

THE PROPOSED ALIGNMENT FRAMEWORK IN ENTERPRISE
ARCHITECTURE DEVELOPMENT FOR THE OMANI PUBLIC SECTOR

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Dedicated to:

My wife and my children who have been the source of my enthusiasm and patience

My father and mother who injected in me the desire of learning

My brothers and sisters

Thank you for your prayers and support

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In the name of Allah, The Most Gracious, The Most Compassionate. Thanks be to Allah for easing and reconciling my PhD journey.

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ABSTRACT

The misalignment between Enterprise Architecture (EA) development and stakeholders' goals plays a vital role in the low acceptance of EA in organizations and governments. Literature has highlighted the need for an alignment framework to support enterprise architects to align the development process of EA with the stakeholders' goals. Hence, this research developed an alignment framework to align the EA development process with the stakeholders to produce an agreed architecture that supports the architects. Multiple Perspectives Theory (MPT) was used to develop a preliminary research model that provided the initial guidance in data collection and analysis. The research employed a qualitative case study approach to build an in-depth understanding of EA development process, enterprise architects and stakeholders' roles, as well as the factors influencing the alignment between them. The Government Architecture Framework (GAF) of the Omani public sector was used as the case study that included GAF documentation review, and interviews with architects and stakeholders who participated in the development of GAF. The findings showed that twelve alignment factors influenced the development of GAF which are standardization, development scope, principles, governance, top management support, culture, commitment, awareness, communication, value of EA, change management capability and experience. These factors were used as the base to develop the alignment framework followed by a focus group session with GAF architects was organized to validate the final framework. As a conclusion, the study has shown that the alignment framework provides a comprehensive understanding for practitioners and academicians about the factors and their influences at each EA development step.

ABSTRAK

Pelaksanaan ketidakselarasan antara matlamat pembangunan Senibina Perusahaan (EA) dan pemegang taruh memainkan peranan penting dalam memanfaatkan sepenuhnya EA dalam organisasi dan kerajaan. Kajian literatur telah menekankan tentang perlunya rangka kerja penyelarasan untuk menyokong arkitek senibina bagi menyelaraskan proses pembangunan EA dengan matlamat pemegang taruh. Oleh itu, kajian ini telah membangunkan rangka kerja penjajaran untuk menyelaraskan proses pembangunan EA dengan pihak pemegang taruh dalam menghasilkan seni bina yang menyokong para arkitek. Teori Pelbagai Perspektif (MPT) digunakan untuk membangunkan model kajian asas yang menyediakan panduan awal dalam pengumpulan dan menganalisis data. Kajian ini menggunakan pendekatan kajian kes kualitatif untuk membina pemahaman dengan lebih mendalam mengenai proses pembangunan EA, peranan arkitek senibina dan pihak pemegang taruh serta faktor-faktor yang mempengaruhi penjajaran antara mereka. Rangka Kerja Seni bina Kerajaan (GAF) dari sektor awam Oman digunakan sebagai kajian kes yang merangkumi kajian dokumentasi GAF dan temubual dengan arkitek serta pemegang taruh yang turut serta dalam pembangunan GAF. Dapatan kajian menunjukkan bahawa dua belas faktor penyesuaian mempengaruhi pembangunan GAF yang merupakan standardisasi, skop pembangunan, prinsip, tadbir urus, sokongan pengurusan teratas, budaya, komitmen, kesedaran, komunikasi, nilai EA, perubahan keupayaan dan pengalaman pengurusan. Faktor ini digunakan sebagai asas untuk membangunkan kerangka penjajaran diikuti dengan sesi kumpulan fokus dengan arkitek GAF dianjurkan untuk mengesahkan kerangka akhir. Sebagai kesimpulan, kajian ini menunjukkan bahawa rangka penjajaran menyediakan pemahaman yang komprehensif untuk pengamal dan ahli akademik tentang faktor dan pengaruh mereka pada setiap langkah pembangunan EA.

