AN INTEGRATED SERVICE ARCHITECTURE FRAMEWORK FOR INFORMATION TECHNOLOGY SERVICE MANAGEMENT AND ENTERPRISE ARCHITECTURE

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Dedicated to:

My devoted and supportive wife,
Dr Zahra Jalalipour
And my beloved children,
Mohammad Mahdi and Alireza

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ABSTRACT

Today, IT service providers are faced with the demands and challenges in implementation of different IT frameworks/standards in the same organization, which are intended to align business and IT investments to provide IT governance. This requirement has gained more attention in IT Service Management (ITSM), Enterprise Architecture (EA), Service Oriented Architecture (SOA) and Services Computing (SC) due to embracing the service oriented concepts. There are some evidences and motivations on integration of IT Service Management (ITSM) and Enterprise Architecture (EA) in academia and industry. Very few efforts have been done to define a relationship between ITSM and EA based on ITIL V2. The ITIL V3 and its new 2011 edition, offered an IT service lifecycle recommending on using EA in ITSM. The efforts for development of Service Oriented EA (SOEA) also support the idea of integration. This research has developed a research roadmap to propose a service based framework for this integration. The integration of ITIL V3 and EA has been launched by identification of Service Architecture Requirements (SARs) to develop a model for service architecture supporting ITSM. The research adapted case study strategy, design science research and Delphi expert panel survey. Exploration of five case studies in Iran and Malaysia investigated service architecture requirements of ITSM/ITIL and Success Criteria in Integration (SCI) of ITSM/ITIL and EA. Then, the proposed framework was established on common goals and architectures of EA and ITSM frameworks such as IT and business alignment, information sharing, application architecture, data architecture and technology architecture. Service architecture model was designed based on service architecture requirements. Subsequently, a service-based solution referred as Integrated Service Architecture Framework (ISAF), has been developed to resolve the research problem. Twenty experts were nominated using snowball sampling to participate in Delphi study. The proposed framework has been refined and matured through a three round Delphi process. This process also has ensured that the refined framework is capable of satisfying different aspects of the integration surrounding service architecture model.

ABSTRAK

Kini pembekal perkhidmatan teknologi maklumat (IT) berdepan dengan permintaan dan cabaran dalam melaksanakan pelbagai rangka kerja/piawaian di sesebuah organisasi untuk menjajarkan pelaburan perniagaan dan IT serta menyediakan pentadbiran pengurusan IT. Keperluan ini mendapat lebih perhatian dalam Pengurusan Perkhidmatan IT (PPIT/ITSM), Seni Bina Enterprais (SBE/EA), Seni Bina Berorientasikan Perkhidmatan (SBBP/SOA) dan Komputeran Perkhidmatan (KP/SC) disebabkan oleh penggunaan konsep berasaskan perkhidmatan. Terdapat beberapa bukti dan motivasi terhadap integrasi ITSM dan EA dalam bidang akedemik dan industri. Hanya segelintir kajian telah dilaksanakan untuk mendefinasikan kaitan antara ITSM dan EA berdasarkan ITIL V2. Manakala ITTL V3 dan edisi terbaru tahun 2011 menawarkan kitaran hayat perkhidmatan IT serta mengesyorkan penggunaan EA dalam ITSM. Kajian untuk pembangunan Seni Bina Enterprais Berorientasikan Perkhidmatan (SBEBP/SOEA) juga menyokong idea integrasi. Kajian ini telah mewujudkan sebuah pelan tindakan penyelidikan untuk menawarkan rangka kerja berasaskan perkhidmatan untuk integrasi ini. Integrasi ITIL V3 dan EA telah dilancarkan dengan pengenalan kepada Keperluan Seni Bina Perkhidmatan (KSBP/SARs) untuk membangunkan sesebuah model untuk seni bina perkhidmatan yang menyokong ITSM. Kajian ini disesuaikan dengan strategi kajian kes, penyelidikan reka bentuk sains dan kaji selidik *Delphi* panel pakar. Penerokaan lima kajian kes di Iran dan Malaysia menyiasat keperluan seni bina perkhidmatan untuk ITSM/ITIL dan Kriteria Kejayaan Dalam Integrasi (KKDI/SCI) bagi ITSM/ITIL dan EA. Rangka kerja yang dicadangkan diwujudkan matlamat berasaskan dan seni bina yang sama untuk rangka kerja EA dan ITSM, seperti penjajaran IT dan perniagaan, perkongsian berdasrkan maklumat, seni bina aplikasi, seni bina data dan seni bina teknologi. Model seni bina perkhidmatan telah direka berdasarkan keperluan seni bina perkhidmatan. Seterusnya penyelesaian berdasarkan perkhidmatan yang dirujuk sebagai *Integrated Service Architecture Framework (ISAF)*, telah dibangunkan untuk menyelesaikan masalah penyelidikan yang berkaitan. Dua puluh orang pakar telah dikenalpasti menggunakan persampelan *Snowball* untuk menyertai kajian *Delphi*. Rangka kerja yang diutarakan telah ditapis melaluai tiga kitaran proses *Delphi*. Proses ini juga memastikan rangka kerja yang ditapis memenuhi beberapa aspek berbeza dalam integrasi sekitar model seni bina perkhidmatan.

