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College of Information Technology

Department of Information Systems

**IT Cloud Computing adoption strategy Framework
development in Bahraini financial enterprise from an
Enterprise Architecture Perspective**

A Thesis Submitted in Partial Fulfilment of the Requirements for the MS.c.
Degree in Information Technology

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Defense Committee's Approval

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Abstract

The Information Technology (IT) era supports the adoption of Cloud Computing (CC) on a large scale in many business fields, at which the Financial Institutions (FI) such as Banking sector is not an exception.

Several gaps were found during the literature review. While several CC methods, strategies, or frameworks have been proposed or utilized for CC adoption in many economic sectors including the FI banks, it is still a relatively new initiative in many other countries including Bahrain. While Enterprise Architecture (EA) is claimed to be a leading information and business management discipline to develop an architecture that guides the transformation to CC adoption of an enterprise from a baseline state to a target state. However, there is an evident lack of scholarly articles on the development of CC adoption frameworks from an EA perspective. Also, it was found that scholarly articles in the evaluation of the CC adoption framework are scarce.

To address those gaps, this thesis aims at developing and evaluating a cloud computing adoption framework for financial institutions (CCAFF) in Bahraini Banks by adapting a tailored version of the Open Group Architecture Framework (TOGAF) and embedding a tailored version of an enterprise cloud adoption strategy (ECAS) and then evaluating the CCAFF based on several criterians.

A six phased Design Science Research Methodology (DSRM) is employed to design the research report, guide, and develop the CCAFF, while the exploratory nature of the research necessitates the employment of a holistic single Case Study strategy for an FI-01 bank, based on semi-structured interviews and document analysis data collection techniques. Alongside, the data was analyzed using the pattern matching technique. For the CCAFF evaluation, the Delphi technique was employed at which seven experts in two rounded panels contribute to the evaluation findings based on six criteria.

The evaluation findings demonstrated promising results in terms of ease of use (86.4%), usefulness (84.6%), decision-making support (86.6%), comprehensiveness (85.8%), time efficiency (84.8%), and usage intention (84.8%).

Keywords: Cloud Computing Adoption, Strategy Framework, FI, Banks, Enterprise Architecture, TOGAF, Kingdom of Bahrain.

Dedication

This thesis work wouldn't have been possible without the support of Allah and my family. This is why I dedicate this research to my parents and my siblings. I would also like to thank all the faculty members of the University of Bahrain for their help and support.

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List of Acronyms

ADM	Architecture development method
Archimate	Open and independent enterprise architecture modeling language
AWS	Amazon web services
BA	Business Architecture
CC	Cloud computing
CCAFF	Cloud Computing Adoption Framework for Financial institutions
DSRM	Design science research methodology
EA	Enterprise architecture
ECAS	Enterprise cloud Adoption strategy
Enterprise model	An abstract that represents the organization in a blueprint
FEAF	Federal Enterprise Architecture Framework
FI	Financial institution
Iaas	Infrastructure as a service
ICT	Information and Communication Technologies
IGA	Information and eGovernment Authority
ISA	Information System Architecture
IT	Information Technology
NIST	National Institute of Standards and Technology
Paas	Platform as a Service
Saas	Software as a Service
SLA	Service Level Agreement
SME	Small and medium enterprise
TA	Technology Architecture
TOGAF	The open group architecture framework

Chapter 1

Introduction

1.1 Overview

This chapter presents an overview and discusses the fundamental background of the study, while Section 2 emphasizes the current knowledge state with actual gaps in the research area. Section 3 identifies the main research issues using the explorative technique to present the problem statement, whereas the research objective and questions are claimed in Sections 4 and Section 5. The significance of the research and the research structure are discussed in Section 6 and Section 7, respectively, while research methodology and limitations are highlighted in Sections 8 and 9 consecutively. Section 10 sums up the entire chapter.

1.2 Background of the study

From one side, Cloud computing (CC) has created a new horizon in many economic sectors, at which it provides on-demand computing services with a dynamic performance capability, low entry costs, ubiquitous access, availability, flexibility, and scalability (Zhang et al., 2010; Muller et al., 2015), and it has rapidly grown, so it would enforce institutions to adopt it (Kashfi, 2017).

According to Mell and Grance (2011), the national institute of standards and technology (NIST) defines Cloud Computing (CC) as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”.

On the other side, Enterprise Architecture (EA) is a discipline that gained remarkable attention from academia and the practitioner's communities (Theuerkorn, 2004) as it resembles blueprints of the organization's actors, processes, and IT (Huhns et al., 1993).

A number of the Enterprise Architecture frameworks (EAF) has emerged in production sectors, defense, health, governmental, private, or even general-purpose domains, one amongst which is the Open Group Architecture Framework (TOGAF) (Schekkerman, 2004).

The Business Architecture (BA) of EA-based TOGAF addresses the concerns of the users related to people, process, function, business information, usability, and performance (The Open Group, 2018). The BA views include business function, business services, business process, business locations, organization chart, business strategy, objectives, etc, while the Information systems architecture (ISA) views include data, applications, and technology architecture views including technology hardware, operating systems, networks, networking communication devices, etc (The Open Group, 2018).

Consequently, integrating EA with CC provides enterprises an opportunity for more scalability, high storage capacity and availability, continuity, and security parsing (Merrill and Kang, 2014; Bernal et al., 2016). However, the survey conducted by Forrester (2012) indicates that enterprises face several challenges when performing a successful implementation of cloud solutions such as the transformation of legacy IS apps and associated maintenance. Alternatively, Speed (2011) indicates other challenges which affect the comprehensiveness of the cloud strategy.

Subsequently, Rimal et al. (2011) see that after the cloud transformation, CC needs to be tailored and complemented with the EA as the relationship and integration between EA and CC according to Gill et al.

(2014) has insufficient empirical studies so, it is essential to build a link between CC and EA (Abderrahim and Choukair, 2014).

To address this gap, this research study aims to develop and evaluate a CC adoption framework (CCAFF) in financial institutions bank sector, from the lens of Enterprise Architecture, at which the developed framework is meant to be holistic by addressing the entire IT- CC adoption strategy for FI in Bahrain and to be evaluated on a single case study (FI-01), specifically by applying a tailored version of EA development methodology (TOGAF) and a Cloud computing adoption strategy (ECAS).

Thus, for successful development of the CCAFF, this research study follows a six phased Design Science Research Methodology (DSRM), at which a holistic single Case Study is employed as a research strategy for the development, with variant validity and reliability measures, while a Delphi technique is applied to evaluate the CCAFF based on six criteria, two panels, and six experts' feedbacks.

1.3 Problem statement

Rapid EA development mismatches the innovation demand rate which is imperative transforming from traditional system to the CC to keep up with current IT new technology.

There are three main dimensions in this research problem such as: the beginning of difficulties in the cloud computing environment related to security, compatibility, etc., moving to difficulties and resistance from the financial institution (FI bank sector) itself.

The government of the kingdom of Bahrain has stated its vision for digital transformation to CC. However, there are no clear steps for cloud adoption. Also, some Bahraini enterprises follow the trend of moving their departments into the cloud, but still, there is a lack of Bahraini CC adoption

framework, especially in the FI bank sector as enterprises desire to move applications to cloud but the direction isn't clear.

One of the difficult points with most current framework development is the availability of multiple methodologies to embrace such as TOGAF, Department of defense architecture framework (DODAF), Federal enterprise architecture framework (FEAF), Zachman FW, etc., at which each tool has its own characteristic, workflow mechanism, and advantages over other tools.

Previously mentioned, there is no general framework absorbing different enterprise categories which means that each case needs an independent tailored framework that should be generic in the same enterprise field.

Enterprises with limited resources prefer to invest in their resources than cloud computing adoption (CCA). One of the major issues is that collecting data about financial enterprises (banks) has many bureaucracy & policies challenges.

Finally, a transition plan for CC ADOPTION needs a proper strategy to handle the transformation taking into consideration the needed time to transform to cloud computing, issue of information system compatibility, lack of security in accessing data in the cloud, unexpected error occurs during the process. Therefore, to assure reliability and achieve the requirement, any proposed framework needs to be evaluated with quality test metrics.

1.4 Research objectives

This research study is aimed at developing and evaluating a CCAFF framework for the FI (Banking) sector. The three main objectives are:

RO-1. To identify the Enterprise Architecture (EA) development method that can develop a framework for cloud computing adoption by

tailoring versions of TOGAF as a development tool and ECAS as a cloud adoption strategy.

RO-2. To study an FI bank in Bahrain from the perspective of EA. This study will migrate the institution from AS-IS state to the TO-BE state. This includes the three architectural layers of business, information system, and Technology.

RO-3. To evaluate the developed framework (CCAFF) for CC implementation by applying the Delphi technique and setting six criteria for the evaluation process.

1.5 Research questions

Driven from the three research objectives, this research study addresses three major questions and ten stemming sub-questions as follows:

RQ1. What is the best EA architectural development method that can be utilized for the CC adoption in FI (Banking) sector?

The rationale of RQ1 is to discover the way of developing CCAFF for CC ADOPTION using a development framework tool such as TOGAF, compare between different development tools, and choose cloud computing adoption strategy, also compare between variant adoption strategies to choose the most suitable one that is aligned with the TOGAF.

RQ1.1 What are the most popular EA architectural methods?

RQ1.2 Why is TOGAF best matches CC adoption in FI (Banking)?

RQ1.3 What is the best CC adoption strategy aligned with TOGAF?

RQ2. How can a Bank migrate from the baseline (As-Is) state to the target (To-Be) state?

The rationale of RQ2 is to provide the method, including the strategy of transitioning a bank from its baseline (As-Is) to the target (To-Be) states.

RQ2.1 Does TOGAF move FI-01 from its baseline to target Business architecture?

RQ2.2 What is the baseline and target Applications architecture of FI-01?

RQ2.3 What is the baseline and target Infrastructure architecture of FI-01?

RQ2.4 What is the best migration plan for the Business, Application and Infrastructure architectures of FI-01?

RQ3. How to evaluate the developed CCAFF framework for implementation?

The rationale of RQ3 is to provide answers such as the identification of the best criteria for successful CCAFF development, the best evaluation method and execution process, and whether the analytical findings are meeting the desired results of the assessment criteria. To do that, 1) six criteria have been found best assessing successful CCAFF development. This includes ease of use, usefulness, decision-making support, comprehensiveness, time requirement, and intention to use. 2) Delphi technique was found the most suitable evaluation methodology at which a panel of seven members was formulated in two assessment rounds to give their feedback on the efficiency of the CCAFF based on six criteria.

RQ3.1 What are the assessment criteria for successful CCAFF implementation?

RQ3.2 What can Delphi's evaluation process assess the CCAFF?

RQ3.3 Do the evaluation results satisfy the assessment criteria for successful CCAFF implementation?

1.6 Research significance

The importance of the research study lies under the following four rationale points. First, this study develops a cloud adoption strategy framework (CCAFF) from an EA perspective to assist the financial institutions and banks, Bahraini Government, and Telecommunications Regulatory Authority (TRA) for the successful adoption of CC. Second, this research study provides assistance for the technical and business managers to adopt CC in their banks by providing them with trustworthy, stepwise, evaluated, and practical phases. Third, this research study provides a

reference to researchers to empirically analyze and evaluate the adoption of CC from the lens of EA perspective for future build-on research initiatives. Fourth, the research study findings contribute to understanding the role of implementation of CC in financial institutions generally and in FI bank sectors specifically, from an EA point of view.

1.7 The Model (CCAFF)

The developed cloud computing adoption framework for financial institutions (CCAFF) is a result of an entirely blended version of tailored EA-based architectural framework (TOGAF) for an FI-01 case (Bank), with a tailored version of an enterprise cloud adoption strategy (ECAS). An evaluation of the developed framework is scientifically evaluated by the Delphi technique based on several criterians. Further explanation is provided in Chapter 3.

1.8 Research Design Methodology

This research study employs the Design Science Research (DSRM) method to perform the design solutions for the enterprise (FI-01) and create the artifact represented by the CCAFF framework. Depicted in Figure 1.1, the DSRM is composed of six stages.

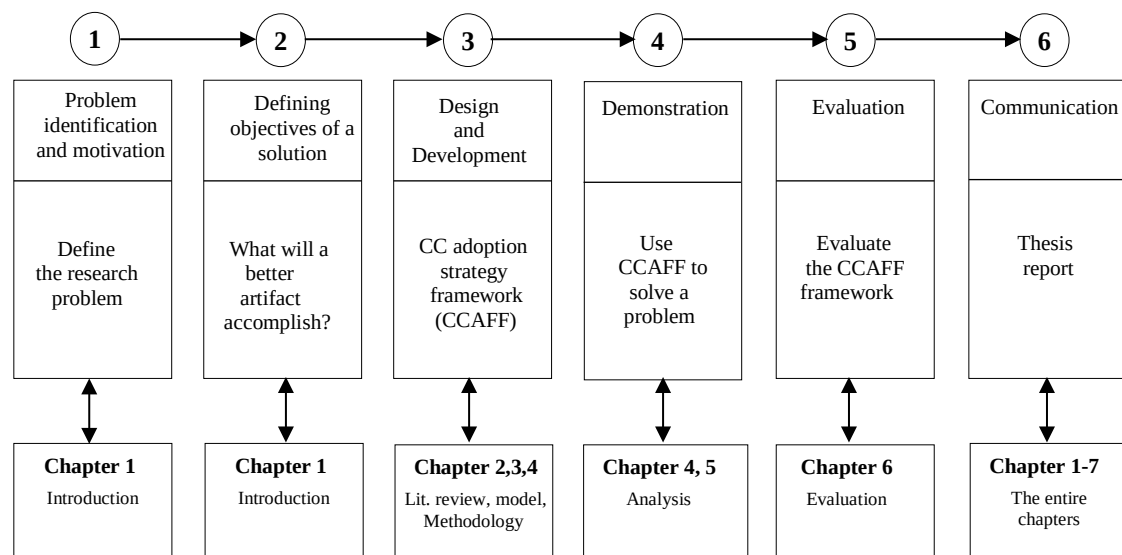


Figure 1.1 Thesis Design structure methodology

The first stage defines the research problem at hand which is a practical problem. The second stage defines the research objectives at which what will a better artifact (CCAFF) accomplish. In the third stage, a holistic single Case Study strategy for FI-01 bank is employed based on semi-structured interviews and document analysis data collection techniques. Alongside, the data is analyzed using the pattern matching technique. In the evaluation stage, the CCAFF is evaluated using the Delphi technique which was employed based on 7 experts in two rounded panels to contribute to the evaluation findings based on 6 criteria. The sixth stage communicates the research findings and publications. Further explanation is provided in subsequent Chapters.