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LIST OF ABBREVIATIONS

ARA	-	Application Reference Architecture
ADM	-	Architecture Development Management
BITA	-	Business Information Technology Alignment
BRA	-	Business Reference Architecture
CEO	-	Chief Executive Officer
CIO	-	Chief Information Officer
DC	-	Doctoral Consortium
DoDAF	-	Department of Defense Architecture Framework
EA	-	Enterprise Architecture
FEAF	-	Federal Enterprise Architecture Framework
GAF	-	Government Architecture Framework
GERAM	-	Generalized Enterprise Reference Architecture & Methodology
GT	-	Grounded Theory
ICT	-	Information and Communications Technology
IM&T	-	Information Management and Technology
IT	-	Information Technology
IRA	-	Information Reference Architecture
IS	-	Information Systems
MPT	-	Multiple Perspectives Theory
NCSI	-	National Centre of Statistics & Information
PACIS	-	Pacific Asia Conference on Information Systems
PDO	-	Petroleum Development Oman
RQ	-	Research Question
SAM	-	Strategic Alignment Model
SLR	-	Systematic Literature Review
SOA	-	Service Oriented Architecture
TOGAF	-	The Open Group Architecture Framework

TRA	-	Technology Reference Architecture
UTM	-	Universiti Teknologi Malaysia

CHAPTER 1

INTRODUCTION OF THE RESEARCH

1.1 Overview

The research investigates the challenge of alignment during the development process of Enterprise Architecture (EA) between the enterprise architects and the stakeholders in the public sector. This chapter introduces the research by a background about EA, definition of EA, definition of the enterprise architects and the stakeholder. Then, it discusses the gap addressed by the research and it defines the context of alignment in the research. Furthermore, it explains the research objectives and the research motivation from both academic and practice perspectives. Moreover, it conveys the significance of the study from three dimensions theoretical, methodological and practical. Finally, it describes the outline of thesis chapters and it summarizes the chapter's key messages.

1.2 Background

The dynamic environment and the increasing complexity of business processes cause challenges for the organizations to see the holistic view of their business. Moreover, the high turnover of IT solutions and the increased reliance of business on IT created a challenge to align business strategy with IT investment (Ask & Hedström, 2011; Birkmeier *et al.*, 2013). Based on a survey conducted by Gartner

among EA practitioners in 2012, it reported that EA practitioners are influencing \$1.1 trillion of enterprise IT spending globally (Gartner, 2014).

According to a survey conducted in 2010 by Society for Information Management among 172 organizations in USA, Business IT Alignment (BITA) ranked as one of the top five key issues facing IT executives (Luftman & Ben-Zvi, 2010). Hence, Enterprise Architecture (EA) is suggested as an approach to improve BITA (Iyamu & Mphahlele, 2014), manage organizational complexity (Korhonen & Halén, 2017), and support digital transformation (Tamm *et al.*, 2015). Korhonen & Halén (2017) explained that EA gained the attention of academics and practitioners in the recent years as a facilitator for BITA and improving organization agility. The improvement in BITA is expected to be achieved through architecting of the business processes, the information flow needed or resulting from these processes, the required applications to execute the business processes and the required IT infrastructure to run the applications and data (Alaeddini & Salekfard, 2013). These architectures are governed through a set of roles and authority to guide the decision making process that addresses various stakeholders' needs (Espinosa, Boh, & DeLone, 2011). Despite EA proposed to improve BITA, there are challenges within EA that hinder to realize this improvement which are further discussed in Section 1.5.1.

Lankhorst defined EA, as “*a coherent whole of principles, methods and models that are used in the design and realization of an enterprise's organizational structure, business processes, information systems, and infrastructure*” (Penttinen & Isomäki, 2010, p. 1), refer to Figure 1.1. EA as concept officially born in 1987 when John Zachman had applied architecture holistic planning concepts relying on his observations in airline industry and construction of buildings to publish Information Systems Architecture (Lux, Riempp, & Urbach, 2010). Later, it was improved and renamed to the Zachman architecture framework (Zachman, 1996). Zachman framework provides categorization on how to relate IT with business by representing different views for the organization (Santos, Santoro, & Cappelli, 2014). Influenced by Zachman framework, other frameworks were introduced later, examples Department of Defense framework (DoDAF), Federal Enterprise Architecture

framework (FEAF) and The Open Group Framework (TOGAF) (Bourey & Medini, 2012). These frameworks are used as a guide to develop EA for a particular organization but difficult to be applied for wide government EA. Hence, many governments customized the industrial frameworks to build their own EA e.g. AlSoufi & Ahmed (2012).