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LIST OF ABBREVIATIONS

CMDB	-	Configuration Management Database
CS-A	-	Case Study A
CS-B	-	Case Study B
CS-C	-	Case Study C
CS-D	-	Case Study D
CS-E	-	Case Study E
EA	-	Enterprise Architecture
ISAF	-	Integrated Service Architecture Framework
ITIL	-	IT Infrastructure Library
ITSM	-	IT Service Management
itSMF	-	IT Service Management Forum
OGC	-	Office of Government Commerce
SAR	-	Service Architecture Requirement
SCI	-	Success Criteria in Integration
SD	-	Service Design
SLA	-	Service Level Agreement
SLM	-	Service Level Management
SLR	-	Service Level Requirement
SOA	-	Service Oriented Architecture

SOE	-	Service Oriented Enterprise
SOI	-	Service Oriented Infrastructure
TOGAF	-	The Open Group Architecture Framework
MOF	-	Microsoft Operations Framework

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In this chapter, an introduction to thesis is provided. First of all, the background of the problem is described. After that, the problem statement, research questions, research objectives, scope, and importance of the study are described respectively.

1.2 Background of the Problem

Considering the fact that service innovations are intensively associated with innovations, adoption and diffusion of ICT, there is a rich context for IS and Management researchers on service design, service development, service delivery, service management from social, managerial, technical, and organizational perspectives. Business services are currently dependent on IT services which have provided the organizations with tools and process of change for the last decades (Galup *et al.*, 2009). IT service management (ITSM) was established based on modern international standards such as ISO/IEC 20000 and ITIL. In this area, there is

a need for carrying out a research to investigate the social and economic outcomes of ITSM as it relates to globalization of IT services (Galup *et al.*, 2007). ITIL is an important and influential centre of gravity in IT Service management (Betz, 2007). Although ITIL V2 has been applied over the last ten years, its concern has been more on Service Delivery and Service Support. It has been realized that there is gap with respect to the strategy and design of service in this version (Baioco *et al.*, 2009). Therefore, in 2007, OGC released ITIL V3 to cover the whole lifecycle of service including: Service strategy, Service Design, Service Transition, Service operation and Continual Service Improvement (Bardhan *et al.*, 2010). In this version, each stage is supported by a publication, with which general guidelines on IT Service Management are provided. However, it is necessary that the volumes be customized and tailored in order to be used in practice (Lahtela *et al.*, 2010).

Implementing the Service Design (SD) stage of ITIL V3 known as the second phase of service lifecycle requires that the service provider consider different aspects of service design including service solutions and technology architectures (OGC-V3-SD, 2007). Besides, ensuring the consistency and integration of all IT activities and processes, entails that a holistic approach should be adopted in service design (Bardhan *et al.*, 2010; OGC-V3-SS, 2007). In fact, in order to have an effective and efficient design of any service product, a service architecture should be developed, with which all pieces of information related to service including application, information, data and infrastructures for any IT service are integrated (Zhao *et al.*, 2009).

Primarily, Enterprise Architecture (EA) has been introduced in the domain of business and IT/IS planning, and is generally modelled as a four layer architecture, namely, business architecture, data/information architecture, application architecture and infrastructure architecture (NIST, 2010; Nurcan and Schmidt, 2009). Recently, researchers and practitioners have attempted to incorporate service concepts in EA planning (Aier *et al.*, 2009; Haki and Forte, 2010). As can be seen, ITIL needs this special architecture for design of IT services. However there is no specific solution for service architecture in EA frameworks. In other words, there is a gap on how to use EA in ITIL due to the current EA frameworks' not being capable of supporting

the service architecture. There has been also motivation on integration of these two frameworks (i.e. ITIL and EA) with regard to their importance and common aspects urging the efforts for integration of ITSM and EA.