1.9 Research structure

This Section presents builds on the thesis structure shown below in Figure 1.2. Chapter 1 presents the research structure by introducing the subject, investigating the existing research problem, aligning the problem all along with the research objectives and significance. Chapter 2, however, studies the gap of the research area and presents the research related works, while chapter 4 represents the employed research design methodology.

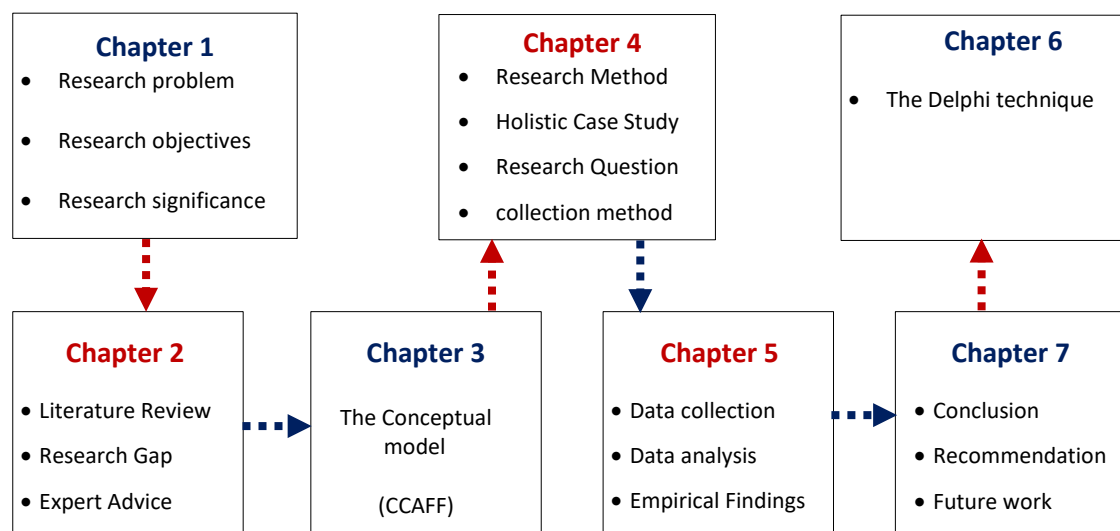


Figure 1.2 Thesis design structure

Previous studies are collected by applying the Systematic literature review (SLR) method to show various points of view. Following is Chapter 3 which presents the proposed conceptual model for cloud computing adoption (CCAFF) that is generated by the utilization of a tailored version of TOGAF ADM and the Enterprise Cloud Adoption Strategy (ECAS). Chapter 4 outlines the selected research design methodology denoted by the Design Science Research (DSR), formulate a holistic Case study and protocol, define the data collection and analysis methods via structured interviews, validate the procedures by several quality test techniques such as the internal, external and reliability tests. Chapter 5 outlines the data analysis performed and the data findings. Chapter 6 evaluates the CCAFF framework based on the Delphi technique. Conclusion and future work are both discussed in Chapter 7, which will open the door for other researchers to look over other areas for further exploration and sum up the research study at hand.

1.10 Research Limitations

Research limitations are attributed to the availability of multiple development tools, variant adoption strategy, and selection of the most suitable methodology for developing and evaluating that matches the FI-01 Architecture.

In terms of the geographic location, the study is limited to the FIs in the Kingdom of Bahrain.

In terms of framework development tools, there appears many framework development tools to select from such as DODAF, FEAF, or Zachman. However, TOGAF was found the best matching due to several factors that will be described in Chapter 2.

In terms of business domains, there appears various types of institutions such as telecommunication, education, manufacturing, etc.

However, the financial institutions (FI) sector was found in need due to several reasons that will be described in Chapter 2.

In terms of business sectors, this research study focuses on the bank sector, at which FI is composed of many sectors such as insurance companies, pension schemes, etc. However, the focus in this research is on the banks' sector which is considered to be the most common type of FI and the largest share rather than other types. Concerning the banking category's scope, the utilized case study is applied in retail banks, which are the most common ones.

In terms of the type of Case study, the study follows the strategy of a single holistic case analysis, however, partial data was collected from multiple Banks that are likely similar to FI-01 in Bahrain in terms of size, type, and business domain. For this reason, embedded case study strategy has been avoided to deep focus in FI-01 to have rigid study.

In terms of the the cloud service providers, there appears various international providers such as: Microsoft Azure, google cloud platform, or IBM Cloud, However, The kingdom of Bahrain embraced only one cloud service provider which is Amazon Web Services (AWS).

1.11 Summary

This chapter aims to overview the background of related studies, also identify the main study problems, demonstrate the objective and Significance of this research respectively. The reviewed literature shows increased demand for CC ADOPTION which highlights the contribution and reasons behind the study, points out the importance to the banking sector as a financial institution in Bahrain, next that, the structure of the entire research describes the content and provides an overview of the applied methodology and techniques. Finally, the research limitations are discussed followed by defining the research terminology.

Chapter 2

Literature Review

2.1 Introduction

This chapter investigates the state of the art in correspondence with the objectives and the formulated questions of the study. A typical layout of this chapter is composed of seven thematic Sections. Section 2 discusses the employed literature review profiling methodology to find the previous studies and identify the study gap. Section 3 is entirely dedicated to Cloud Computing (CC) which highlights its types, deployment models, characteristics, and advantages in detail, followed by several adoption solutions. Section 4 investigates the financial institutions (FI) in terms of types, characteristics, and importance, at which the banking sector was emphasized including its types and characteristics, particularly the Bahrain banking sector. Section 5 introduces EA in terms of definitions, types, characteristics, views, and viewpoints, the TOGAF framework, and a comparative part of TOGAF and other frameworks. Section 6 illustrates the CC adoption focusing on the banking sector as an example of FI and provides a comparative analysis w.r.t Bahrain and other countries. Section 7 sums up the findings of the chapter.

2.2 The Literature review methodology

Based on the insights of Levy and Ellis (2006), a Systematic Literature review methodology (SLR) is applied to investigate the state of the art of the research study at hand. Starting with the study objective and questions, the first step is identifying the main keywords for the search, then searching in primary data sources using as shown in Table 2.1. The next step is analyzing and redefining the search inquiries, by adding multiple

words using (AND/OR) formulas. The final result entails performing further refinements to the data sources by selecting Scopus indexed journals articles with high indexes and eliminating the non-relevant ones. Completing the extract steps, the most relevant related work comprising of 27 articles are generated as shown in Table 2.2.

Table 2.1 The searching keywords

Cloud computing	Enterprise Architecture	Financial enterprise
Cloud	TOGAF	Bank
CC	ADM TOGAF	Retail bank
CC Adoption	Framework	Financial institution

Table 2.2 The findings of the SLR methodology

Phase	Thematic subjects							Total
	Financial	TOGAF	EA	CC	EA +FI	CC + EA	TOGAF+CC +EA+FI	
Phase1: Selection of data sources	Journals articles + Conference proceeding papers + Books + Google scholar							
Phase2: Applying searching formula	No formula	No formula	No formula	No formula	OR	OR	OR	370
Phase3: Refining the document	-	-	-	-	AND	AND	AND	105
Phase4: Manual reviewing and exclusion	35							35
Phase5: Selection and review of articles and papers	27							27

2.3 Cloud Computing

Goscinski and Brock (2010) define cloud computing (CC) as the use of resource pool on-demand or on spot with highly scalable infrastructure resources, taking the advantage of computing power with no need to predict actual need at which the estimation need and cost will not be considered.

2.3.1 Cloud Computing characteristics

Speaking about the advantages, it was evident that CC mitigates extra cost and focuses on a business strategy without considering the ICT and gives an advantage of anywhere access meaning that the IT support team is not needed at which the team would consume most of the organizational

budget. Also, CC can solve problems relevant to the operating systems and infrastructure handling which both depend on the chosen cloud infrastructure. On the other hand, the cloud still has a bad reputation in terms of security (Koehler et al., 2010).

2.3.2 Cloud Computing deployment models

Depicted in Figure 2.1, according to Adwan (2019), Cloud computing deployment is distinguished according to three major categories including, public cloud, private cloud, and hybrid cloud. Other articles add the community cloud.

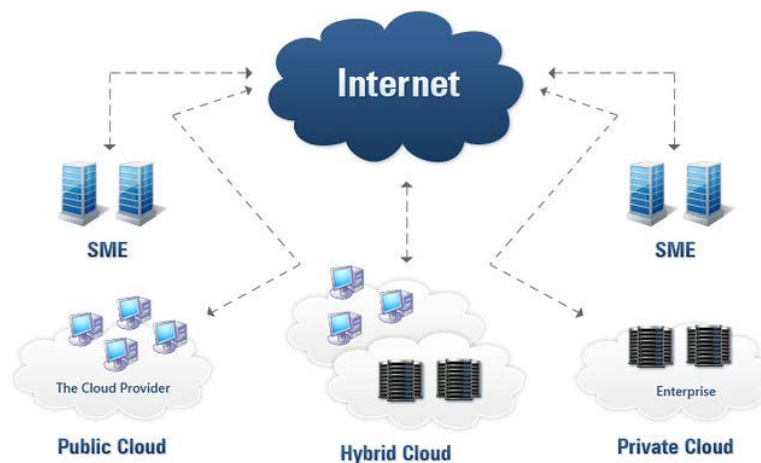


Figure 2.1 Cloud Computing deployment model (Source: AWS)

The private and community cloud infrastructures are operated by one small-medium enterprise (SME), several departments, or third party/s. However, the community cloud infrastructure-based SMEs must have the same mission, security requirements, policy, and compliance standards. The public cloud infrastructure can be provisioned for open use by the public and can be owned, managed, and operated by a business, academic, or government SME, while the hybrid cloud infrastructure is a composition of two or more of multiple cloud infrastructures (Adwan, 2019).

Choosing between different CC deployment models for enterprise adoption is dependent on several factors for example budget, time luxury,

organization board decision, institution characteristic, the required development, current IT infrastructure, these factors could be either external from the institution or internally from the institution itself or both.

2.3.3 Cloud Computing service models

Depicted in Figure 2.2, Goscinski and Brock (2010) represent the three main service models of CC software as a service (SaaS) which supports end-users, platform as a service (PaaS) which supports the application developer, and infrastructure as a service (IaaS) which supports infrastructure and network architecture.

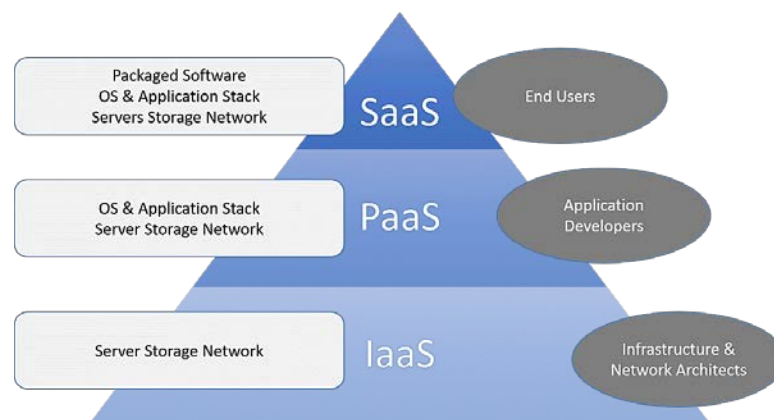


Figure 2.2 Cloud computing models (Source: AWS)

2.3.4 Cloud Computing adoption

CC advantages sparked the interest in CC adoption in many business domains. Statics reveal high growing CC adoption rates in multiple regions (Vu et al., 2020), and this is despite the facts mentioned by Goscinski and Brock (2010) in that the CC adoption rate is not rising as fast as expected due to some reasons. Khajeh-Hosseini et al (2012) believe that any transition plan needs a proper strategic plan to handle errors and ensure proper migration to the newly developed framework. In achieving its objectives, Koehler et al. (2010) believe that the CC adoption plan requires 5 to 15 years. The size of the enterprise plays a big role in terms of CC

adoption for MSMEs has limited resources and tight budget, therefore are not favored CC adopted.

2.4 The Financial Institutions (FI)

According to Nowak (2012), the term FI refers to all legal entities providing financial services on market, that is any companies that provide financial services as intermediaries in monetary, such as deposits, currency exchange, investment, and loans.

2.4.1 Types and characteristics

FIs are classified as either non-profit such as charitable societies, and charities, or pro-profit such as banks, and insurance companies. According to Sweeting (2017), there is a massive range of financial institutions/enterprises but he focuses on the following main four boards: banks, insurance companies, pension schemes, foundations, and endowments, while Brigham and Houston (2021) detail more financial institutions as depicted in Figure 2.3. This includes financial service corporations, savings and loan associations S&LS, mutual saving banks, credit unions, pension funds, life insurance companies, mutual funds, and hedge funds. The FI provides financial services that deal with money management as an intermediary in the mindset of borrowers and savers.



