Usability Elements as Benchmarking Criteria for Enterprise Architecture Methodologies

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Abstract

An Enterprise Architecture (EA) serves as a blueprint to deal with the complexity within an organisation. Information Technology architects implement EA by utilizing the EA methodologies and frameworks. Although there are many methodologies and frameworks in enterprise architecture, each of them does not completely address all enterprise issues. The qualitative characteristics of the EA methodologies should be evaluated before implementing the EA in the organization, otherwise the organization might fail to achieve the organizational goals, cause confusion in the business process, and waste a lot of resources. One of the qualitative characteristics is usability, which should be evaluated in EA frameworks as an essential element of the whole system. The purpose of this study is to detail out the usability elements in EA methodologies.

Keywords: Enterprise architecture; usability; methodology; benchmarking

Abstrak

Seni bina Perusahaan (EA) ialah cetak biru untuk menangani kekompleksan dalam suatu organisasi. Arkitek Teknologi Maklumat melaksanakan EA dengan menggunakan metodologi dan rangka kerja EA. Walau pun terdapat banyak metodologi dan rangka kerja EA, setiap satu daripadanya tidak dapat menangani kesemua isu berkaitan perusahaan. CIri-ciri kualitatif bagi EA perlu dinilai sebelum EA dilaksanakan di organisasi kerana sekiranya ini tidak dilakukan, organisasi mungkin akan gagal mencapai matlamat-matlamatnya, menyebabkan kekeliruan dalam proses bisnes, dan membazir banyak sumber. Salah satu ciri kualitatif ialah penggunaan semula, yang patut dinilai dalam setiap rangka kerja EA sebagai salah satu elemen terpenting dalam sistem keseluruhan. Tujuan kajian ini ialah untuk melihat secara terperinci unsur-unsur penggunaan semula dalam metodologi EA.

Kata kunci: Seni bina perusahaan; penggunaan semula; metodologi; penanda aras

■1.0 INTRODUCTION

Nowadays, the external environment for business process is unstable as changes occur from time to time. Organisations have to deal with such complex environment in order to achieve their goals and missions. To do so, the business process should be integrated with information technology (IT) to facilitate the management role as a strategy to achieve organizational goals. An Enterprise Architecture is a blueprint to guide the manager and fill the gap between business and IT. In addition, an Enterprise Architecture serves as a blueprint to deal with the complexity within an organisation.

IT architects implement EA by utilizing the EA methodologies and frameworks. Although there are a lot of methodologies and frameworks in enterprise architecture, each one does not completely address all enterprise issues (Lim *et al.*, 2009). Some of the popular methodologies are (Lim *et al.*, 2009): Zachman framework (Zachman, 1987), The Open Group

Architecture Framework (TOGAF) (Open Group, 2009), and the Department of Defence Architectural Framework (DoDAF, 2007). Although many researches have been done on the methodology of Enterprise Architecture within the last decade, there is no consensus among researchers on which methodology is the most complete (Sessions, 2012, Magoulas *et al.*, 2012). For instance, Zachman methodology consists of different perspectives of stakeholders that describe products from their viewpoints as artefacts in each layer while TOGAF methodology consists of Architecture Development Method (ADM) which addresses the Management Requirements.

EA methodologies have strong and weak points which should be considered in choosing the best EA framework for an organization. To do so, the qualitative characteristics of the EA methodologies should be evaluated before implementing the EA in the organization, otherwise the organization might fail to achieve the organizational goals, cause confusion in the business process and waste a lot of resources (Khayami, 2011). One of the

qualitative characteristics is usability, which should be evaluated in EA frameworks as a whole system.

A model for assessing the usability of enterprise architecture methodologies is proposed in (Bijarchian and Ali, 2013). This model describes the usability criteria and links these criteria to the respective elements of EA methodologies. The purpose of this study is to look deeply into those elements in EA methodologies. By considering those elements in EA methodologies, the usability of EA Methodologies would be enhanced.

■2.0 MATERIALS AND METHODS

The foundation of the usability model is based on five factors which are satisfaction, usefulness, effectiveness, safety and efficiency. Each of these factors corresponds to its semantic and is utilized in a respective layer of EA. As an example, the users in business view should be satisfied with the interaction with

system. Thus, the satisfaction factor and its criteria are placed in the business view. The users in data view should feel safe in accessing and exchanging data, and want to ensure their data are safe in the data layer. Thus, safety factor and its criteria are placed in the data view. Usefulness should be placed in application view because users' tasks are supported by using an application. The technologies that are used in enterprise architecture enable users to perform their task accurately and completely. In other words technology assists users to perform their task effectively. Thus, the effectiveness factor and its criteria are placed in technology view. The aim of the enterprise is to efficiently utilize all the resources in order to achieve an effective result. Thus, the efficiency factor and its criteria are placed in the enterprise view (Lim *et al.*, 2009; Minoli, 2008; Seffah *et al.*, 2006).