The trend of service-oriented EA is also considered at foundation stage appealing for the integration of EA and SOA (Chen *et al.*, 2009). In fact, although the core of an EA is capable of defining the architectural models of an enterprise to meet requirements of future changes in an efficient and planned manner, SOA also represents the potentiality to complement and improve EA from various perspectives (Kistasamy *et al.*, 2010). One of the main ideas of SOA is to bridge the gap between the business layer and the application layer. Bridging the gap is implied as facilitating the implementation of processes with IT as the reuse of the services is fostered. Therefore, Considering the influence of SOA on the business process, service and application layer , its integration into the ongoing EA will be beneficial to all business units of the target organization (R. Meersman, 2008).

Recently, many academic and practical disciplines have been initiated on service. Among them, service science (Bardhan *et al.*, 2010), service management (Gu and Lago, 2009), service engineering (Demirkan *et al.*, 2008) and service computing (Spohrer *et al.*, 2008b) can be mentioned. Each domain conceptualizes the service concept based on its needs and application. Thus, different definitions and applications of service confuse the researchers and practitioners (Schmidt, 2010). For instance, in Service Oriented Architecture (SOA) and IT Service Management (ITSM), the ‘service’ has different scopes. In fact, in SOA discipline, services support the application development, while in ITSM discipline, services cover all types of IT services from infrastructure services to information system services. So, there is a call to conduct research and publish works on service oriented disciplines (Demirkan *et al.*, 2008). One of the major challenges and issues of service sciences and industries that should be taken up by the researchers is the integration of technological and managerial research in a service oriented view. The encouragement is to conduct computer science, information system (IS) and management researchers for development of multi disciplinary research to address the integration issue (Gu and Lago, 2009; Qing and Patricia, 2009). In addition,

various research paradigms and methods are recommended to investigate managerial challenges and technical problems in service-oriented systems (Qing and Patricia, 2009). Furthermore, quantitative, qualitative and mixed approaches and various research strategies including experiment methods, case and field studies, and design science approaches are allowed to be applied (Bardhan *et al.*, 2010; Demirkan *et al.*, 2008). As a suggestion, 'service' should be considered as a centre point for Service Oriented Architecture, IT Service Management and Enterprise Architecture; however it should be reconceptualised and turned into a service-oriented integrated framework covering the frameworks and standards including EA, ITSM and SOA.

1.3 Statement of the Problem

My personal experience, observation and field notes in delivery of IS/IT projects within various scales of organizations in more than one decade raised the question why in the process of IS/IT service delivery in planning and maintenance activities, customers encounter lack of quality and integration in IT/IS. Considering this point, it has been recognised that Enterprise architecture planning is able to provide a governance framework for improvement of qualified IT/IS planning, and IT service management solution is capable of ensuring the quality of support activities in IT/IS services delivery for the host organizations. Therefore, the idea of integration has been raised. Having reviewed the literature, it is found that there is a gap in realization of integration of ITSM and EA. Yet, the efforts already made in practical and academic domains in defining the relation between ITSM and EA are all focused on ITIL V2. Main changes of ITIL V3 including briefing on service lifecycle and suggestion for architectural design of service have motivated the researcher to explore and develop this idea, which is likely to ensure service customers on quality of IT/IS delivery in planning and maintenance activities. It will also help service providers on how they can implement both ITSM and EA.

1.4 Research Questions

Based on background of research and the research statement, the following questions are raised for the problem:

RQ1: "How to fulfil architectural requirements of IT services in ITSM/ITIL using Enterprise Architecture (EA) in order to meet IT service objectives?"

1) What are common issues and goals in ITSM/ITIL and EA?
2) What are the architectural requirements of services in ITSM/ITIL?
3) How EA contributes in ITSM to fulfill architectural requirements of IT/IS services?
4) What are the existing efforts on the relationship of ITSM/ITIL and EA?

RQ2: "How to integrate ITSM/ITIL and EA through development of a service architecture model and a service based framework in order to meet the architectural requirements of IT services?"

1) What are the success criteria in integration of ITSM/ITIL and EA?
2) How to design service architecture model for ITSM and EA?
3) How to develop an integrated service based framework to support architectures of IT services?

