

Technology, Organizational and Environmental (TOE) Factors Influencing Enterprise Application Integration (EAI) Implementation in Omani Government Organizations

Fatma Mohammed Al-Balushi*, Mahadi Bahari and Azizah Abdul Rahman

Department of Information Systems, University Technology Malaysia, Johor, Malaysia;
al_belushifatma@hotmail.com

Abstract

Objective: This paper presents the primary study findings about the factors that influence Enterprise Application Integration (EAI) implementation in Omani Government Organizations. The case study selected has been implementing EAI technology between three government organizations. **Method:** The case study analysis aimed to investigate the essential factors based on Technology, Organizational and Environmental (TOE) model. Also, this study employs Grounded Theory Approach (GTA) and Lewin's change model. **Findings:** As a result of this primary case study, there are 8 factors found to be influential during the implementation process. **Application:** a framework has been proposed from the findings to provide a guideline for practitioners in Omani government organizations for the newer EAI implementation projects.

Keywords: Case Study, Enterprise Application Integration (EAI), GTA, Implementation, Implementation Process, Oman, TOE

1. Introduction

Most government organizations develop various Information Systems (IS) to meet the business requirements. Unfortunately, these systems lack integration and consistency among them. For successful business operations, Information Technology (IT) has become very vital in any organization worldwide. New trends and breakthroughs in IT have introduced distinctive challenges for the global economy. As result, these dis-separate IT systems makes it very difficult for the government organizations to integrate across various government organizations. Lots of problems have been identified as result of the lack of integration, e.g. data redundancy,

inconsistency and maintenance cost¹. So, EAI provides massive benefits in terms of assisting business process integration, transforming e-services, supporting decision-making collaboration. In fact, this all mean that government organizations have a problem to keep up with the rapid changes which resulted in wastage of money, bad perception about the responsible agencies fronting the government administration and loss of trust^{2,3}.

EAI has many benefits categorized as (e.g. organizational, technical and strategic). EAI also has a motive to integrate separate different applications into one application. This unique feature of EAI allows the data and process to communicate with each other across an application^{4,5}. EAI solutions have been implemented by several

*Author for correspondence

organizations⁶. This paper aims to develop a framework of EAI implementation process for Omani government organizations.

As reported in the literature, there has been a lack of successful EAI project implementation in government cases regarding the integration of the existing IS environment. Also, the failure rate of EAI projects is about 70%⁷. So, this shows that EAI implementation is suffering due to a lack of awareness concerning the implementation process⁸. There is considerable risk faced by many implementation projects which is the lack of awareness about the most important factors during the implementation process of EAI technology⁷. Therefore, investigating the influential factors in the EAI implementation process may encourage the stakeholders and make them aware of the characteristics required for the success of technology implementation.

Therefore, this paper is attempted to explore the influential factors that contributes towards successful EAI implementation in e-Government environment in Oman. Also, this research was undertaken because some studies have recommended that future work could be made to get better understanding of EAI technological solutions in different cities, countries and sector organizations^{7,9,10}. The paper is divided as follows: the coming section presents the background knowledge about EAI implementation research; then it explains the methodology applied. Section 3 describes the major categories found from the analysis and the proposed framework for the EAI implementation process. The final section concludes the study and provides some possible future research directions.

1.1 EAI Implementation Background

In any modernize organization; IT systems are an essential requirement for its success and its continuation. Stated¹¹ that as the technology evolution continues in the world, it requires an innovations follow-up especially the changing innovations. EAI implementation¹² as the new research and its best methods applied to achieve the necessary integration. There are limited studies for EAI implementation in government organizations domain. Most of the EAI implementation studies are in Small and Medium Enterprises (SMEs), private sector and healthcare^{13,14}. Most of the existing EAI implementation models/frameworks are common. These models/frameworks implement EAI through a set of essential

factors. These common factors can be reused in different EAI models/frameworks but there are some domain specific factors which are not applicable for all. For instance, data quality is mentioned more in the eGovernment integration studies so it more of a concern for this specific domain. In addition, the factors influencing the implementation process for EAI implementation defer from an organization to another. This is obvious since the organizations are different in nature and in context of each country. Hence, the set of factors used to support EAI implementation in Small and Medium Enterprises (SMEs) differ from those applied in government organizations.

1.2 EAI Implementation Factors in Government

This paper is an extension of¹⁰ works. The 10's framework extracted the factors from EAI implementation, government, e-government integration and e-government implementation. This framework contains 30 factors which have been categorized into Technology, Organization and Environment based on TOE model. The Technology factors are technological risks, IT infrastructure, evaluation frameworks, personnel IT knowledge, IT sophistication, data security and privacy, data consistency, integration standards, distributed database and data quality. Organizational factors are centralization, return on investment (ROI), managerial capability, barriers, benefits, formalization, proper implementation planning, size, IT support, , meeting user requirements, system training, cost, commitment by management, change resistance and system champion. Environmental factors are higher administrative authority, citizen's satisfaction, critical mass, market knowledge and external support. Thus, this framework may assist the researcher in building an understanding about the factors influencing EAI implementation in Omani government organizations.