Figure 2.3 Financial Institutes types (source: quora.com)

2.4.2 The Banking sector

One of the most commonly known sectors in FI is banking. Banking has the largest segment compared to other FI sectors. Bernardo Nicoletti outlines the range of bank types including, commercial, investment, saving, CBB, industrial, real estate banks, agricultural, Islamic, retail (Nicoletti, 2014). All around the world, there is a similar set of factors between these types, but the fundamental differences depend on firm size, total and fixed assets, market-to-book ratio, and profitability. Table 2.3 summarizes the characteristics of each banking type.

Table 2.3 the bank types

Bank type	Description
Commercial bank	Serve public & private sector to offer deposit, loan, and investment services.
Investment bank	Provide financial services that deal with fund advisory seeking for profit.
Saving bank	Accept saving deposit to pay interest for these deposit.
CBB bank	Manage the country currency and deal with government or other banks.
Industrial bank	Provide investment certificates for public & private sector.
Real estate bank	Provide real estate finance for residential and commercial properties and lands.
Agricultural bank	Lend money for long period with less interest to support small enterprises.
Retail bank	Provide services to public sector and act as consumer banking/personal banking.
Islamic bank	Provide financial services that are compatible with islamic law's transactions.

2.4.3 The Bahraini banking sector

According to the Bahraini Economy's Annual Economic Review 2010, the small-sized companies account for 10% of the total, while the medium-sized ones represent 7.3%. The official statistics of 2013 show a slight deviation in the number of SMEs in Bahrain Table 2.4, that SMEs are defined as being either micro, small, or large. The kingdom of Bahrain defines them as being based on the number of employees and turnover in the region.

Table 2.4 The Bahraini definition of SMEs (Source: MOIC, 2012)

Category	Number of employees	Capital investment	Annual Turnover
Micro	1- 10	Up to 20,000 BD	Up to 100,000 BD
Small	11-50	20,001 – 500,000 BD	100,001 – 1 Mil BD
Medium	51-250	500,001 – 3 Mil BD	1,000,001–5 Mil BD

Representing the number of companies in the Bahraini economy for the year 2013 in Table 2.5, concerning the economic units, the financial total market is ranked 1st place by representing 41.8%.

Table 2.5 SMEs contribution to the Bahraini market (Source: LMRA, 2016)

Economic Unit	Micro	Small	Medium	Large	Total	Total (%)
Construction	6843	2081	179	58	9161	11.2
Wholesale, trade, banking and repair	30585	1039	190	27	31841	38.92
Manufacturing	7940	639	142	28	8749	10.7
Real Estate, Renting, and Business	11639	563	74	15	12291	15.03
Hotels and Restaurants	4311	496	123	7	4937	6.035
Transport, and Communication	1782	209	40	10	2041	2.495
Financial intermediation	2163	133	44	13	2353	2.876
Other Social and Personal services	4853	109	11	0	4973	6.079
Education	264	71	33	0	368	0.45
Electricity, Gas, and Water supply	25	5	1	1	32	0.039
Not specified	391	2	2	0	395	0.483
Agriculture, Hunting, and Forestry	2012	47	12	0	2071	2.532
Health and Social work	266	33	10	2	311	0.38
Mining and Quarrying	52	18	11	3	84	0.103
Fishing	2175	2	0	0	2177	2.661
Public Administration	4	0	1	0	5	0.006
Extra Territorial	14	0	0	0	14	0.017

The Bahraini financial sector is well-developed and diversified, consisting of a wide range of conventional and Islamic financial institutions and markets, including retail and wholesale banks, specialized banks, insurance companies, finance companies, investment advisors, money changers, insurance brokers, securities brokers, and mutual funds.

Illustrated in Table 2.6, Bahrain has 370 financial institutions in the country as of the end of December 2020 including 91 banking institutions, 34 insurance companies, 53 investment business firms, and 86 specialized licensees. The sector is therefore well-positioned to offer a wide range of financial products and services, making it the leading financial center in the

Gulf region. The financial sector is the largest single employer in Bahrain, with Bahrainis representing over 67% of the workforce of near 14 thousand. Overall, the sector contributes 17.2% of Bahrain's Gross Domestic Product (GDP), making it one of the key drivers of growth in the country. The sector is regulated and supervised by the Central Bank of Bahrain (CBB), which since 2006 has functioned as the single regulator for the entire financial system.

Table 2.6 The Bahraini financial facts (Source: BAB)

Regulator	Central Bank of Bahrain
Financial Institutions	370
Financial Sector Workforce	• 13,737 (2020) • Bahrain nationals 9,430 (67%) • Foreign nationals 4,665 (33%)
Key Economic Indicators	Financial Sector contribution to GDP 16.1%
Banking Sector	• US\$202.8 billion • No. of institutions 91 • Retail banks 30 • Locally incorporated 13 • Branches of foreign banks 17 • Wholesale Banks 61 • Representative Offices 8 • Bank Society 1 • Islamic Banks • No. of banks 18 • Assets US\$31.2 billion

Bahrain's Banking consists of both conventional and Islamic banks and is the largest component of the financial system, accounting for over 85% of total financial assets. The banking sector includes 30 retail banks (13 locally and incorporated and 17 foreign banks' branches), 61 wholesale banks, and 8 representative offices of overseas banks. The banking sector has played a pivotal role in the emergence of Bahrain as a leading financial center in the region.

As of December 2020, banking sector assets stood at over US\$207 billion, more than 12 times annual Gross Domestic Product. Industry growth has been supported by an open market economy; stable and prudent macro-economic and fiscal policies; a credible regulatory framework in line with international standards; and a notably strong and well qualified local

workforce. All these factors have combined to cement Bahrain's position as a regional banking hub, successfully attracting numerous foreign banking organizations to establish a physical presence in the country.

The Banking sector in Bahrain has proved its resilience during the COVID-19 pandemic as it contributed significantly to support clients, society, and the economy while maintaining its financial solvency. In addition, the has shown a revolutionary jump in its digital banking services as well as open banking services. Many digital banks were established. The CBB laid down a suitable ecosystem for the flourishing of modern banking services.

2.5 Enterprise Architecture

2.5.1 Types and characteristics

According to (ISO/IEC 4210:2007), an enterprise can be formed as a unit, organization, corporation, division, department, etc., with a systemic information system having a business strategy and ICT infrastructure that interconnected in ownership, there are 4 main components in any EA which are: business architecture, data architecture, application architecture, technology architecture. In academia and practice, Enterprise Architecture (EA) is defined as an approach entailing information, business management, and modeling. According to Huhns et al. (1993), EA as depicted in Figure 2.4 is the blueprint that identifies the essential parts of an organization including, people, business processes, technology, information, financial, and many other components, along with their business strategy.

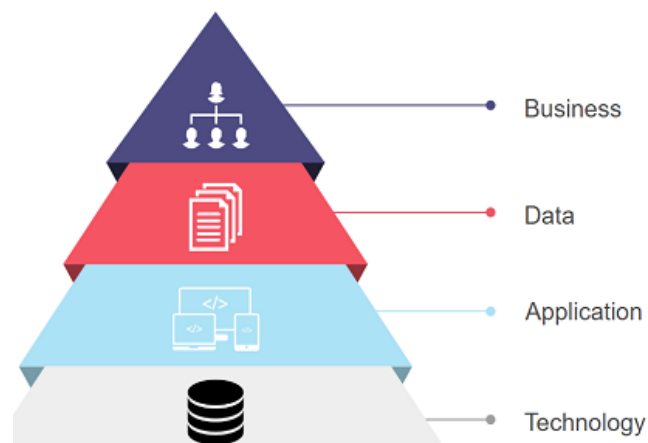


Figure 2.4 Enterprise Architecture (source: ringcentral.com)

2.5.2 Views and viewpoints

EA views described the architecture inter-connected structure together, this view the complexity of the organization component, these details classifying and overview the current organization positioning by the lens of the architecture framework. Archimate is one of the used tools for viewing the enterprise from a certain aspect, moreover, showing the relations between organization components. Viewpoint representing EA by a set of models in an abstract mode, in more simple definition view is what are you seeing in the EA, while viewpoint: is from where you are looking to the EA (Theuerkorn, 2004). The architecture domain is divided into four main layers: business architecture, data architecture, application architecture, and technology architecture, each of which has relations between components and the subsequent layers.

2.5.3 Frameworks

A framework is a tool for logical structure classifying and organizing complex information in an enterprise. Session (2007) believes that a Framework (EAF) is considered a central component that defines the suggested architectural artifacts and describes how artifacts are related to each other. In the 1980s, John Zachman developed the first EA framework,

denoted by “Zachman Framework”. Since then, lots of other frameworks have been rolled out including, DODAF, FEAF, TOGAF, and many others.

Each framework has its own perspectives and views (Urbaczewski, L. and Mrdalj, S., 2006). The comparison between those frameworks (Cameron and Mcmillan, 2013) yielded that each framework has its criteria and different attributes, however, the open group architecture framework TOGAF has more suitability than the others.

2.5.4 The TOGAF framework

TOGAF is considered to be the most popular architectural framework that provides the methods and tools to produce, use, maintain, and develop EA. It is an open structure that covers the entire enterprise (holistic). TOGAF has many areas of technical architecture. To start presenting the framework, TOGAF is composed of eight phases, the business architecture (Phase B) addresses the concerns of the users related to people, process, function, business information, usability, and performance at which it is composed of multiple views such as business function, business services, business process, business locations, organization chart, business strategy, and objectives, etc.

On the other hand, the information system architecture (denoted by ISA- Phase C) views are composed of data, applications. Finally, a technology architecture (Phase D) is composed of all infrastructure components such as hardware devices, operation systems, networking, etc. these three phases are the main component of the current enterprise architecture as we call it (AS-IS). Opportunities and available solutions are (Phase E). The migration plan from the current framework to the proposed one (phase F). Implantation governance (phase G), architecture change management (phase H), and Architecture vision (phase A).

TOGAF gets aligned with the EA 4 main architectures (i.e., the business architecture, the application architecture, the data architecture, and the technical architecture). Business architecture describes the business processes described in the business architecture, while the interaction application with each other is described in the Application architecture, the enterprise data storage organization and accesses are described in the data architecture, technical architecture describes software and hardware infrastructure that support applications (Dube and Dixit, 2011; The Open Group, 2018; Alm and Wißotzki, 2013). TOGAF added value to the user to build open systems-based solutions for business issues and needs, in addition, TOGAF is one of the well-known and most trustworthy EA standard, because it offers flexibility and verified validation (Dube and Dixit, 2011), these capability helps improve the operational efficiency and continuation (Balabko and Wegmann, 2006).

2.5.5 TOGAF vs. other frameworks

Many Comparative analysis studies have been utilized in variant places between TOGAF and other frameworks. Table 2.7 explores the comparative findings of various architecture frameworks. Tang et al. (2004) analyze several frameworks including, RM-ODP, 4+1 View, TOGAF, FEAF, DODAF, and ZF. An architecture framework that explicitly supports an element is reported as Y. If it does not support that element or its absence is not noted in the documentation, then it will be reported as N. where an architecture framework partially support or eludes to support is reported as P. Findings resulted that TOGAF provides the most supporting goals, inputs, and outcomes total (Y+P).

Table 2.7 A comparison between TOGAF and other frameworks

Framework	Yes (Y)	Partial (P)	Not (N)	Total (Y+P)	Total (N)
ZF	9	9	9	18	9
4+1 View	11	10	6	21	6
FEAF	18	6	3	24	3
DODAF	21	4	2	25	2
RM-ODP	18	7	2	25	2
TOGAF	25	2	0	27	0

Similarly, based on features, Mentz (2012) compare some famous architecture frameworks FEAF, DODAF, TEAF, TOGAF, ZF, and generalised enterprise reference architecture and methodology (GERAM). Results revealed that TOGAF could be combined with other frameworks. Moreover, Ganesan and Paturi (2009) in Table 2.8 compares multiple frameworks. TOGAF scored first place as the results afford TOGAF more advantages over other frameworks.

Table 2.8 Business Architecture comparison matrix(Source:Ganesan&Paturi,2009)

Framework	Data (What)	Function (How)	Network (Where)	People (Who)	Time (When)	Motivation (Why)
TOGAF	Business Services Business Data Model	Business Processes Business Functions	Locations	Business roles Users Organization Unit	N/A	Business Goals and Objectives
Federal Enterprise Architectural Framework (FEAF)	-List of Business Objects -Semantic Model	-List of Business Processes -Business Process Model	-List of Business Locations -Business Logistics System	N/A	N/A	N/A
Standard for Business Architecture Description	-Business Outcome -Business Resource	-Business Behavior -Business Function	Business Location	-Business Role Player -Business Commitment	N/A	-Business Situation -Business Purpose
Strategic Architectural Model (SAM)	Business Component	-Business Process -Business Function	N/A	Organization	Program/Project	Objective or Goal
Crompton Architectural Metamodel (CAM)	Product	-Business Process -Function	Location	-User Business Interested - Party Supplier IT System	N/A	-Goal Objective CSF -Marketing Aim
Avancier Methodology (AM)	Scope: Actors, Inputs and Outputs	Processes	Location	Organization Sponsor and Stakeholder	Plans	Inputs: Goals, Requirements and Constraints
ArchiMate	-Product Value -Business Object Representation Meaning	-Business Process -Business Function -Business Interaction	Business Interface	-Business Role -Business Actor -Organization Contract -Business Collaboration	Business Events	N/A

2.6 CC Adoption in the FI- Banking sector

Throughout the literature review, it was evident that each enterprise has a unique framework to control the flow of tasks. However, currently, the current framework's development appears to mismatch the frequency rate of innovation. The paradigm shift is the adoption of cloud computing.