Each of these five factors has its own set of criteria that can be used to measure the usability in the respective layer of EA (Table1).

Table 1 Description of usability criteria

Criteria	Description
Time behaviour	Saving time in performing a function
Load time	How fast the system responds to the user
Resource utilization	Capability to consume appropriate amounts and types of resources
Consistency	Degree of uniformity among elements
Accuracy	Capability to provide correct results or effects
Completeness	Whether a user can complete a specified task
User guidance	Providing help and meaningful feedback on errors when they occur
Operability	Amount of effort necessary to operate the system
Flexibility	The ability to adapt to different business situations
Minimal action	Performing a task in the minimum number of steps
Interoperability	The ability to exchange and use information

■3.0 RESULTS AND DISCUSSION

Each layer of the respective usability elements and its relationship with the criteria are discussed in this section (Table 2).

3.1 Business Layer

In business layer, the usability criteria are Flexibility, Minimal action, Operability, and User guidance. According to Sessions, flexibility means the ability to adapt a system to the evolution of the business (Sessions, 2012). Thus, flexibility can be obtained if EA methodology addresses the need for adaptation to business evolution. Smirnov *et al*. (2009) argues that, based on the reuse principle, the purpose of a Reference Model is to increase productivity by reducing the number of steps taken to perform a task. Hence, the quality of the Reference Model enables users to

perform their task by taking minimum steps. In other words, the quality of a Reference Model can fulfil the minimal action criteria. Operability refers to the system design of function in which operators can perform their assigned mission easily in the system (Uwohali, 1996). For this reason, if the function of operators is defined in EA frameworks, the operability of the system would be enhanced in the business process. Regarding user guidance, EA Framework for interoperability of the system should provide guidance in order to facilitate the exchange and use of information by enterprise systems and users (Lim *et al.*, 2009). In other words, the interoperability can be enhanced throughout organization if a reference model can support users by providing guidance and meaningful feedback against errors.

Table 2 Usability elements in EA methodology

EA Layer	Factors (Seffah *et al.*, 2006)	Criteria (Seffah *et al.*, 2006)	Usability elements in EA Methodology
Business Layer	Satisfaction	Flexibility	The flexibility would be obtained if EA methodology addresses the adaptation to business evolution
		Minimal Action	The quality of the Reference Model enables users to perform their task by taking minimum steps
		Operability	If the function of operators is defined in EA methodology, the operability of the system would be enhanced in the business process
		User Guidance	The interoperability can be enhanced throughout organization if reference model can support users by providing guidance and meaningful feedback against errors.
Data Layer	Safety	Consistency, Accuracy, Completeness & Timeliness	If EA methodology addresses Consistency, Accuracy, Completeness and Timeliness, then data quality and the extent of data sharing would be enhanced
		Fault tolerance	EA methodologies can utilize IT redundancy to cope with fault tolerance
		Resource Safety	If secure structure of database is addressed in EA methodology, it can be expected more likely the data resources would be secured.
Technology Layer	Effectiveness	Flexibility & interoperability	Using standard technology package in technology layer (Network) provides scalability and interoperability and accordingly enhances flexibility on that layer
		Consistency, Accuracy & Completeness	When decoupling is supported by EA methodology, the service quality can be enhanced in order to obtain consistency, accuracy and completeness in the Technology layer.
Application Layer	Usefulness	Resource Utilization	Dealing with vendor lock-in by means of standardization would enhance resource utilization.
		Flexibility	If the EA framework supports decoupling by providing clear description, then flexibility can be obtained in application layer
		Load Time	The EA methodology should define the dependency between applications in order to enhance the load time
		Security	If Information Application security is addressed in EA methodology, then Security can be enhanced in application layer.
Enterprise View	Efficiency	Resource Utilization	Linking EA methodology with SDLC (Software Development Life Cycle) would affect resource utilization and accordingly enhance return on investment (ROI)
		Time Behaviour	Linking EA methodology with SDLC (Software Development Life Cycle) would provide better and faster service by saving time in performing function.
		Minimal Action	If EA methodology provide transitional plan, then users can perform their tasks in a minimum number of steps
		Operability	Scope Integration provides reusability of artefacts which leads to reduce the number of steps that should be taken in performing tasks.