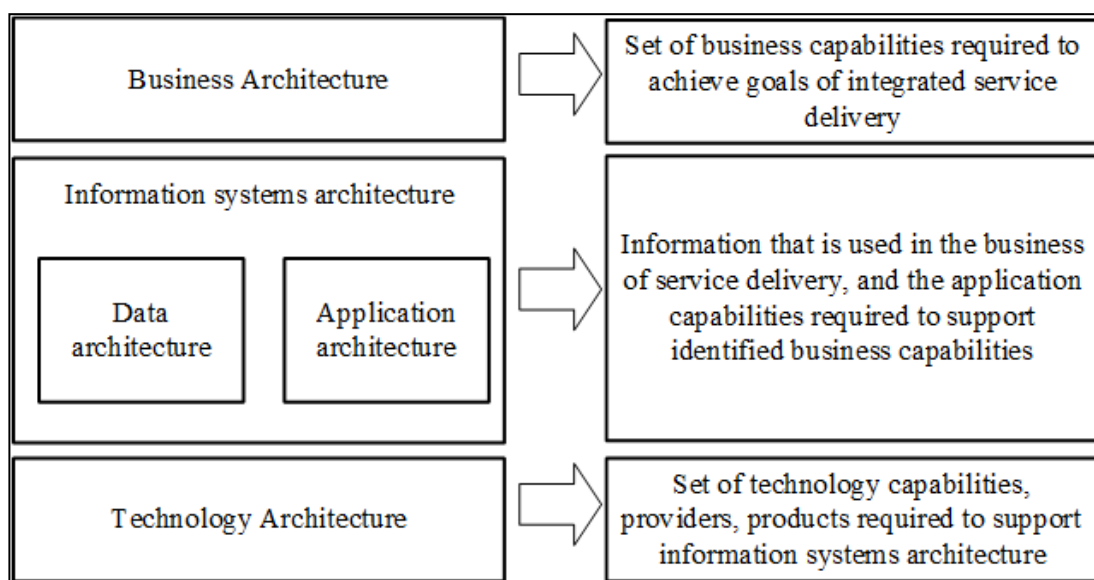


Figure 1.1: Enterprise architecture layers and definitions (extracted from AlSoufi & Ahmed, 2012, p.155)

Literature has discussed the existence of challenges facing the development of EA. These challenges include value demonstration challenges (Zijl & Belle, 2014), stakeholders management challenges (Nakakawa *et al.*, 2013), organizational challenges (Iyamu & Mphahlele, 2014) and technical challenges (Buckl *et al.*, 2011). Additionally, literature explained that the involvement and the fulfillment of stakeholder needs impacts the activities and the acceptance of EA (Fallmyr & Bygstad, 2014; Farwick *et al.*, 2014). The enterprise architects are responsible of collecting information about the enterprise in terms of business processes, the used applications & data and IT infrastructure (Buckl, Matthes, & Schweda, 2010a). They evolve the EA through a set of models and play the role of managing, communicating, leading and modeling (Clark *et al.*, 2014; Gotze, 2013). The Open Group define EA stakeholder as “*an individual, team, or organization (or classes thereof) with interests in, or concerns relative to, the outcome of the architecture*” (Azevedo *et al.*, 2011, p. 29). Although enterprise architects are part of EA

stakeholders but called as enterprise architects to differentiate their role of leading and managing the development process.