There is a gap between the academic CC adoption initiatives and actual CC adoption utilization. In addition, the decision of adaption in the financial enterprise which handles sensitive data has many restrictions, bureaucracy as (Misra and Mondal, 2011) said due to its value. khajeh-hosseini et al. (2012) debate among adoption considerations in terms of benefit and risk for SME. lots of internal and external factors from the enterprise itself affect the cloud adoption, mainly: firm size, environmental, regulation (Espadanal and Oliviera, 2012), these factors should be considered before CC adoption.

In the financial institutions, Scott (2021) considers the public cloud as a CC environment at which cloud solutions are located publicly outside the banks, thus, having no control; however, control functions are provided to the company using publicly hosted cloud services by subscription. On contrary, the private cloud solutions are located inside the banks having all control so, computing resources (Physical on-site data centre/s (“on-premises”)) are used by a third-party provider (“hosted private cloud”), while hybrid cloud solutions integrate the private and public clouds within the same bank to perform specific functions, which suggests a perfect adoption type to all financial institutions.

Researchers have studied the effect of CC adoption in FI banking sectors and argued that CC adoption is highly important for banking in terms of CC technology benefit. Table 2.9 provides a comparative analysis of current studies to demonstrate the similarities and the differences.

Table 2.9 Comparative analysis from variant geographical regions

Source	Location	Year	Research purpose	Model/FW/Method/Strategy
Usage of CC in bank sys.	Egypt	2016	The study explores the improvement of CC security by suggesting some rules and discussing the effect of cloud security in financial enterprise adoption, considering several CC adoption facts.	N/A
Impact of CC in bank indust res.	Iran	2015	The study compares between the current structure/resources of a bank industry and the impact of on promise cloud computing technology in terms of reducing cost and reducing energy consumption.	Static Comparison
Design interoperable CC FW for bank industry	Ethiopia	2017	The study proposed to design an interoperable cloud computing framework that serves the banking community and enables to perform inter-banking transaction easily and to minimize the technological costs.	Community cloud deployment model and SaaS
Designing CC arch for bank industry: Dashen	Ethiopia	2019	The study is applied in Dashen bank.	CC architecture
Enhanced cloud adopt FW for finan: bank, Kenya	Kenya	2020	The study develops an enhanced cloud adoption framework that guides CC adoption in the FI sector and tests the performance of the framework.	Explanatory and case study research designs
A cloud comp adopt FW for financial svc instit in SA	South Africa	2015	The study examines ways in which South African financial service providers can increase the rate of adoption of CC services, by developing a framework for medium-sized financial organisations to assess the feasibility of their financial services for the adoption of cloud computing.	Technology Organisation Environment Framework (TOE)
Customer pers. On adoption of CC in banking	Malaysia	2016	The study considers the financial enterprise bank sector adoption by considering the adoption strategy in customer perspective.	TAM-diffusion theory model (TAM-DTM)
View on CC in banking sec	India	2014	The study views the benefit of CC adoption in business model of financial enterprise bank sector.	Cloud services model
Cloud Computing in Banking Systems	India	2014	The study discusses the bank new channels and products development, the featuring of adaptation in technological infrastructure and the changes made to achieve strategic positioning in terms of digital CC.	Cloud deployment model
KIET FW for CA: Indian bank	India	2018	The study proposed a framework for Indian banking sector have strong regulatory framework based on diffusion theory for CC adoption, also author implement this framework in reality with high percentage of success.	Diffusion theory
CC technology– Digital transformative solution for banking industry	India	2020	The study compares between the traditional banking processes and the advance technology of cloud computing for banking industry. Results show the advantages of cloud computing especially for these fields: micro banking, modernization, and mobile applications.	N/A
Goal-oriented requirement engineering method	UK	2011	A framework that is utilized for users to trace user requirements and trade-offs for CC adoption.	Goal-oriented requirement engineering method
Romanian i.nt bank market from the pers. of CC services.	Romania	2013	The study analysis the Romanian Internet banking market and compare some of the most popular Internet banking platforms. The result represents SaaS as a type of cloud computing service that suits bank deployment.	Cloud services model
Use by banks of CC: An emp study	EU	2016	The study summarizes how cloud computing adoption in the bank sector is restricted to regulators, as well as how cloud providers affect the CC adoption in banks.	N/A
A strategic framework for decision-makers	USA	2012	This framework perform initial planning, determines enterprise capabilities and vision, determines Target architecture and enablers, performs Gap analysis and transition planning, performs implementation planning, and Governance	Fine-Grained Security Model (FGSM)
The improved CC adoption FW to secure services	USA	2015	The study provides an improved CC Adoption Framework V1.1 (CCAF 1.1), which emphasizes the security policies, recommendations, techniques, and technologies to be updated.	Enterprise cloud adoption strategy

Noticeably, the research works are categorized based on their geographical location employment and the frameworks, methods, models, or strategies applied in the CC adoption. For example, five studies were found in the middle east region and Africa (MENA), such as Egypt, Iran, Ethiopia, and Kenya, while seven studies were found in Asia including four in India and one in Malaysia. Two studies were found in Europe, one of which is in Romania, while one study was found in the USA.

There appears many models/ methods/ frameworks to choose from, however, most studies don't provide holistic frameworks towards CC ADOPTIONfor FI. Also, most proposed solutions are not evaluated and tested in reality. Moreover, some studies consider specific concerns such as security of the cloud, importance of CC, and many other areas of CC, but the CC adoption. Other cases view the enterprise from a different aspect not from EA view or use other frameworks development tools that give different results, other than that there is some comparison between traditional processes with advanced technology in banking without measuring the effort of the suggested/ proposed framework. Finally, most of these studies are utilized outside of the GCC region.

Speaking about the CC adoption in Bahraini FIs, Adwan (2019) advocates that according to the CC strategic plan of the kingdom of Bahrain government 2030 vision, governmental and non- governmental institutions are obliged to adopt CC in their businesses. Adwan (2019); Ali, (2020); Hafezi and Zolait (2019) advocate that the GCC countries show interest in CC adoption especially in KSA. However, the CC adoption is not including the FI. This is due to data collecting limitations, sensitivity, and confidentiality of data that abide by the restricted rules and regulations. Moreover, each Section/department of the FI needs authority or permission to get information. Most institutions prefer using local resources instead of cloud-oriented ones. Therefore, CC adoption strategies are rare in the FI

sector in comparison to other sectors. By introducing Amazon cloud services recently in Bahrain, variant institution opportunities for cloud computing adoption have emerged. Information and government authority (IGA) of the kingdom of Bahrain view eGovernment first in cloud transformation. Alternatively, Table 2.10 summarizes the frameworks, methods, or models applied in the CC adoption in the previous scholarly works. Comparing between theories and factors related to CCA, there are no specific methodology to be used, most theories depend on the intention to adopt CC, the actual usage of CC, The adoption decision of CC.

Table 2.10 Summary of CC Adoption models, frameworks, or methods

Model/FW/Method	Mechanism summary	How it is different than EA
Goal-oriented requirement engineering method	A framework that is utilized for users to trace user requirements and trade-offs.	This framework lacks the Business, Information Systems, and technology architectures.
A strategic framework for decision-makers	This framework perform initial planning, determines enterprise capabilities and vision, determines Target architecture and enablers, performs Gap analysis and transition planning, performs implementation planning, and Governance	The CC adoption strategy is not aligned with the TOGAF framework.
CC architecture	A research design architecture that focuses on reducing the need for labor to manage the IT infrastructure while enhancing the uses of technology.	These research works are not relevant to EA in terms of investigating and exploring the Cloud computing environment and describing the CC architecture. They may assess effectiveness and benefits gained from cloud to FI by Comparing on resource and cloud however lacking a deep understanding of EA.
Explanatory & CS research design	A research design that guides for CCA testing in the cloud environment to measure the performance based on a suggested framework.	
Cloud deployment model and SaaS	Cloud deployment is a process that involves deploying an application through a platform or infrastructure or software as a service, these studies suggested SaaS as the best of other deployment models.	
Cloud services model	This research views the benefit of CCA in the business model of FI in the bank sector.	
Static Comparison	Comparison method between on promise cloud computing vs on resources in terms of reducing cost-reducing power consumption.	This theory explains the theoretical side of adoption but lacks a practical stepwise framework
Diffusion theory	The concept of diffusion of ideas explains how an idea or technology can be spread among various people and groups.	
FGSM	Fine-Grained Security Model is CCAF which focuses on security.	This framework focuses on security-wise dimension only while CCAFF considers five other measurement parameters
TAM-DTM	The technology acceptance model is a theory that explains how technology users come to accept and use it. The concept of the acceptance model states that the main factor that influences people's use of technology is their behavioral intention.	This theoretical model considers the technology acceptance in its abstract format while CCAFF is capable of practically adopting cloud-based technologies.

Speaking about few most famous theories including, the technology-organization-environment (TOE) framework that explains the innovation process in the context of an organization, TOE considers three contexts that influence the adoption of innovation by an organization these are: the technology, the organization, and the environment context. Organizational context refers to the descriptive characteristics of an enterprise such as: enterprise size, management structure, degree of centralization, and quality of human resources, moreover the environment context also includes market elements, competitors, regulatory environments, and government policies. The essential variables that influence the adoption of cloud services in TOE are top management support, and IT competence, competitive pressure, and government support.

Moving to Diffusion of Innovation (DOI) that seeks to explain how, why, and at what rate new ideas and technology spread, the new idea spread depends on: the innovation itself, adopters, communication channels, time, and the social system. The essential variables that influence the adoption of cloud services in DOI are technical characteristics of relative advantage, complexity, compatibility, observability, and trialability. In addition to TOE and DOI, institutional theory (INT) defines different institutional pressures, such as the coercive pressure, normative pressure, and mimetic pressure. Institutional pressure has proven to be an essential determinant of innovation adoption.

There are further theories as listed in Table 2.9 including, Technology acceptance model (TAM) which is an information systems theory that models how users come to accept and use a technology. Resource dependence theory (RDT) that studies how the external resources affect the behavior of the organization. The essential variables that influence the adoption of cloud services in RDT include Interdependence factor, important of resource, resource control. Table 2.10 summarizes the utilized

mechanism Model/FW/Method in the comparative analysis to measure the similarity and dissimilarity to EA perspective.

2.7 Summary

This chapter provides a comprehensive overview of the current state of the research. As discussed previously using SLR techniques, going through background studies to explore and present the current statement of the study problem. Starting with CC information technology, the cloud facts such as type, model, characteristic, advantages, and disadvantages have been debated. next was an explanation of FI, passing through standard definition and different types, moreover, display the importance of this field. gradual from FI to banks sector, then overly types of bank, this present the reason of choosing FI over other sectors. after that the need of EA and EA properties demonstrate, furthermore a comparison between variant framework development tools that show TOGAF perspective over other frameworks. Finally, before starting developing a new framework CC adoption strategy for banking sector using adm TOGAF tool, a comparative study is applied globally and locally, this state current Bahraini FI CC adoption requires to congress business objectives, the methodology is covered in Chapter 4.

Chapter 3

The Conceptual Model

3.1 Introduction

This chapter addresses the conceptual model of the Cloud Computing Adoption Framework (CCAFF) for the Financial Industry (FI)- Banking sector, in the Kingdom of Bahrain from the perspective of Enterprise Architecture (EA). This chapter is typically composed of three Sections. Section 2 introduces the conceptual model of the CCAFF, at which the architectural baseline (AS-IS) and target (TO-BE), a discussion of an ECAS all along with the alignment of TOGAF and ECAS are thoroughly investigated and provided. Section 3, however, concludes the chapter.

3.2 The conceptual model

Meeting the objective of the research study, a CCAFF is developed by 1) utilizing a tailored version of TOGAF and 2) aligning TOGAF with a tailored version of enterprise cloud adoption strategy (ECAS) by Isom and Holly (2012).

On one hand, Rouhani et al (2013) advocate that TOGAF acts as a general-purpose framework for enterprise architecture development that is developed to meet different stakeholders' requirements at which it embraces a set of EA views. This architectural representation articulates the baseline/future business states and explains how architecture is represented and what it is composed of (The Open Group, 2018). This will be discussed in Section 3.2.1 and Section 3.2.2. On the other hand, ECAS as proposed by Isom and Holley (2012) is needed by enterprises to plan for governing cloud adoption strategy as it ensures appropriate development with proper controls for progression with business continuity, and upon execution

governs implementations so that cloud projects are in alignment with enterprise strategy.

Consequently, the integration between TOGAF and ECAS in a proposed CCAFF framework is meant to develop a comprehensive framework for CC adoption of the Bahraini FI sector as depicted in Figure 3.1 and further explained in the following Sections.

To migrate FI-01 from AS-IS state to TO-BE state, EA development method is applied to utilize the business, information system, and technology architecture. In addition, for both of the implantation governance phase and architecture change management phase, Delphi technique is applied to evaluate the framework which gurantees that CCAFF has achieved the goal in terms of ease of use, usefulness, decision-making support, comprehensiveness, time efficiency, and usage intention.

3.2.1 The Baseline and Target Architecture states

According to The Open Group (2018), eight TOGAF phases outline the current state “AS-IS” of the enterprise, including the Preliminary phase, Architecture Vision phase, Business Architecture (BA) phase, Information Systems Architecture (ISA) phase, and Technology Architecture (TA) phase. However, the remaining phases outline the target state “TO-BE” of the enterprise, including Opportunities and Solutions, Migration Planning, Implementation Governance, and Architecture Change Management.

The Preliminary (Phase 0) is the preparation stage that defines the initial actions required to understand the enterprise model to help develop the new architecture, by answering standards enterprise questions. The preliminary phase is important and necessary to start developing EA. The questions asked collects related information regarding the existing workflow and daily operations, policies, and procedures understand the business strategy, moreover, identify the profile of the institution.

