and guidelines on enterprise architecture so that the enterprise's IT adoption and information requirements fit nicely into its business strategy

2.0 LITERATURE REVIEW

The importance of aligning an enterprise's information requirements in terms of its data and processes that constitute its information infrastructure with the business strategy has been recognized ever since IBM brought up the idea of Business Systems Planning in the early 1980s.

According to King (1988), the business strategy of an enterprise is translated into the enterprise's Information Systems Strategy through the process of Information Systems Planning. This IS strategy, according to the author, guides the development of the enterprise information architecture (EIA). This is also supported by Rockart and Hoffman (1992) who contend that enterprise architecture should be the guiding architecture for the design and development of information systems in a complex enterprise. Meanwhile surveys of IS executives highlight the importance of Enterprise Architecture ranked among the top IS issues in recent years (Neiderman et al., 1991; Brancheau et al., 1996). These articles suggest the development of IS-related innovations need to be considered in a systematic manner within the framework of various architectures encompassing the business architecture, information architecture, data architecture, systems architecture and computer architecture.

Spewak (1992) identifies three architectures in his definition of Enterprise Architecture Planning: data architecture, applications architecture and technology architecture.   The author contends that these architectures define and describe the data, application and technology needed to support the business.   A

well-documented architecture of the enterprise should be able to define and describe the enterprise in terms of its strategic goals, objectives and strategies; the enterprise's business rules and measures; its information requirements and applications systems; relationships between applications and data elements, and the enterprise's technology infrastructure. The Enterprise Architecture also establishes guidelines, standards and operational services that define the enterprise's systems development environment.

According to Spewak (1992) among the accomplishment of establishing an Enterprise Architecture includes: 1) Facilitate change management by linking strategic requirements to systems that support them and by linking the business model to application designs; 2) Enable strategic information to be consistently and accurately derived from operational data; 3) Promote data sharing, thus reducing data redundancy and reducing maintenance costs; and 4) Reduce software development cycle time and costs.

The Zachman Framework identifies six aspects of architectures to focus about the enterprise with five levels of models representing different development views. The views begin with the conceptual level, the owner's view, through the details of logical and physical design, and construction of a system. Each of the leveled view corresponds to the six aspects of the architectures, i.e. DATA, FUNCTION, NETWORK, PEOPLE, TIME and MOTIVATION (Spewak, 1992).

Seow (2000) observed that EIA is becoming more and more popular among enterprises in Malaysia based on the keen interest on the subject and the over whelming participation among key IS players in workshops and seminars on Enterprise Architecture organized by professional training and consulting companies. However, the author expressed doubt that enterprises are doing the same with EIA where its actual practice may have been very minimal as enterprises adopt a wait-and-see approach. This may suggest that up to the present moment, no empirical evidence have been gathered on the extent of current practice on EIA among enterprises in Malaysia.

3.0 WORK IN PROGRESS

The research approach follows the case study method, as EIA is assumed to be quite recent and studying new phenomenon in its natural context would be best tackled using the case study research approach as suggested by Yin (1989). In-depth study of selected enterprises was conducted, in which the unit of analysis is the department responsible for planning the enterprise's IS usage and IT adoption. A case study protocol was constructed to help facilitate investigation and fact-findings to ensure consistency across multiple cases. Techniques of data gathering that were used are

interviews, documentation and questionnaires. Reliability is measured against responses from the multiple cases where inter-item discriminant analysis was determined based on patterns of evidence.

Ten enterprises were selected for the case study. These represent both public and private sectors. The aim is to achieve theoretical generalization where according to Yin (1989), a minimum of four units of analysis suffice though a single unit is still permissible when certain conditions were met.

Interviews were recorded and transcribed, and scripts were returned to the interviewees to ensure validity of responses. Respondents of interviews were mainly the IS Planning analysts or the person(s) responsible for developing the EIA or the enterprise's IT master plan. Questionnaires were distributed to key user representatives for cross validation and intra-organizational consistency. Documentations such as annual reports and the enterprise's business strategies were analyzed to determine the enterprise's motivations, concerns, and performance indicators (KPIs).

Pattern-matching technique was used to analyze the data. This was then mapped against the established Zachman Framework to determine the extent of practice.

4.0 FINDINGS

4.1 Initial Findings

An initial study was conducted in 2005 to gather information on the general practice of enterprise information architecture planning in forty-four selected organizations. The aim is to provide early indication of what are currently the trends in information architecture in organizations in Malaysia.

Thereupon, an in-depth study of selected organizations was carried out to examine actual practice and how current implementations compared to the established Zachman's Enterprise Architecture Framework. To-date, twelve organizations have been involved in the case study and five organizations are included in the initial results presented in this paper.

Table 1 shows the summary results of the initial study of the enterprise information architecture planning practice.