To encapsulate the implementation process, Lewin's model of change which consists of three stages e.g. unfreezing, moving and refreezing were chosen¹⁵. Consequently, the study has viewed Lewin's change model as: in the unfreezing stage, the study identifies how the stakeholders create responsiveness to the need to implement EAI and creates an accessible environment for the technology implementation. In the moving stage, the implementation of the EAI technology is investigated thoroughly and also

identified how stakeholders accommodate the technology. Whilst in the refreezing stage, the process of stabilizing and maintaining the EAI technology is identified. In view of these circumstances, this study is expected to further assists in better understanding the stakeholders' phenomenon in implementing EAI technology. Figure 1 depicts the factors through the Lewin's change model based on TOE model.

2. Method

The data collection considered various issues. First, questions were suitably designed and validated to achieve the research goal. Following¹⁶ work, the initial interview questions are developed. The interviews were undertaken as one-to-one basis. Each interview lasted about 45-60 minutes, on average. Some interviews more than the average time because each unexpected answer from the earlier interviews were included as a new question for the next interview.

This analysis thoroughly employed three coding phases e.g. the open, the axial, and the selective^{16,17}. The open coding generated concepts and categories from the data. The axial coding called paradigm modeling is used to establish relationships between categories. Selective coding subsumed all categories into core categories.

Referring to the framework of EAI implementation factors for Government¹⁰ and in vivo codes which were used by the interviewees, 8 main categories were proposed for this case study (see Table 2).

2.1 Case Study: Project B

Project B is the names used in his paper for the primary case study due to confidentiality reasons. This project is serving as Government-to-Business (G2B) example. It is integrating between GO_5 and GO_6 through Information Technology Authority (ITA) platform. Application at GO_5 is considered as one of the 10 core national systems in the Oman government¹⁸. This integration of EA started during Feb and March of 2014 via the use of web service technology. The integration is established under the umbrella of ITA through secure Oman Government Network (OGN). The web service is an application-to-application integration interface that allows other external systems to query information from GO_6 database pertaining to manpower details of Omanis' and foreigners. The web-service enables the

GO_5 staff to inquiry for details of manpower registered in the private establishments through the commercial registration (CR) number. This service renders information related to the company employees such as the total number of Omani's and Expats working, numbers of males and females, count of runaway employees, or those have court case etc. This helps to define the summary status of the employees and the Omani-expatriate ratio in various sectors.

Conversely, GO_6 employed the web service provided by GO_5 to facilitate the procedures of applying for work permit for the businesses. The GO_6 ensures and verifies the validity of commercial registration electronically and easily without having to request supporting document of commercial registration from the employers. The commercial registration details are retrieved from GO_5 database through the web service.

This is updated and stored directly in the GO_6 database to be used by the clearance system. The staff in the GO_6 clearance department uses these data to validate the work permit application submitted by the customers by checking the validity of the GO_5 commercial registration. Consequently, it grants the foreign workers to start their business. GO_5 Web Service XML provides message over internet connection protocol (http). The application operates through Maven 3, which is a standard Java tool and supports the Web Service technology to send and receive RPC based envelops. The data exchanged between the application of GO_5 and GO_6 is in Web Services SOAP XML message format.

The stakeholders of this project are interviewed face-to-face and their details are enlisted in Table 1. These stakeholders are chosen due to their rich experience in the EAI implementation process. In addition, it provided a clear understanding about the EAI implementation process.

3. Results and Discussion

3.1 Proposed Categories of EAI Implementation Process

To develop EAI framework the following categories were emerged from the analysis of the data collected. These categories present the most essential factors for the EAI implementation process for Omani government organizations (Table 2).

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3.2 Proposed Framework of EAI Implementation Process for Project B

Upon the main categories emerged from the analysis, the EAI implementation framework is proposed. The developed framework consists of the main EAI implementation factors identified in Omani government organizations for Project B (Figure 1).

Figure 2 shows the vital factor for the EAI implementation process for Project B. There are some factors which found to be important during the full implementation cycle. For instance, data quality is important for all three phases from the Technological factors. Management support, implementation planning, staff training, requirements management, staff training and project team are vital in all phases from the Organizational factors.

On the other hand, some factors found to be considered only at one phase of the implementation process. For example, the centralization is essential only at the Unfreezing phase. While, citizen's satisfaction is very crucial at the Refreezing phase of the implementation.

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4. Conclusion

The primary case study confirmed 8 important factors which need to be undertaken during EAI implementation in Omani Government Organizations. This is an on-going research and the experience gained during the primary study made the researcher more confident to asking the stakeholders the appropriate questions. In addition, the open-ended approach applied in this study helped to further comprehend the existing issues being discussed. More inner meaning about the EAI implementation phenomenon has been gained by rephrasing and restructuring the interview questions based on the points highlighted from the early interviews.

There are some factors tend to be not influential for Project B which were proposed on¹⁰ framework. So, from the 30 factors proposed only 8 found to be essential for EAI implementation for this primary study.

The proposed framework provides insight for additional studies in the EAI implementation subject, and it is expected that other researchers will reach similar paths of enquiry to further investigate this new and interesting area of study. It is recommended that this framework could be tested on other contexts and EAI projects in government domain for more verification.

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