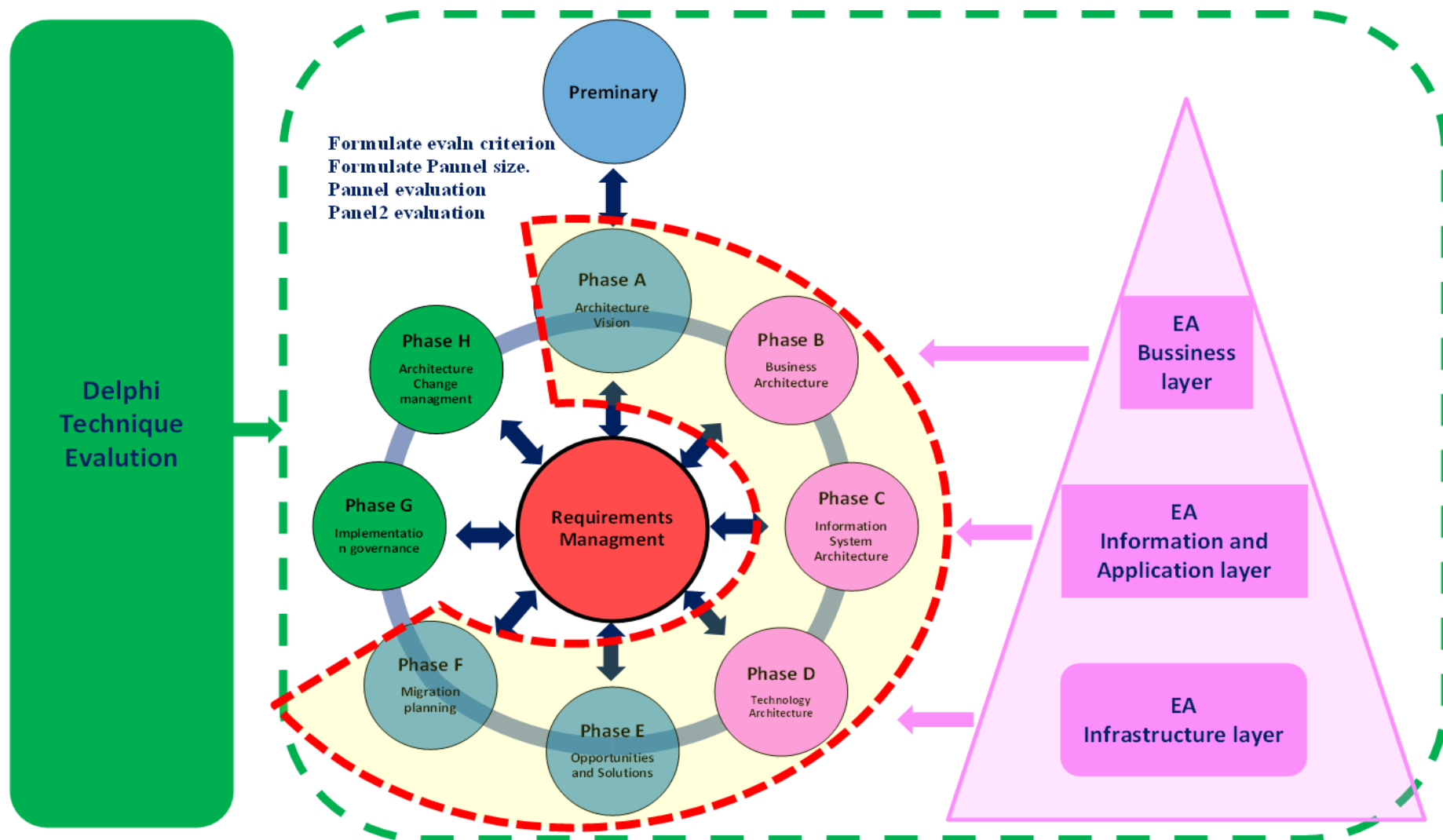


Figure 3.1 The CCAFF Conceptual model

The Architecture Vision (Phase A) begins with the existing EA to understand the evolutionary development cycle and capabilities, while the business principles, goals, strategy, and other factors are considered. Also, ensure that components of the BA are defined and identified clearly, stakeholders and objectives are addressed. In addition, the main business constraints are articulated. Lastly, formal approval is obtained to proceed with the EA project.

The Business Architecture (Phase B) shows the way that enterprise executes business. The views comprise different business aspects such as Business Strategic Objective (BSO), Organization Structure, Business units (BU), Business Actor and Role (B A/R), Business Services (BS), Business Function (BF), and Business Processes (BP). To reach this view, a set of data collection comprised of the BSO ID, BSO Name, and BSO Description. Furthermore, the organization structure contains BU and A/R views, going into detail about describing each business unit and related roles or actors whether internally or externally. The view of Business Service (BS) describes the end services that each business unit provides which keeps in line with both the BF and BP, to achieve this view, the collected data contain BS ID, BS Name, and BS Description. Next, the view of Business Function (BF) describes the business units that carry out the business services to meet the BSO, all business functions must be justified, to achieve this view, the collected data contain BF ID, BF Name, BU ID, and BS ID. Finally, the view of Business Process (BP) describes the business processes needed to deliver the functions, while a set of functions deliver the end services, to achieve this view, the collected data contain BP ID, BP Name, BP Description, BF ID, and BS ID.

The Information Systems Architecture (Phase C) represents the data and application systems that support the BA of the enterprise. The main application systems should be defined that support the business and

the data that interact between these applications. That the capabilities of the application are referred to the used technology (the infrastructure). By listing all the used applications these collected data include information about the applications such as Application ID, Application Name, Application Description, Application Vendor, and Application Origin. Second, the BA connects the ICT applications and data layer by matching the Bus, A/Rs, BFs, BSs, and BPs with the used application. The collected data contain Application ID, BU ID, A/R ID, BS ID, BF ID, and BP ID. Thus, key data helps in view the Application Process (AP) which deliver the identified services in term of view application priority.

The Technology Architecture (Phase D) shows the enterprise used technology (infrastructure) that should be aligned with the data and application component and should support the vision and mission of the enterprise business. The Technology Architecture TA is comprised of hardware, software, and network. The collected data contain Tech ID, Tech name, App ID, and App Name.

The Opportunities and Solutions (Phase E) is the initial stage for the creation which leads to implementation and migration plan which is stated in phase F later on. At this phase, an overview of the future opportunities is identified taking into consideration the benefits and the degree of impact to the enterprise. Opportunities are identified from the gaps in phases B, C, and D based on the enterprise capabilities and business objectives. Opportunities can be formed in many terms such as new technology, new stakeholder, new investment, new applications, new models, or improvements to the current situation. Therefore, by identifying new opportunities new solution is designed. the opportunities and solutions phase views a clear vision for the future update to the existing architecture. Much more Proper planning helps in developing a better strategy for migration and implementation plan.

The Migration Planning (Phase F) is the final phase before the actual implementation of the architecture. the proposed strategy by Isom and Holley (2012) is Enterprise Cloud Adoption Strategy (ECAS) matches this phase to provide the migration plan for the CCA. Based on Isom and Holley (2012) adoption strategy, the strategy of cloud adoption lifecycle is composed of six phases as demonstrated in Table 3.1.

The implementation Governance (Phase G) presents the actual architecture implementation, which is adapted according to the situation, more details addressed in this phase will gain the actual architecture implementation. The most important part of this phase is to keep monitoring the implementation effectiveness and ensure proper controls are applied to minimize the risks at the lower level. The benefit of these monitoring actions is to create a learned list, which can be used in post-implementation as primary data for future development and improvements.

The Architecture Change Management (Phase H) provides feedback for the migration and implementation phase and describes the cloud services' actual delivery, this ensures that the EA achieves its business objectives, and also EA is adapting with the latest development in cloud technologies. Further, this phase identifies whether the changes have intended to create new capabilities or enhance the current situation. Figure 3.2 summarizes the TOGAF phases. The expected outcomes are organized and standards are updated to maintain proper risks assessment to EA changes. Moreover, risks associated with the new changes are analyzed.

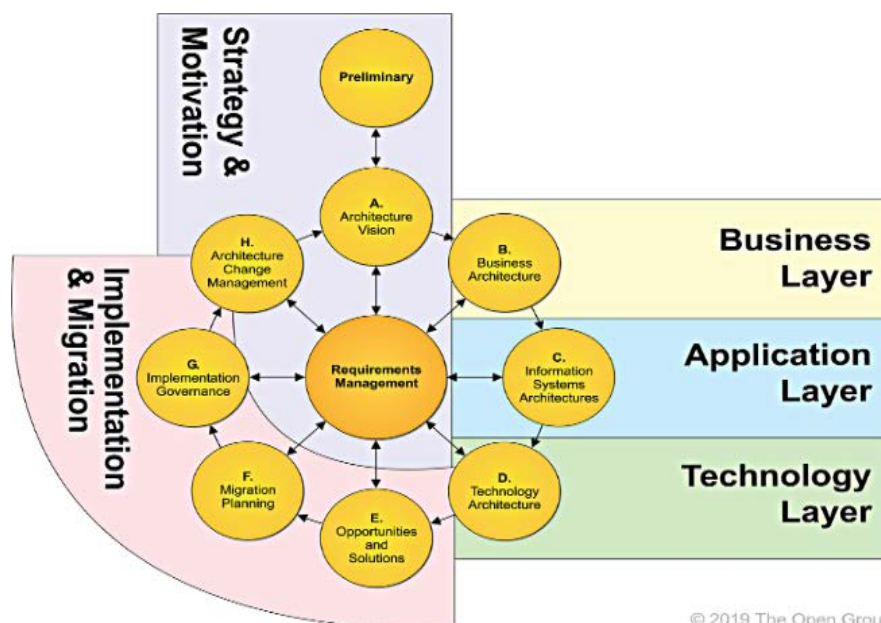
3.2.2 The Enterprise Cloud Adoption Strategy (ECAS)

Integrative with Phase A until Phase F as discussed in Section 3.2.1, the insights of Isom and Holley (2012) as represented by ECAS are tailored and complemented herein to provide a holistic migration plan for the

enterprise cloud adoption (CCAFF). The strategy is composed of six phases of the cloud adoption lifecycle as demonstrated in Table 3.1.

Table 3.1 Enterprise cloud adoption strategy phases

	Phase Name	Phase explanation
1	Initial planning	High-level analysis exploring the business objectives and how adopting a cloud can fit with the business strategy is executed. There are several key outputs from this phase, i.e. the business model in which the current capabilities and values are explored to find the necessary improvements, a high level plan of projects including the project owners, and the expected business outcomes to be realized in a due time.
2	Enterprise capabilities and cloud vision	Understanding of the overarching abilities needed to support the cloud implementation. Several key work artifacts from this phase are the vision statement of cloud adoption; adoption pattern; a business case which provides information about plausible costs and benefits, value propositions and ROI for cloud; and a governance model.
3	Target architecture and cloud enablers	Requirements influencing the cloud adoption decisions are explored in greater details. There are three areas relevant for the updates in the existing EA in relation to the cloud adoption: 1) the business architecture, 2) the information system, and 3) technology and infrastructure architecture.
4	Gap analysis and transition planning	Gap analysis is necessary to help the comparison of company's actual performance with its potentials and thus to know the shortfalls of current situation. A transition plan is the preparation for a change and for this, a sufficient understanding on the change management needs is essential to achieving the benefits. The key deliverables for this phase are a change management plan which addresses how to organize the people and the organization from its current state to the future state, and a cloud adoption roadmap which provides a list of actions for realizing the cloud adoption strategy.
5	Implementation planning	Arrangement with the cloud provider is made and contract is signed to commence the necessary works. The key activities of this phase are the SLA arrangement and the formulation of the integration requirements.
6	Governance	A continuous activity which underlines the whole processes of cloud adoption. The governance is expected to provide a strategic direction which defines how the cloud adoption will be performed, managed and controlled.



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Figure 3.2 TOGAF Process Phases (Source: TOGAF 9.1)

3.2.3 TOGAF-ECAS alignment and CCAFF

This Section discusses the compatibility between the TOGAF framework and the ECAS. Table 3.2 displays the mapping between these two components, while Table 3.3 elaborates the final format of the CCAFF.

Table 3.2 The mapping between TOGAF and ECAS (Adopted: Utomo, 2014)

The Enterprise Cloud Adoption Strategy	The TOGAF Phases								
	Phase 0	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F	Phase G	Phase H
Stage1: Initial planning		X							
Stage2: Enterprise capabilities and cloud vision		X							
Stage3: Target architecture and cloud enablers			X	X	X				
Stage4: Gap analysis and transition planning						X			
Stage5: Implementation planning							X		
Stage6: Governance		X	X	X	X	X	X	X	X

Table 3.3 The CCAFF phases description

The Preliminary phase (Phase 0): preparation Stage of the initial actions required to understand the enterprise model to develop the new architecture (CCAFF). IT comprehends the general operational and policies in an FI-01.
The Architecture vision (Phase A): describes the scope of new architecture. the stakeholders, their objective, and the creation of architecture vision. Integrated with ECAS Stage1 in envisioning new opportunities when cloud computing is implemented. While Stage2 provides an understanding of overarching abilities needed to support the implementation of cloud, and enterprise capabilities. Moreover, define the business principles, business goals, business strategy and business constraints.
The Business, Information system, Technology Architectures (Phases B, C, D): are concerned with the development of EA. These three phases are aligned with ECAS Stage3 at which BA, ISA, TA shows the way that enterprise executes business.
The Opportunities solution (Phase E): is identified from the gaps in phases B, C, and D based on the enterprise capabilities and business objectives. Opportunities formed in many terms such as: new technology, new stakeholder, new investment, new applications, new model, or improvements to current situation. this mapped with ECAS Stage4 at which it identifies the shortfalls between the actual and potential performance, and the creation of a change management plan.
The migration plan (Phase F): create a detailed plan for real implementation and migration from the baseline to the target architectures transformation. It's related to ECAS Stage5 , the implementation planning and migration processes are carried out Therefore, reviewing the desired requirements from the targeted architecture is essential to provide an input for vendor's.
The Implementation governance and Architecture change management (Phase G & H): ensure that the delivery of transition plan complies with the defined architecture, and provide a continuous monitoring over the changes to the architecture. monitoring keeps the implementation effectiveness, and ensure proper controls are applied to minimize the risks at lower level, provides feedback for the migration and implementation phase and describes the cloud services actual delivery. governing standards are updated to maintain proper risks assessment to EA changes, these risks associated with the new changes are analyzed to compare between previous architecture with the new one. Which can help in providing solution for building new business scenarios.