1.5 Objectives of the Study

This research aims to develop an integrated framework to address IT Service Architecture requirements in ITIL V3 using Enterprise Architecture. The research objectives are settled based on the above goal, research topic, problem statement and research questions:

1) To identify architectural requirements in design of IT Services in ITSM.
2) To identify the success criteria for integration of ITSM/ITIL and EA.
3) To design an IT Service Architecture Model for ITSM and EA.
4) To develop a framework for integration of ITSM/ITIL and EA.

1.6 Scope of the Study

This topic was chosen when limited works were found on the relationship of old version of ITIL (V2) and EA. The importance of the problem and also major differences of ITIL V2 and V3 made researcher decide to extend this integration to ITIL V3 within new ideas as discussed previously. The following directions are implicitly considered as the scope of this study:

1) First of all, the primary focus of research is on ITSM/ITIL and IT service design requirements.
2) Secondly, this researcher is interested in EA frameworks which can support or address ITSM/ITIL architectural requirements
3) Moreover, the research is planned to design IT Service Architecture in Service Design stage of ITIL V3.
4) Finally, the concentration is on the layers of EA which form IT Service Architecture such as application layer and infrastructure layer. However, the business layer of EA is not covered through this research.

1.7 Significance of the Study

This research attempts to contribute in practice by development of a service-based framework and provision of an architecture model for service in order to support implementation of ITSM using ITIL V3. This framework will help IT service

providers and IT service customers to implement ITSM, especially ITIL, along with Enterprise architecture in a successful manner. The framework will facilitate implementation and coordination of ITSM and EA projects. This framework also will provide a helpful governance for IT/IS project/service development in organizations.

In academia, this research has introduced the service architecture layer (model) for enterprise architecture. Therefore, the proposed layer will address the gap of business architecture and application architecture. It has also filled the gap of EA and ITSM through service architecture model. Furthermore, the service based framework has provided a service oriented solution for at least EA, SOA and ITSM. This idea can be extended to other domains.

1.8 Organization of the Thesis

Being organised in nine chapters, this thesis presents the process of the research in a structured and coherent manner. There are inter-relationships between different chapters and sections of the thesis. Chapter 1 introduces the research area of concern. The chapter begins with the description of the research background, discussing the ambiguities and requirements surrounding service concepts in SOA, ITSM and EA despite its importance. The chapter proceeds with the problem statement, the research questions and research objectives. This chapter also describes the significance of the research based on its contributions to theory, practice and methodology.

Chapter 2 discusses the literature related to the service architecture in various domains including SSME, ITSM and ITIL. It also explores the role of enterprise architecture in organization and in ITIL. Related works to the research concern have been discussed and compared to the primary proposed framework. Chapter 3 describes the methodology used in the research. This chapter begins with the

research paradigm and the rationale of using multiple research strategies including case study and design science research. The chapter then presents operational framework for each phase to explain activities of the research in detail. Data collection methods and procedures are also discussed.

Chapter 4 introduces the selected case study from Iran and Malaysia and presents the collected data. This chapter then analyses the collected data to explore the issues and benefits of integration of ITSM and EA. The success criteria of proposed framework have also been identified. Chapter 5 begins with a review on service architecture requirement. It designs an architecture model for IT services. Some criteria identified for success of the framework have been addressed in the model. Different aspects of IT services including service portfolio, service architecture and service level management have also been designed. Finally this chapter presents the integrated service architecture framework (ISAF).

Chapter 6 begins with introduction of Delphi expert panel method. It explains the process, data and the results of the verification process. The results show how much ISAM framework and service architecture model fulfilled the service architecture requirements and success criteria of integration. Chapter 7 finally concludes the research and identifies the research contributions. The chapter draws the conclusions by describing the research outcomes in relation to the achievement of the research objectives. The chapter then examines the research contributions to theory, practice and methodology. Lastly, the chapter discusses recommendations for future research.

1.9 Summary

In this chapter, primary issues related to conducted research have been discussed. The goal of this research was defined as “developing a conceptual integrated framework to identify and address IT Service Architecture requirements and issues using Enterprise Architecture”. The questions of this research being raised

by background of research, literature review and researcher's experiences are defined. Moreover, the research objectives and scopes are defined with regard to the problem statement and research questions.

This research attempts to contribute to practice by developing a service based framework and provision of an architecture model for service in order to support implementing ITSM using ITIL V3. This framework will help IT service providers and IT service customers to implement ITSM, especially ITIL, along with Enterprise architecture in a successful manner. In academia, this research introduces the service architecture layer (model) for enterprise architecture. Therefore, the proposed layer addresses the gap of business architecture and application architecture. It also fills the gap of EA and ITSM through service architecture model.

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