The concept of alignment has been discussed in the context of IS and normally refers to Business-IT Alignment whether in enterprise operational level or strategic level (Rouhani *et al.*, 2015). Luftman, Papp, and Brier (1999, p. 3) defined BITA as “*applying IT in an appropriate and timely way, in harmony with business strategies, goals and needs*”. Literature explained that the involvement and the fulfillment of stakeholder needs are the cornerstone for the success and the acceptance of EA (Buckl *et al.*, 2011; Fallmyr & Bygstad, 2014; Farwick *et al.*, 2014). In the context of this study, the alignment scope covers the enterprise architects and the stakeholders to agree on the final developed architecture. Hence, the study defines alignment as develop EA models in an appropriate and timely way in harmony with stakeholders concerns and goals.

Linstone (1989) explained that the enterprise comprises from a socio-technical system that means framed by technical and social characteristics. EA is developed within this socio-technical system which is impacted by social and technical factors as discussed by many scholars e.g. Aier and Schelp (2010) and Bernus, Noran, & Molina (2015). Hence, it is essential to empirically identify these factors that influence the alignment between the enterprise architect and the stakeholders in EA development process. Thus, the study is aiming to explore the factors influencing the alignment between the two parties (enterprise architects and stakeholders) to create an in-depth understanding to develop alignment framework that supports the EA practitioners in the development process of EA.

1.3 Research Problem

Despite the interest of organizations to adopt the concept of EA, it is facing challenges to demonstrate organizational value or effective execution. Rotterdam University conducted a survey in 2008 that shows 66% failure of EA initiatives (Gosselt, 2012). In 2009, Gartner identified top 10 EA pitfalls among them wrong

selection of architect leader, lack of stakeholders understanding, enterprise architects group does most of the architecting without agreement on the architecture content (Gosselt, 2012). The enterprise architects are confronted with difficulties while involving the stakeholders to develop EA. The alignment between the enterprise architects perspective (driven by EA development process) and the stakeholders perspective (driven by needs and concerns) is one of the common difficulties in EA development because both the architects and stakeholders should have a shared understanding of the organization problem and the required solution to overcome it (Nakakawa, Proper, & Bommel, 2011). Banaeianjahromi & Smolander (2016) studied empirically the obstacles facing EA development among them; EA literature rarely addresses the issues related to enterprise architects.

The current EA frameworks lack models to support the enterprise architects to align the EA development process with the stakeholders needs (Nakakawa *et al.*, 2011). Du Preez, van der Merwe, and Matthee (2014) and Gartner (2014) discussed the important role of involving the stakeholders and addressing their concerns in the effective execution and success of EA. However, the enterprise architects are facing challenges to align the development process of EA with the stakeholders' needs that result in low utilization or no acceptance of EA (Buckl *et al.*, 2010b; Fallmyr & Bygstad, 2014; Iyamu & Mphahlele, 2014).

There is scarcity of studies that build an in-depth understanding of the alignment between the enterprise architects and the stakeholders during the development process of EA and the factors shaping this alignment (Bakhshandeh *et al.*, 2013; Du Preez *et al.*, 2014). Since the enterprise architects and stakeholders are the main actors in EA development, Buckl *et al.* (2010b) pointed out the need for a framework that guides the alignment between the enterprise architects and the stakeholders during the development process. Such framework is expected to support the enterprise architects in the EA development process by uncovering the factors influencing the alignment between the enterprise architects and the stakeholders during the development process and provide a set of recommendations to address each factor.

The development of EA for the wide government is challenging because the current popular EA frameworks e.g. TOGAF & Zackman are mostly used to develop EA for a specific organization (Langermeier *et al.* 2015). Thus, the governments worldwide tend to tailor the existing EA frameworks and IT standards to develop their own specific framework. Despite the rapid expansion of EA in public sector, the academic studies did not give enough attention towards EA in public sector (Bakar & Selamat, 2016). The government of Oman via the IT regulatory body sponsored and developed Government Architecture Framework (GAF) in 2010 to improve the integration between government entities and ease access services for the citizens (ITA, 2010). However, similar to other EA initiatives, the developed architecture framework was rarely utilized by the government entities. As highlighted earlier by practitioners and scholars, one of the reasons for the low utilization can be rooted to the misalignment between the development process with the stakeholders needs.