3.3 Summary

This chapter has aimed at explaining the proposed conceptual model of CCAFF in detail dictating the TOGAF phases along ECAS stages. The first stage was developing the framework using a tailored version of TOGAF which was proven to be the best matching framework for this purpose. The second stage was describing the AS-IS and TO-BE phases. In addition to the application of a tailored version of the ECAS strategy for the adoption, a comparison was performed between multiple models, and selection of the suitable one was achieved by aligning the ECAS with TOGAF to develop the CCAFF framework.

Chapter 4

Research Methodology

4.1 Introduction

This chapter summarizes the following undertaken procedures for this research with reasons for selecting these approaches. The research methods used for obtaining required data to reach the main research objective. The typical layout of this chapter is composed of eight Sections. Section 2 justifies and describes the Design Science Research Method (DSRM) for the CCAFF and report development. The approach represented by the qualitative research paradigm is clarified in Section 3. Moreover, the following research strategy represented by a holistic single case study is described in Section 4, while the data collection tools represented by semi-structured interviews are demonstrated in Section 5. The analysis techniques represented by Pattern matching are explained in Section 6, while validity and reliability tests are introduced in Section 7 respectively. Lastly, Section 8 summarizes the chapter findings.

4.2 Research strategy

Many research strategies can be applied in qualitative research such as case studies, surveys, action research, experiment. According to the nature of the exploratory study, the most suitable way to understand the organization process, function, services, ... etc. is the case study. That's because it is used to examine the real-life situation. The case study is one of the most popular data collection strategies (Yin, 2011). Normally it is used in answering how and why questions, to rely on multiple sources of evidence, when many more variables of interest than data points, also to be

mentioned that Case study demonstrates success based on real results, not just theories.

Following Yin's process, beginning with selecting the case, then identifying and defining the research question. Depicted in Figure 4.1, there are several case study methods. However, this research uses a holistic single-case design to study all FI-01 as a single unit. This selection aims to generalize the framework to be used across any company of the same sector.

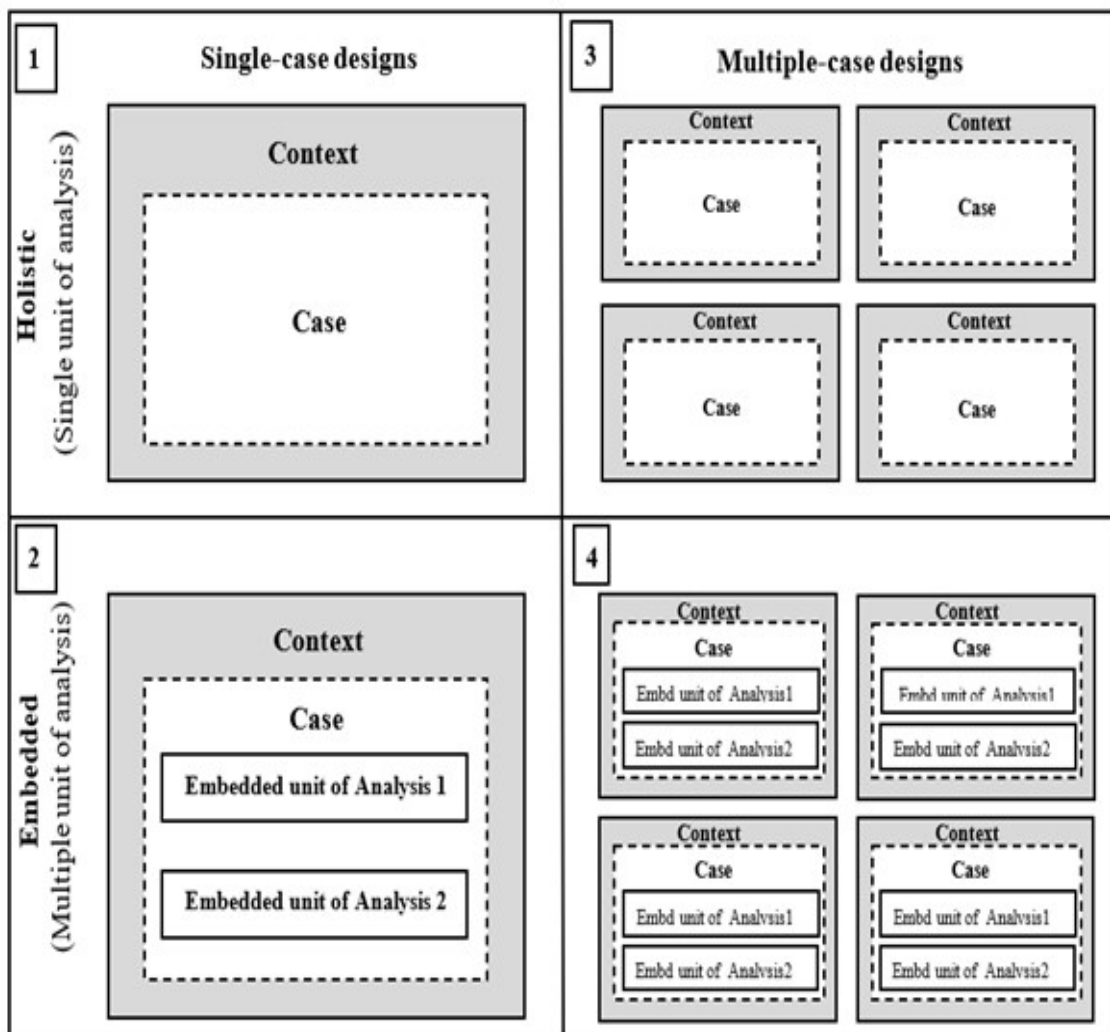


Figure 4.1 Case Study types (Adopted: Yin, 2011)

4.3 Research method and approach

This Section explains in detail the research design methodology. In addition, a detailed description of the applied model and analysis technique will be discussed.

Starting with the main research strategy, the Design Science research methodology (DSRM) will be used to develop and perform an artifact design in practices that could be implemented in reality according to the current enterprise situation. DSRM is a scientific study that is used by people to solve a practical problem or perform an improvement. The artifact has many facets could be either a model, algorithm, IT system, or new technology, these examples have a main common denominator that is tangible, new, original, novel.

The DSRM has six stages starting with the first stage that explicates the problem which could be either a practical problem or knowledge problem. Next stage is the second stage that defines the requirement which probably is either feature/functions or generic qualities. The third stage is designed and develop the CCAFF artifact that describes the component of the proposed framework and solution design. The fourth stage demonstrates the created artifact CCAFF by implementing and testing the case in reality. The fifth stage evaluates the artifact through ex-ante evaluation or ex-post evaluation. The sixth stage communicates the research findings. These stages help gain improvement (development) or solve a problem. As pefer mentioned DSRM process has flexibility option not to go through all stages of activity according to the case, so it could skip the first stage process and begin from the second stage, in addition to that flexibility DSRM process could also skip the first two stages and start performing from stage three.

Because of the design nature of the research, this study uses DSRM as a suitable and relevant methodology. Table 4.1 summarizes the framework of the DSRM based on Peffers et al. (2012).

Table 4.1 The DSRM steps (Adopted: Peffers et al., 2012)

Step	DSRM activities	Activity description	Knowledge base description
1	Problem identification and motivation	What is the problem? Define the research problem and justify the value of a solution	Understand the problem's relevance, its current solutions and their weaknesses
2	Define the objectives of a solution	How should the problem be solved? In addition to general objectives such as feasibility and performance, what are the specific criteria that a solution for the problem defined in step one should meet?	- Knowledge of what is possible and what is feasible. - Knowledge of methods, technologies and theories that can help with defining the objectives
3	Design and development	Create an artifact that solves the problem Create constructs, models, methods or instantiations in which a research contribution is embedded	Application of methods, technologies and theories to create an artifact that solves the problem
4	Demonstration	Demonstrate the use of the artifact Prove that the artifact works by solving one or more instances of the problem	Knowledge of how to use the artifact to solve the problem
5	Evaluation	How well does the artifact work? Observe and measure how well the artifact supports a solution to the problem by comparing the objectives with observed results	Knowledge of relevant metrics and evaluation techniques
6	Communication	Communicate the problem, its solution, and the utility, novelty and effectiveness of the solution to researchers and other relevant audiences	Knowledge of the disciplinary culture

The first step is Problem identification and motivation clarification, by identifying the problem of the research with the concepts and theories, this highlights the research significance by justifying and defining the statement of the problem with the proposed solution. The research problem must be identified to propose an optimized solution that will lead to the artifact's development (Peffers et al., 2012). This step was presented in Section 1.2 of the research study.

The third step of the DSRM is to design and development the artifact (CCAFF), at this step wide range of techniques will be applied based on enterprise architecture and functionality to develop the artifact, these techniques include design, analysis, coding, and modeling to guide

building the artifact (Peppers et al., 2012). this step is presented in the Section of the research.

The fourth step of the DSRM is the demonstration, this represents the solution that solves the proposed problem (the artifact), in this step, several research methods such as case studies, simulation, experimentation, participated research, questionnaire, experimental, or action research can be applied to demonstrate the benefits of the artifact (Peppers et al., 2012). The demonstration is used to verify the effectiveness of the proposed solution that solves the research problems. The demonstration step carried out the validation expert interviews as presented in chapter 5 and 6.

The fifth step of the DSRM is the evaluation, which should compare the actual outcomes of the artifact with the research objectives together. This step includes a discussion of the practical outcome that is come from the demonstration step feedback. the evaluation step is respectively important because implementation depends on the requirements. In this case study, the Delphi technique is applied to evaluate the developed artifact CCAFF, which is presented in chapter 5 of the research.

In addition, the communication step is the sixth step of the DSRM process at which the importance and effectiveness of the artifact to the researcher problem are communicated, the identified problem and the proposed solution are documented for publication, excluding any restricted or sensitive information that the enterprise does not want to declare.

Speaking about the research approach, any active research should follow a research paradigm such as qualitative or quantitative research. Thus, qualitative research found suitable and is used to generate data for development and to understand the current situation issue in depth. Table 4.2 demonstrates the multiple data collection techniques that can be applied depending on the study strategy.

Table 4.2 Overview of variant study strategies (Source:Chism et al.,2008)

Study Type	Strategy	Merriam (2002)	Denzin & Lincoln (2005)	Creswell (2007)	Saunders et al (2009)
Qualitative Studies	Case study	✓	✓	✓	✓
	Action and		✓		
	Basic interpretive	✓			
	Clinical research		✓		
	Critical research	✓			
	Ethnography	✓	✓	✓	✓
	Grounded theory	✓	✓	✓	✓
	Phenomenology	✓	✓	✓	
Quantitative Studies	Archival research				✓
	Experiment				✓
	Survey				✓

4.4 Data collection method

The data collection process has started in FEB 2021, typically multiple techniques from multiple sources have been applied, beginning with primary data source the used method is structured interviews which follow the guidelines of Myers (1997); Myers and Avison (2002). the interview sessions were performed with the IT manager of FI-01, followed by IT department employees. Several Key informant interviews were sorted based on their position as shown in Table 4.3, due to the covid19 pandemic several interview mode has been used for the data collection such as virtual online meeting (zoom and team), phone calls, and e-mails. Template.1 shows the interview questions that have been answered. The secondary data source is from the FI-01 website, banking publisher, and

Table 4.3 The informant profiles table

No.	Department	Position	Interview Mode	Duration
1.	IT	Director	Virtual meeting	1 hour
2.	IT	Infrastructure Systems Engineer	Virtual meeting	2 hours
3.	IT	Developer	Telephone calls	2 hours
4.	HR	Manager	Telephone calls	1 hour
5.	Finance	Operator	Face to face meeting	1 hour

newspaper articles.

According to Lin and Wu (2007), the open-ended questions with semi-structured interview help the interviewees to explain their point of

view in more detail, which open the area for more useful discussion. The semi-structured interview shows the understanding level of the participants and provides more clarification that also ensures gathering valuable information. using designed templates to record the needed data, three areas have been discovered in this interview, The first area is the FI-01 vision, mission, and core competencies, as well as the business units, business services, business functions, and business processes, whereas the second area comprises of application and data ICT, while the third area is comprising of the infrastructure of FI-01, furthermore, other sources such as brochures, FI-01 official web site, Bahrain Association of Banks (BAB) was investigated also.

4.5 Data analysis method (techniques)

Yin (2011) indicated five analysis techniques to qualitative data including, pattern matching, explanation building, time-series analysis, logic models, and cross-case synthesis. Pattern matching is found the most suitable technique to analyze a case study to analyze the FI-01 case as will be discussed in Chapter 5. The explanation building technique and Time-series analysis are avoided as the case study isn't descriptive and doesn't deal with any time series data. The logic model technique and Cross-case synthesis aren't suitable for the current case due to the absence of events of repeated cause & effect patterns and are not a multiple case study.