The table shows that more than half (61%) of the sample organizations adopted some kind of an enterprise information architecture. A closer look at the data shows that the IT industry topped the list with all (100%) of the organizations practiced EIA. Next is the manufacturing and production industry with 78% of the companies practiced EIA. Lesser practice of EIA

was found in the services industry (55%) and utility industry (40%). The least is in the government and government-linked companies with only 36% of the sample.

In terms of size, 10 out of 16 (62.5%) of the large organizations practiced EIA. For medium size organizations, 7 out of 10 (70%) practiced EIA, and 10 out of 18 (55.5%) of the small size organizations practiced EIA. These initial findings indicate that organizations in Malaysia are practicing enterprise Information architecture, however, these practices are more prevalent in the industry and private sectors. The

public sector shows only minimal practice. The findings also indicate practice of EIA is more widespread in medium and large organizations.

On the proportion of EIA planning that gets implemented, overall 70% of what is planned in the EIA is implemented. Results from the government and government link companies may be suspicious as only two government organizations provided the feedback. Otherwise the private sectors show between 61% to 80% implementation of the EIA planning which indicate a moderately high implementation rate.

Table 1: Initial study

| Type | Freq. | Size | | | EIA | % |
		Large	Medium	Small	Practices	Implement
Govt. & GLCs	11	5	4	2	4(36%)	87.5*
Industry (m'fg,prod)	9	2	2	5	7(78%)	77.1
IT industry	8	3	1	4	8(100%)	63.8
Services	11	3	3	5	6(55%)	61.0
Utility	5	3	-	2	2(40%)	80.0
Total :	44	16	10	18	27(61%)	Ave (70%)

*Data based only on two organizations

4.2 Cross Case Analysis

Tables 2 and 3 show the cross case analysis of the five organizations participated in the case study. For reasons of confidentiality, the organizations' names are presented anonymously.

Table 2 presents the background of the case study organizations. Two organizations represent the public sector and the remaining three are from the private sector, each from IT, banking and the education. In terms of size, the sample belonged to the medium and large organizations and all are situated in the capital city of Kuala Lumpur. All the organizations have a formal IT department typical of any medium to large organizations with IT staff ranging from 27 to 200.

In terms of EIA practice, all five organizations conduct EIA planning with three formal and two informal planning. It is surprising that a moderately large banking institution practiced informal EIA planning given a substantial RM23 million annual IT investment. However a closer look at the data

presented in Table 3 shows that the same bank (Org2) outsources their EIA planning and implementation to third parties. This is also true for Org5, which also have informal EIA planning, and practiced third party outsourcing.

In terms of the rate of EIA implementation, with the exception of Org3 and Org4, three other organizations (1,2 and 5) have 75% to 90% rate of EIA implementation that is considered high. Org3 implements 50% of its EIA whilst Org4 only implements 20%, which is considered too low. The scope of EIA is enterprise wide as indicated by all five organizations. Reviews are conducted yearly or twice yearly as in the case of Org5, however Org2 has indicated no procedure for reviews. A closer examination of Org2's requirements shows that instead of periodic reviews, they would prefer those personnel involved with EIA to accumulate requirements through post-mortem sessions and bring these forward to the next EIA exercise conducted yearly. This would ensure current EIA planning and implementation to run

smoothly and not hindered by new and additional requirements along the way.

Table 3 shows the EIA practice of the five organizations participated in the case study. As can be seen majority of the organizations prefer to outsource their EIA activities, from planning right up to design and development of the applications. Based on the mapping of the Zachman's EIA framework, most of the EIA work focussed only on the first three dimensions of DATA, FUNCTION and NETWORK. Perhaps these are the three most common architectures and models available currently, and these three dimensions can represent most of the architectural work from the planning perspective right down to design and development. However, the Owner perspective appears not to be addressed, either because actual owners of the data and functions (and business processes) were not involved in the EIA or organizations do not see the significant of the owner's role in the EIA formulation. Similarly, the findings did not distinguish the Builder and the Sub-contractor perspectives as patterns of data show similarities between the two. Perhaps the need to outsource some of the in-house development did not arise in the case study organizations.

Table 2: Cross Case Analysis – Background

	Org 1	Org 2	Org 3	Org 4	Org 5
Industry	IT	Bank	Govt.	Educ	Govt.
Size	200	1200	7000	935	4000
Location	KL	KL	KL	KL	KL
IT dept	Yes	Yes	Yes	Yes	Yes
No. of IT staff	200	27	95	Na	130
IT investment	100m	23m	10m	21m	Na
EIA planning	Formal	Informal	Formal	Formal	Informal
% implemented	90%	75%	50%	20%	90%
EIA review	Yearly	None	Yearly	Yearly	Twice/yr
EIA scope	All	All	All	All	All
Timeframe	5 yrs	yearly	5 yrs	5 yrs	na