Hence, the research investigated the EA development alignment phenomenon in the public sector by selecting the Omani GAF as a case study. The researcher considered the context uniqueness of the public sector as many governments customize their own EA development process by understanding the development process of GAF and the roles of the enterprise architects and the stakeholders.

In particular, the research attempted to answer the question: ***How could the enterprise architects align the development process of EA with the stakeholders' goals in the public sector of Oman?*** To answer this main question, four sub-questions were created as following:

- *RQ 1: What is the development process of EA in the public sector?*
- *RQ 2: What are the roles of stakeholders and enterprise architects in the development process of EA in the public sector?*
- *RQ 3: What are the factors influencing the alignment between the enterprise architects and the stakeholders in the development process of EA in the public sector? How these factors are interrelated with the development process and the roles of stakeholders and enterprise architects?*

- *RQ 4: What framework can be used to support the alignment between enterprise architects and the stakeholders in the development process of EA in the public sector?*

To address the research questions, the researcher investigated the development process of GAF and explored the roles of the stakeholders and enterprise architects in the development process to have in-depth understanding of its settings. The researcher used project documentation and conducted interviews with the main actors of the GAF to understand and conclude the factors that influenced the alignment between the enterprise architects and the stakeholders during the development process of GAF. Furthermore, the researcher investigated the interrelationship between the alignment factors with the development process and the roles of the enterprise architects and the stakeholders.

1.4 Research Objectives

Based on the discussion of the research questions in section 1.3, the main research objective is: ***To support the enterprise architects to align the development process of EA with the stakeholders goals in the public sector of Oman.*** This objective is achieved by accomplishing four supporting objectives as follow:

- *Objective 1: To understand the development process of EA in the public sector*
- *Objective 2: To explore the stakeholders' and enterprise architects' roles in the development process of EA in the public sector*
- *Objective 3: To identify the factors influencing the alignment between the enterprise architects and the stakeholders in the development process of EA in the public sector. To explain the interrelationship between the factors and the development process as well as the roles of the architects and the stakeholders.*
- *Objective 4: To propose and validate the alignment framework for the development process of EA in the public sector*

1.5 Motivation of the Research

This section explains the motivating drivers to conduct this research based on trends from practice, academic, context and researcher's background.

1.5.1 Practice and Academic

Based on Gartner predictions, 40% of EA programs would be terminated by 2012 (Gosselt, 2012). Furthermore, Gartner pointed out the top 10 EA pitfalls that hinder the effectiveness of EA initiatives among them; wrong selection of architect leader, insufficient stakeholder awareness, not engage business and enterprise architects group does most of the architecting without agreement on the architecture content (Gosselt, 2012). Section 1.3 stressed on the importance role of stakeholders in the acceptance of EA. Also, it showed the scarcity of academic studies that address the alignment between the enterprise architects and the stakeholders. Thus, this study is driven by the limited academic studies that investigate the alignment between enterprise architects and stakeholders in the development process of EA. This alignment is considered as a corner stone for EA success (van der Raadt *et al.*, 2010). It is also supported by the practitioners' who explained the importance of stakeholders in the effective EA development and execution. The development of EA is costly in terms of finance and time to acquire or develop architecture skills internally and consume resources in the development and implementation. So it is expected that the research findings will contribute towards the effective execution of EA program and consequently realizing organizational value out of it.

1.5.2 Candidate's Background

In the context of Oman, the government developed GAF to guide the government entities in the digital transformation through a coordinated and integrated manner. Despite the development of GAF, the usage of GAF by the

government entities is less than expected. As discussed by literature and practitioners, the misalignment between the architects' team and the stakeholders in the development of EA is one of the main pitfalls. The GAF sponsor and participants showed interest to participate in the research. Thus, the researcher studied the GAF development approach and the alignment factors influenced each development step whether a positive or a negative influence.

The researcher is TOGAF 9 certified and prior the study worked as Information Management and Technology (IM&T) Consultant under IM&T Business Alignment department at Petroleum Development Oman (PDO). As explained earlier, one of the main drivers to adopt EA is to improve business IT alignment. Taking this into consideration and the researcher professional background, the field of the study was highly related to the researcher's expertise.