4.6 Quality tests

Demonstrated in Table 4.4, Rowley (2002) recommends performing four tests and corresponding tactics to ensure the quality of the procedures and rigorous research findings. These include construct validity, internal

and external validity, and reliability, considering that only three are applicable in this study.

Table 4.4 Case study design quality test (Source: Rowley, 2002)

Quality Test(s)	Purpose	Research Phase	Case Study Tactic(s)
Construct validity	Exploratory	Data collection	Use multiple sources of evidence (Triangulation)
			Establish chain of evidence
		Composition	Have key informants review draft case report
Internal validity	Explanatory	Data analysis	Do pattern matching
	Causal study		Do explanation building
			Do time series analysis
External validity	Exploratory	Research design	Use replication logic in multiple case studies
		Data collection	Use case study protocol
Reliability	Exploratory	Data collection	Develop case study database (Chain of evidences)

4.6.1 External validity (research design & data collection)

Three criteria were found of high importance to the success of the case study (FI-01). These include research strategy, generalization of the findings, case selection, and data collection techniques.

According to Hancock and Algozzine (2006), a qualitative case study was found to be an appropriate research strategy for this study as the business nature of the Bahraini FI-01 isn't clear to the researcher and that qualitative collection of the data (i.e., semi-structured interviews and documents analysis) was analyzed qualitatively (i.e., statistically).

According to Yin (2011), generalization of the findings was achieved based on the case study type at which a single- holistic case study approach (i.e., FI-01) for data collection was employed. Also, the criterians of case selection were satisfied by 1) FI-01 was the most welcoming bank, 2) the CEO demonstrated high commitment and seriousness to the study, 3) the CEO demonstrated high interest in the quality of findings of the study, 4) the CEO answered the interview questions (i.e., primary source) transparently and provided us with requested materials including, organization structure and ICT applications lists, procedures and documentary written materials (i.e., secondary source). Moreover, for data

collection, a case study protocol as in Table 4.5 was developed to demonstrate the research objectives & questions, etc.

Table 4.5 Case study protocol document (Source: Rose et al., 2014)

No	Title	Document content																																													
1	View	This case study aims to collect and analyse data related to EA includes: (BA, ISA, TA) to develop and evaluate a CCAFF as an artefact for the CCA to FI-01 bank.																																													
2	Case Study Procedure	<table><tr><th>No</th><th>Steps</th></tr><tr><td>1</td><td>Choosing the suitable research strategy.</td></tr><tr><td>2</td><td>Select an organization to apply the case study.</td></tr><tr><td>2.1</td><td>Request for a meeting and get response and submit official interview letter.</td></tr><tr><td>3</td><td>Prepare the questions for data collection in the interview session</td></tr><tr><td>3</td><td>Apply the TOGAF ADM framework.</td></tr><tr><td>4</td><td>Record the collected data in a database (word table format).</td></tr><tr><td>5</td><td>Develop the CCAFF for the FI-01.</td></tr></table>	No	Steps	1	Choosing the suitable research strategy.	2	Select an organization to apply the case study.	2.1	Request for a meeting and get response and submit official interview letter.	3	Prepare the questions for data collection in the interview session	3	Apply the TOGAF ADM framework.	4	Record the collected data in a database (word table format).	5	Develop the CCAFF for the FI-01.																													
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3	Case study Questions	<table><tr><th>Part</th><th>Question</th></tr><tr><td>1</td><td>Participant profile: - What are the units/departments of the organization?</td></tr><tr><td>2</td><td>What is the current Business architecture of FI-01? - What are the Business Strategic objectives of FI-01? - What are the Business Units& Actors/Roles of FI-01? - What are the Business Functions of FI-01? - What are the Business Services of FI-01? - What are the Business Processes of FI-01?</td></tr><tr><td>3</td><td>What are the ICT Applications used of the FI-01? - What are the ICT Applications used in FI-01? - What are the ICT Applications used in FI-01 in term of organization units/departments? - What are the ICT Applications in term of business services in FI-01? - What are the ICT Applications in term of business Functions in FI-01? - What are the ICT Applications in term of business Processes in FI-01?</td></tr><tr><td>4</td><td>What are the IT infrastructures component of FI-01? - What are the IT infrastructure current strategic objective of FI-01? - What are the IT infrastructure future strategic objective of FI-01? - What are the IT infrastructures that support current ICT Applications?</td></tr></table>	Part	Question	1	Participant profile: - What are the units/departments of the organization?	2	What is the current Business architecture of FI-01? - What are the Business Strategic objectives of FI-01? - What are the Business Units& Actors/Roles of FI-01? - What are the Business Functions of FI-01? - What are the Business Services of FI-01? - What are the Business Processes of FI-01?	3	What are the ICT Applications used of the FI-01? - What are the ICT Applications used in FI-01? - What are the ICT Applications used in FI-01 in term of organization units/departments? - What are the ICT Applications in term of business services in FI-01? - What are the ICT Applications in term of business Functions in FI-01? - What are the ICT Applications in term of business Processes in FI-01?	4	What are the IT infrastructures component of FI-01? - What are the IT infrastructure current strategic objective of FI-01? - What are the IT infrastructure future strategic objective of FI-01? - What are the IT infrastructures that support current ICT Applications?																																			
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3	What are the ICT Applications used of the FI-01? - What are the ICT Applications used in FI-01? - What are the ICT Applications used in FI-01 in term of organization units/departments? - What are the ICT Applications in term of business services in FI-01? - What are the ICT Applications in term of business Functions in FI-01? - What are the ICT Applications in term of business Processes in FI-01?																																														
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4	Data collection matrix	<table><tr><th colspan="4">Data collection techniques and tools</th></tr><tr><th>Data collection technique</th><th>Methods</th><th>Tools (Evidence)</th><th>Rationale</th></tr><tr><td>Primary Source</td><td>- Semi-structured interview - Telephone interview - Virtual meeting</td><td>- Template I - Template II</td><td>- Align the Case with Isom and holy cloud adoption strategy phases. - Align the Case with TOGAF phases.</td></tr><tr><td>Secondary Source</td><td>- Document Analysis - Literature review - Website of the enterprise.</td><td>- Template I - Template II</td><td>- Develop a framework based on current status of FI-01. - Develop the graphical model.</td></tr></table>	Data collection techniques and tools				Data collection technique	Methods	Tools (Evidence)	Rationale	Primary Source	- Semi-structured interview - Telephone interview - Virtual meeting	- Template I - Template II	- Align the Case with Isom and holy cloud adoption strategy phases. - Align the Case with TOGAF phases.	Secondary Source	- Document Analysis - Literature review - Website of the enterprise.	- Template I - Template II	- Develop a framework based on current status of FI-01. - Develop the graphical model.																													
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4.6.2 Construct validity (data collection and composition)

Construct validity for data collection was achieved by linking data collection questions and measures to research questions and propositions

through using multiple sources and a chain of evidence such as 1) Face-to-face interview questions (i.e., primary source), 2) non-standardized interviews by telephone (i.e., primary source), 3) documentary written and website materials including organizational structure and ICT application lists, policies, and procedures (i.e., secondary source). During the composition stage, key informants were allowed to review the draft case study report in the middle of the collection and at the end of the collection procedure to assure its correctness and precision.

4.6.3 Reliability (data collection)

Reliability was claimed through the generation of a case study database (i.e., Business and IS templates) which documented the data collection procedures. Thus, before data analysis, collected data of the interviews, memos, and notes were transcribed, organized, and protected in a database/ filing system (i.e., both printed and electronic) at which Microsoft excel software was employed to develop sheets to manage and organize the collected data by converting it into codes (i.e., coding system) as provided in the associated templates, so data for FI-01 can be easily retrieved and interpreted during the analysis phase.

4.7 Summary

This chapter details the research methodology that is applied in this study which is the DSRM. This research follows a qualitative approach by applying a case study to explore the FI-01 as a holistic single case strategy at which structured interviews were employed to conduct the data collection strategy. In addition, the chapter reviewed the different data sources (primary and secondary) for the data collection at which validity and reliability tests were introduced and applied with different case study tactic(s) to assure high-quality research.

Chapter 5

Analysis and Discussion

5.1 Introduction

This chapter presents the experimental results of the study based on the data obtained from the holistic single Case Study. The representatives of FI-01 describe their business architecture in terms of business units, actors/roles, business end services, business functions that support these services, and business processes that execute these functions. All these data are considered while developing the CCAFF framework for FI-01. In addition to that, the interviewers were requested to explain their ISA in terms of data and available applications w.r.t infrastructure components. Several data collection methods were applied with variant analysis techniques to ensure generating a solid case study design that has value with quality findings. A typical layout of this chapter is composed of six Sections. Besides the introduction in Section 1, Section 2 introduces the data analysis and discussion, and research findings, while Section 3 present the business architecture (BA) in terms of the profile of the FI enterprise, participants profile, the preliminary phase, and the Architecture Vision. In addition, Section 4 discusses the ISA of FI-01 in terms of strategic objectives, applications, findings. next Section 5 discusses the findings of the Technology Architecture (TA) of FI-01 in terms of components related to ISA which links the three layers together. Moreover, Section 6 finds the opportunities and solutions of FI-01, Section 7 presents the migration planning of FI-01 CC adoption, Section 8 introduces the implementation governance and Section 9 informs the Architecture change management. However, Section 10 summarizes the outcomes of the chapter.

5.2 Data Analysis and research findings

Following the data collection of FI-01, the next step was the analysis of the data using the pattern matching method which was provided in correspondence to a developed set of templates, tables, visual matrixes, as well as ArchiMate models. Therefore, according to Ritchie (2013), a pattern matching four-step process includes data indexing, data sorting, data description, and summarizing or synthesizing. First, a data coding index was assigned to each concept identified during interviews. Thus, indexing of the dataset took the format of A.0.0.0.0 referring to the business strategic objectives (SO), as demonstrated in Section 4.2 of the protocol document in Table 4.5 Then, subheadings were given to the concepts under each main heading, identified as A.1.0, 0.0, referring to the BSO id#, etc. Then, giving the next concept the index of A.0.1.0.0 with sub-concepts identified as A.0.2.0.0, etc. We finally recorded numerical codes in the transcripts. Second, data were sorted to assemble text of similar content. Third, data within a category were examined to identify the range of content and dimensions within the theme. Fourth, each theme was created on a thematic chart, and participants were allocated a row in the matrix.

5.3 The Business Architecture (BA) of FI-01

This Section describes the FI-01 in terms of the company profile, the participant profile of the interviewee, the organization structure. The preliminary phase of FI-01 will be discussed which will also include the mission, vision, business objective. The BA consists of several components, to start recognizing these components, many sub-Sections will attend from the general Section to analyze the BA and discuss in detail these components.

5.3.1 The FI-01 profile

A retailer bank (FI-01) was selected according to the provided documents of the interviews and official website. FI-01 was established in 1979 to provide subsidized mortgages for low-to-middle income citizens of the Kingdom of Bahrain, as well as property development activities and facilities management to drive innovation and economic growth. Over Time, FI-01 becomes a facilitator that connects financiers, landlords, developers in a comprehensive ecosystem that is optimized constantly.

Today, FI-01's contribution is to explore smart business models that better support stakeholders. The FI-01 is a Retail Bank type of banking category; it consists of three branches that are distributed across multiple Areas in the kingdom of Bahrain.

FI-01 mission is “Enhance the welfare and empower the Bank’s human capital towards realizing its full potential” and “Lead in benchmarking socio-economic and environmentally sustainable housing developments”. To achieve this mission, FI-01 is seeking to become “Lead the provision of innovative and sustainable housing solutions” as its status on their vision statement. FI-01 has the main core value which is: Integrity, Respect, Ownership, and Innovation.

5.3.2 Participants’ profile

Table 5.1 illustrates the participant profile from various departments in FI-01. This list includes the educational level, work experience, and mode and duration of the interview.

Table 5.1 The Participants’ profiles

Department	Position	Education level	Interview mode	Duration
IT	Director	PhD	Virtual meeting	1 hour
IT	Infrastructure system engineer	Bachelor	Virtual meeting	2 hours
IT	Developer	Masters	Telephone calls	2 hours
HR	Manager	Bachelor	Telephone calls	1 hour
Finance	Operator	Bachelor	Face-to-face	1 hour

The directorate distribution shows that most of the participants were from the IT department (60%). 20% of the participants were directors. Regarding the education level, most of the participants hold bachelor's degrees (60%), however, 20% hold master's degrees, while 20% hold a doctorate. The interviews took 2 hours approx. either by virtual meeting (40%) or via phone calls (40%).

5.3.3 The preliminary phase of FI-01

This is the initial phase of the architecture vision which delivers the Statement of Architecture Work (SOW), which prepares the FI-01 for the architecture plan and establishes the development. The phase begins with the R&D department coordination, by submitting the research proposal to the FI-01 committee, which will be reviewed to get approved, then data collection started with documents and interviews to gather information about the existing workflow, daily operations, and policies.

5.3.4 The Architecture Vision of FI-01

Addressed in Chapter 3, Table 5.2 illustrates the TOGAF's official steps of developing the architecture vision of FI-01. Performing these steps will establish the Architecture vision of FI-01 as the preliminary phase.

5.3.5 The Business Strategic Objectives (BSO) of FI-01

One of the main TOGAF requirements is to determine the business strategic objectives that must be aligned with the IT strategic objectives. Interviewees' responses demonstrate the Business Strategic objectives of FI-01 and the answers are demonstrated in Table 5.3.

5.3.6 The Business Units (BU) of FI-01

One of the most important parts of BA is to understand the organizational structure, Figure 5.1 visualizes the structure of FI-01, this

information is required while developing the framework CCAFF. The responses are demonstrated in Table 5.4.