Table 3: Cross Case Analysis – Zachman Framework

	Planner	Owner	Designer	Builder	Sub-contractor
DATA	Org1 outsource Org2 outsource Org3 in-house Org4 in-house Org5 outsource	Org1 not done Org2 not done Org5 involved	Org1 outsource Org2 outsource Org3 in-house Org4 outsource Org5 outsource	Org1 outsource Org2 outsource Org3 in-house Org4 outsource Org5 outsource	Org1 outsource Org2 outsource Org3 in-house Org4 outsource Org5 outsource
FUNCTION	Org1 outsource Org2 outsource Org3 in-house Org4 in-house Org5 outsource	Org1 not done Org2 not done Org5 involved	Org1 outsource Org2 outsource Org3 in-house Org4 outsource Org5 outsource	Org1 outsource Org2 outsource Org3 in-house Org4 outsource Org5 outsource	Org1 outsource Org2 outsource Org3 in-house Org4 outsource Org5 outsource
NETWORK	Org1 outsource Org2 outsource Org3 outsource Org4 in-house Org5 outsource	Org1 not done Org2 not done Org4 not done Org5 involved	Org1 outsource Org2 outsource Org3 outsource Org5 outsource	Org1 outsource Org2 outsource Org3 outsource Org5 outsource	Org1 outsource Org2 outsource Org3 outsource Org5 outsource
PEOPLE	Org1 not done Org2 involved Org3 involved Org4 involved Org5 involved	Org1 not done Org2 involved Org3 involved Org5 involved	Org1 not done Org2 not done Org3 involved Orgt4 not done Org5 involved	Org1 not done Org2 not done Org3 involved Org4 not done Org5 involved	Org1 not done Org2 not done Org3 involved Org4 not done Org5 involved
TIME	Org1 not done Org2 not done Org3 not done Org4 not done Org5 not done	Org1 not done . Org2 not done Org3 not done Org4 not done Org5 not done	Org1 not done Org2 included Org3 included Org4 included Org5 not done	Org1 not done Org2 included Org3 included Org4 included Org5 not done	Org1 not done Org2 included Org3 included . Org4 included Org5 not done
MOTIVATION	Org1 not done Org2 involved Org3 involved Org4 involved Org5 involved	Org1 not done Org2 involved Org3 involved Org4 involved Org5 involved	Org1 not done Org2 not done Org3 involved Org4 involved Org5 involved	Org1 not done Org2 not done Org3 not done Org4 not done Org5 included	Org1 not done Org2 not done Org3 not done Org4 not done Org5 included ·

Whilst the PEOPLE and MOTIVATION dimensions are included in the EIA planning, both dimensions are somewhat left out during the EIA implementation (in the designer, builder and sub-contractor perspectives). Two of the organizations involved their people to participate in the implementation perhaps to ensure requirements are strictly adhered. As for motivation, one of the main reasons for EIA is alignment of IT adoption to the organization's mission and business strategies. If motivation is not reflected in the development of IS, organizations will face a higher failure rate of IT adoption. There is a need to establish links to transform motivation from the planner's perspective to the developer following the Zachman's EIA framework.

Lastly, the findings identified TIME to be the only dimension not adequately addressed in the Zachman's framework. Remarks given by the participating organization is that TIME dimension represents detailed events that occur in a particular business process, and therefore is not relevant from the perspective of the planner and owner. Presently there is no known mechanism to model TIME from the planner or owner perspective, except for event triggers that can be incorporated in the design and development of database.

5.0 CONCLUSIONS

This paper aims to describe findings based on a research study on current Enterprise Information Architecture (EIA) implementation in Malaysia. Five organizations from public and private sectors were chosen for the case study analysis in this paper. The Zachman Enterprise Architecture Framework was chosen as a guideline to assess the current practice of EIA in these organizations as the framework is particularly known world-wide and has become a de-factor standard for enterprise information architecture practiced by many organizations in the developed countries. Initial findings found that majority of the organizations do practice some kind of enterprise information architecture either in-house or outsource to third parties. The findings also found that certain aspects of the framework were not addressed at all such as the TIME dimension, whilst other aspects that were addressed vary in terms of the different perspectives. These include the Owner perspective and the Builder and Sub-contractor perspectives that were somewhat not distinguishable, apart from the PEOPLE and MOTIVATION dimensions. This gives a general outlook of EIA implementation in the selected organizations, which could be incomplete and not adequately addressed. This conclusion could explain the many failures in IT adoption and inappropriate investment in IT faced by many organizations today.

In view of the findings, efforts should be made to formalize the EIA practice if organizations would want to see their IT adoptions successfully implemented. This is important as the architecture provides the blueprint that links together the organizational knowledge and its business requirements to its mission and strategic objectives so that acquisitions and adoption of IT can closely match and support the organization's key performance indicators.

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