1.6 Research Contribution

The findings of the study are expected to contribute at three different dimensions; theoretical contribution, methodological contribution and practical contribution as follow:

Theoretical contribution

The theoretical contributions of the research is two folds; academic body of knowledge contribution and theory contribution. As discussed in the previous sections that the alignment of EA stakeholders and enterprise architects during the development process of EA did not get enough attention from academic scholars. Hence, this research is contributing to the body of knowledge through addressing this gap by building an understanding on roles of enterprise architects and stakeholders, the EA development process that took place in the selected case study and the development of the alignment framework. EA is still an area, which is not explored by Omani academic researchers despite the growing interest in three leading Omani organizations. Hence, this research is creating a foundation for future academic studies in the area of EA in Oman.

Despite the emphasis of the top IS journals that IS researchers need to ground their work on theories, IS literatures are still under-theorized (Lim *et al.*, 2009). Similarly, Winter, Legner, and Fischbach (2014) and Närman *et al.* (2012) explained the limited utilization of theories in EA studies. Thus, the research contributes towards IS field by utilizing Multiple Perspective Theory (MPT) that provided initial guidance in the data collection and analysis phases.

Methodological contribution

The research employed case study as a research approach to address the research questions. It provided detailed guidelines to apply them for data collection, analysis and trustworthiness in the case study approach. Furthermore, the developed alignment framework can be used as a base for future studies that tackle similar or close research problem.

Practical contribution

The findings of this research are expected to contribute to the EA practitioners by building a comprehensive overview of EA literature (drivers, challenges, benefits and stakeholders). Furthermore, the research is proposing a framework for the alignment between enterprise architects and the stakeholders, which can be used as guidance to support EA practitioners (enterprise architects) to align the EA development process with the stakeholders' goals in the public sector. Additionally, it details the EA development process used by the GAF which contributes towards enhancing the understanding of EA development process in the public sector and can be used as basis to create awareness of EA development process for other governments worldwide which are planning to start similar initiative.

1.7 Outline of Thesis Chapters

This section provides an overview on the rest of thesis chapters. It explains the key points covered by each chapter.

Chapter 2 builds an overview about EA in terms of definition, drivers, benefits, development, EA in public sector and key challenges facing EA. Then, it

sheds the light on the stakeholders in IS and EA context. Furthermore, it highlights the alignment concept both in IS and EA context. It discusses the findings from the studies related to the research problem and the relevant potential theories. Finally, it describes the initial theoretical model and its main components.

Chapter 3 describes the research methodology used in the research. It gives an overview on the research paradigm, qualitative research approaches, research strategy, qualitative data collection instruments and qualitative data analysis. Since the research is using case study approach, it highlights the case study design in terms of case selection, participants, case study protocol, data analysis tool and procedures and research trustworthiness. Moreover, it explains the research operational framework.

Chapter 4 discusses the preliminary study which was conducted to verify the suitability of the case to address the research questions, validate the initial case study protocol and obtain the initial insights about the case. It explains the case description, initial case design and the preliminary findings.

Chapter 5 details the case study findings. It describes the analysis of the collected data. Also, it discusses the GAF development process, roles of the enterprise architects and the stakeholders and the obtained alignment factors.

Chapter 6 describes the development of the alignment framework and its main components. It discusses the interrelationship between GAF development process and the alignment factors. Additionally, it highlights the potential interrelationship between the alignment factors. The validation of the alignment factors and their influence are discussed in this chapter. Also, it shows the considered actions during the research to ensure the research trustworthiness.

Chapter 7 presents a summary of the research findings. It explains the research contribution from theoretical, methodological and practical perspectives. It points out the research limitations and the recommendations for the future studies.

1.8 Summary

The chapter has provided an overview of the research background, research problem, research objectives, motivations and contributions. Despite the importance of aligning EA development process with the stakeholders' needs, there is scarcity of academic studies that build a comprehensive view on the factors influencing the alignment between the enterprise architects and the stakeholders in the development process of EA. The researcher employed a qualitative single case study approach to answer the research questions using GAF project in the public sector of Oman.

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