3.2 Data Layer

The usability criteria for this layer are Consistency, Accuracy, Completeness, Timeliness, Fault tolerance and Resource safety. For measuring Information System Data Quality, Thi and Helfert (2009) propose four criteria, which are consistency, accuracy, completeness and timelines. Thus, Consistency, Accuracy, Completeness and Timeliness are used to measure data quality and the extent of data sharing. In other words, EA methodologies for Information sharing and quality should provide methods to enhance information sharing and quality. According to Velitchkov (2009), the metric for fault tolerance is IT redundancy. EA methodologies can utilize IT redundancy to cope with fault tolerance. Sessions argues that in order to protect the data, a secure configuration should be considered (Sessions, 2012). Thus, if the need for a secure structure of database is addressed in EA methodologies, then most likely the data resources would be secured.

3.3 Technology Layer

The criteria for usability in technology layer are flexibility, Interoperability, Scalability, Consistency, Accuracy, and Completeness. To enhance system interoperability, the standard should be used in technology, application and data (Minoli, 2008) Using standard technology package in technology layer (Network) provides scalability and interoperability and accordingly enhances flexibility on that layer. Thus, EA methodology should address the standard technology package. TOGAF addresses this issue in principle by employing standard business software products and packages. In addition, appropriate instructions for the IT infrastructure should ensure that the networks and hardware are scalable, stable and also address resource efficiently (Mayer, 2011).

Information and Communication Technology (ICT) base or infrastructure level gives infrastructure services to the application level, and thus provides application services to the business level and prepares the business services for its users (Lankhorst, 2004). Therefore, Technology or ICT infrastructure such as a network can fulfil IS requirement quality and enhance the service quality. IS Requirement quality can be measured from the end users'

viewpoints. Consistency, Accuracy, and Completeness are the criteria for measuring the IS requirement quality, and consequently the service quality (Thi and Helfert, 2009). When decoupling is supported by EA methodology, the service quality can be enhanced in order to obtain consistency, accuracy and completeness in the Technology layer.

3.4 Application Layer

The criteria for usability in the Application layer are Resource utilization, Flexibility, Load time, and Security. Sessions (2012) notes that the vendor lock-in system places the client in a weak bargaining situation relative to the vendor. To deal with this problem, the system must be designed according to the API standard in order to transfer and port the system to a new software platform supported by API. As such, the EA framework should support the standardization for resource utilization. Therefore, Dealing with vendor lock-in by means of standardization would enhance resource utilization.

Mayer (2011) argues that to increase flexibility and reduce costs according to business IT alignment, business and IT artefacts should be decoupled in compliance with the service orientation standard in information systems. Thus, if the EA framework supports decoupling by providing a clear description, then flexibility can be obtained in the application layer.

Dependency between system applications increases the risk of interruption of the system (Minoli, 2008). The EA methodology should define the dependency between applications in order to enhance the load time.

According to Velitchkov (2009), the metric of the security criteria is information application security. If Information Application security is addressed in EA methodology, then security can be enhanced in the application layer.

3.5 Enterprise View

The usability criteria for Enterprise View are Resource utilization, Time Behaviour and Minimal Action. The resource utilization criteria can be measured by Return on Investment (ROI) metric. In this manner, the EA methodology is linked to the System Development Life Cycle (SDLC) (Lim *et al.*, 2009). Thus, Linking EA methodologies with SDLC (Software Development Life Cycle) would affect resource utilization and accordingly enhance return on investment (ROI).

The time behaviour criteria can be measured by better and faster service metric. Therefore, Linking EA methodology with SDLC (Software Development Life Cycle) would provide better and faster service by saving time in performing function.

Adaptability of the system is valuable for stakeholders because the system can be upgraded and modified during its lifetime in order to meet the evolution of stakeholders' needs (Engel and Browning, 2008). The usability and consequently, the adaptability of the system depend on the transitional plan described in the EA methodology (Lim *et al.*, 2009). Thus, if EA methodologies can provide transitional plan, then users can perform their tasks in a minimum number of steps.

■4.0 CONCLUSION

Some critical elements of enterprise architecture that can affect the usability of EA methodologies are discussed. By considering these elements in EA methodologies, the usability of EA Methodologies would be enhanced. These elements are determined based on a conceptual study and, therefore, for empirical validation further research would be conducted to verify these usability benchmarking criteria.

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