Table 5.2 Steps and tasks performed to generate the architecture vision

Bus Obj id	Business Objective	Business Objective Description
BSO 01	Provide Social Responsibility	A unique social role to provide subsidized mortgages for low-to-middle income citizens of the Kingdom of Bahrain, as well as engage in community-related property development activities and facilities management.
BSO 02	Provide Service Excellence	To offer products and services that exceed the expectations of our customers.
BSO 03	Professional Management	To develop a competent and innovative management team with high standards of integrity and professionalism.
BSO 04	Enrich Employees	To develop a competent and skilled team through continuous comprehensive training programs.
BSO 05	Improve the Digital Customer Experience	Installing digital banking technology to improve front and backoffice operations.
BSO 06	Meet Regulatory and Compliance Requirements	Adhering all regulation prescribed by central bank of Bahrain.
BSO 07	Enhance Security and Authentication	Strengthen the overall Information Technology security.
BSO 08	Replace Components of the Core Operating System	Replace old systems with systems that can support the bank, and the customers.
BSO 9	Improve Business Processes	Process redesign to achieve paperless processes, improved workflow tools, and task management.

Table 5.3 The Business Strategic Objectives (BSO) of FI-01

No.	Steps	Performed tasks
1	Establish the EA project	Explain the enterprise specific procedures
2	Identify stakeholder, concerns, and business requirements	List the stakeholders of FI-01 based on the formal structure There were no concerns to affect EA Business required groups from different unit for handling the architecture development
3	Confirm and elaborate business goals, business drivers, and constraints	Goals and strategic objectives that drive FI-01 Lack of EA knowledge is the business constraints
4	Assess readiness for business transformation	According to interviews with the IT manager, FI-01 is readiness to cloud adoption in recent plan of the IT strategic objectives.
5	Define scope	Develop and evaluate an artifact CCAFF framework for FI-01 from EA perspective
6	Confirm and elaborate architecture principles	There are four main principles: General principles: efficient use of resources, maximize the benefits, reduce complexity, enhance sustainability, manage decision making in quick and accurate way. Business principles: align BA with strategic goals, responsible to IT, understand business process, manage long-term business-driven capabilities Data principles: data control under authorized access, data governance, data availability and recovery, data security Application principles: avoid duplicated applications, choose open solutions over commercial, buy or reuse before build, support new technology, cloud first, independent platform to deliver application through local network and internet, define and design solutions, scalability Technology principles: technology independence, technology lead, compatibility, manage the requirement-based changes

5.3.7 Actors/Roles (A/R) of FI-01

The interviewer from the HR directorate was asked about the Business Actors/Roles of FI-01. The answers are demonstrated in Table 5.5. The

actors/roles were classified based on the Business unit of FI-01. Each actor/role was recognized and assigned Id numbers.

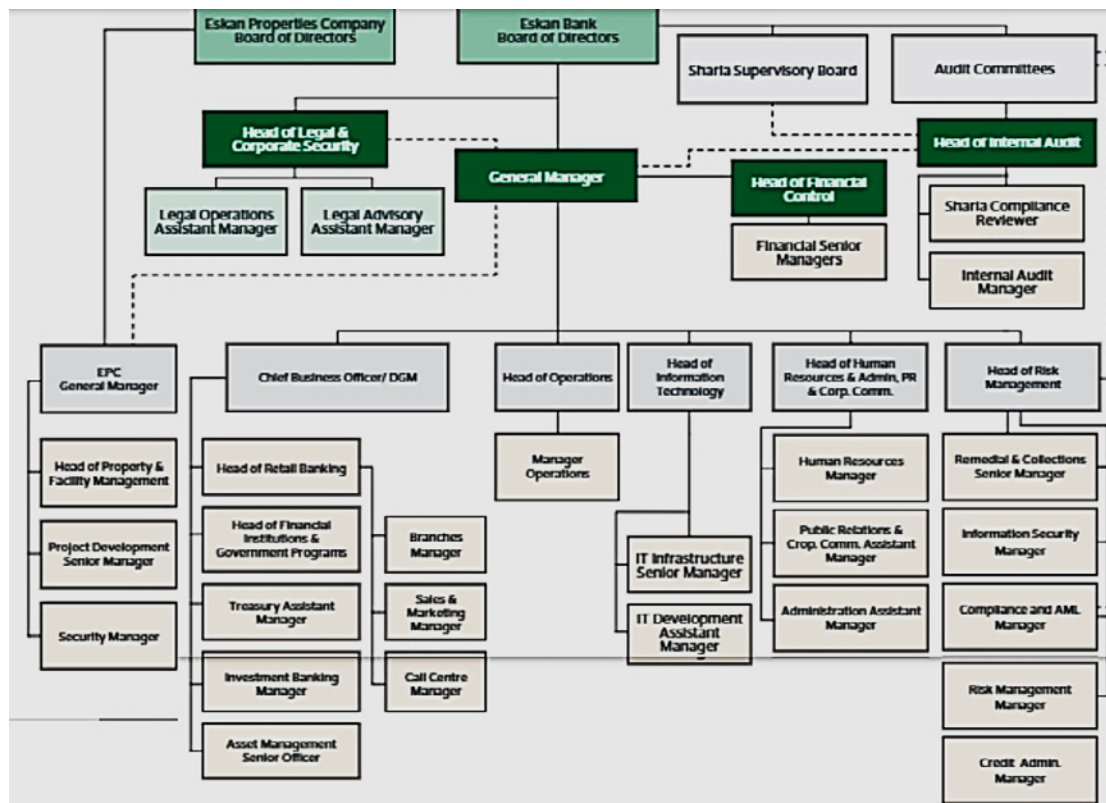


Figure 5.1 The FI-01 Organizational structure

Table 5.4 The Business Units (BU) of FI-01

B-Unit id	B-Unit name	B-Unit description
BU01	Management	This unit is the top-level management that Mange all bank units, responsible to all processes on overall bank.
BU02	Internal Audit	Provide auditing services to the Bank's management.
BU02	Legal Advisory	Provides legal services and advice. Reviewing all banking legal procedures.
BU03	Risk managment	Reduce risk while promoting operational efficiency.
BU05	Financial Control	Providing financial Analysis to support decision maker and publishing financial statements.
BU06	Retail Banking	Providing customers with product and services.
BU07	Financial Institutions & Government Programs	Developmental programs Focus on growing advisory services offerings to clients.
BU08	Human Resources, Administration & Corporate Communications	Process all new hire, benefits, leaves, termination, payroll, etc. in addition training, team building, event organizing.
BU09	Information Technology	Maintaining data and network from Contingencies, creating a highly secure environment for the high growth of electronic delivery channels by offering a technology solutions that match the business strategy.
BU10	Operations	Providing a responsible and accurate telling service experience to reach competitive advantage over other banks.
BU11	Property & Facility Management	Developing, maintaining, and managing the facility and needed renovations.

Table 5.5 The Business Actors/Roles (A/R) w.r.t Business unit (BU) of FI-01

B-Actor id	B-Actor/Role	BU id	BU Name
A&/R1	G. Manager	BU01	Management
A&/R2	H. of L.Adv	BU02	Legal Advisory
A&/R3	A of L.Adv	BU02	Legal Advisory
A&/R4	A. of L. Opn	BU02	Legal Advisory
A&/R5	H. of R. mgt.	BU03	Risk Management
A&/R6	Mgr. R. Mgt	BU03	Risk Management
A&/R7	S. Mgr. Collection	BU03	Risk Management
A&/R8	Mgr. Info Sec	BU03	Risk Management
A&/R9	Mgr. Credit	BU03	Risk Management
A&/R10	Mgr. Compliance	BU03	Risk Management
A&/R11	H. of Audit	BU04	Internal audit
A&/R12	Mgr. of Int Audit	BU04	Internal audit
A&/R13	Rev. of Shariah Compliance	BU04	Internal audit
A&/R14	H. F. Cont.	BU05	Financial Control
A&/R15	S. F. Mgr.	BU05	Financial Control
A&/R16	H. of retail bank	BU06	Retail Banking
A&/R17	Mgr. Branch	BU06	Retail Banking
A&/R18	Mgr. Call Ctr	BU06	Retail Banking
A&/R19	Mgr. Sales	BU06	Retail Banking
A&/R20	H. of fin inst & Gov prog.	BU07	FI & Gov. prog
A&/R21	H. of HR	BU08	HR
A&/R22	Mgr of HR	BU08	HR
A&/R23	Asst Admn Mgr	BU08	HR
A&/R24	Ass Mgr. PR.	BU08	HR
A&/R25	H. of IT	BU09	IT
A&/R26	S. Mgr. IT	BU09	IT
A&/R27	Ass Mgr. IT	BU09	IT
A&/R28	H. of Op	BU10	Operations
A&/R29	Mgr of Op	BU10	Operations
A&/R30	H. of fac mgt	BU11	Property&Facility
A&/R31	S. Mgr. Proj	BU11	Property&Facility
A&/R32	Mgr. Sec	BU11	Property&Facility

5.3.8 The Business Functions (BF) of FI-01

The interviewees responded to this question about the Business Functions of FI-01 and the answers are demonstrated in Table 5.6. The business functions were assigned id numbers and linked to services.

Table 5.6 The Business Functions (BF) of FI-01

Fun-id	Fun name	Fun description	Service id
Fun01	Management	This function manage the processes between the units and divisions of the bank	Svc01
Fun02	Controlling	This function control the operation and processe in the bank	Svc02
Fun03	Customer Affairs	This function is realted to the provides services and products to the customers	Svc03
Fun04	Supporting	The function is supporting the bank in the provided services	Svc04

5.3.9 The Business Process (BP) of FI-01

The interviewees responded to this question about the Business Processes of FI-01 and the answers are demonstrated in Table 5.7. The business processes were assigned Id numbers and linked with the functions that connected to the business services.

Table 5.7 The Business Process (Pro) of FI-01 w.r.t Fun. and Svc.

P_id	Process	S-Pid	Sub Process	S_id	Fun
Pro01	Manage the risk policies and procedures covering lending	P1.1	Solve legal issues involving the organization.	Svc01	Fun0
		P1.2	Deal with negotiations and collection.		
		P1.3	Compile contracts with local law.		
		P1.4	Provide developmental program on client advisory services.		
		P1.5	P1.5 Identifies any arise risk.		
		P1.6	Measure and monitor the risk.		
		P1.7	Control Risk and Assessment.		
		P1.8	Prepare income statement to mgt.	Svc02	Fun0
		P1.9	Prepare balance sheet to mgt.		
		P1.10	Prepare cash flow statement to mgt.		
Pro02	Formulate financial report and planning	P2.1	Oversee daily functions, integrating finance operations.	Svc02	Fun0
		P2.2	Support month-end and year-end close process.		
		P2.3	Prepare and publish timely financial statements.		
		P2.4	provide opinions' based on financial analysis.		
		P2.5	Measure performance and reliability of the organization.	Svc04	Fun0
		P2.6	Direct control over the quality of the products and services.		
Pro03	Provide Customer with products and services	P3.1	Provide telling services.	Svc03	Fun0
		P3.2	Open current and savings accounts.		
		P3.3	Apply for Personal loan auto loan mortgages loan.		
		P3.4	Apply for credit card.		
		P3.5	Seek for financial institutions research.		
		P3.6	Provide special long-term commitment to customers.		
Pro04	Serve administrative and operational functions	P4.1	Process all employee's services.	Svc04	Fun0
		P4.2	Deal with maintenance requests.		
		P4.3	Handle building operation include safety, cleaning, parking.		
		P4.4	Handle any emergency arise issues.		
		P4.5	Develope and maintain the facility with needed renovations tasks.		
Pro05	Maintain and manage the relation between division	P5.1	Approve bank products and procedures.	Svc01	Fun0
		P5.2	Review bank products and procedures.		
		P5.3	Provide 24/7 support to telecomm, website, apps, tech_services.	Svc04	Fun0
		P5.4	Provide recovery plan daily, monthly, yearly.		
		P5.5	Maintain data and network stability.		

5.3.10 The Business Service (BS) of FI-01

The interviewees responded to this question about the Business Services of FI-01 and the answers are demonstrated in Table 5.8. The business services were assigned ID numbers, moreover, services are linked with business unit and actors/roles.

Table 5.8 The Business Service (BS) of FI-01

Service id	Service name	Fun. id	Pro. id	B-Unit id	B-Actor id
Svc01	Provision of Operational, legal, Risk Mgt	Fun01	Pro01, Pro05	U01,U02,U03	A/R 01,02,03,4,5,06,07,08,
Svc02	Provision of Auditing and Control of financial operations	Fun02	Pro01, Pro02	U04,U05	A/R 11,12,13,14,15
Svc03	Provision of Customer banking services	Fun03	Pro03	U06,U07	A/R 16,17,18,19,20
Svc04	Provision of Administrative and operational matters	Fun04	Pro02,Pro04,Pro05	U08,U09,U10, U11	A/R21,22,23,24,25,26, 27,28,29,30,31,32

5.3.11 The BA visual pattern

As a result of data analysis to the BA, Table 5.9 demonstrates the BA visual pattern matrix. The benchmark criteria are categorized into three varieties: “Not involvement” which are mentioned in White cell color, “Partial involvement” which are mentioned in light brown cell color, and “Full involvement” which are mentioned in Grey cell color. The key objective of this visual express generating is to associate the BU with each A/R, BS, BF, and BP of FI-01. ‘Full involvement’ means that the mentioned unit that contain A/R are fully involve to this process “P-0x” that feed the related function that serve the final service, while ‘Not involvement’ means that this unit is not related to this process. in addition, ‘Partial involvement’ means that this unit is partially involve to the submitted processes.

5.4 The Information Sys Architecture (ISA) of FI-01

The ISA consists of application and data, the application could be an application system or application software, in addition, data includes metadata, archive data, data inventory, or other data source. To start identifying these systems, many sub-questions attended from the general main interview question for ISA part “What are the ICT Applications supporting the FI-01?”. The following sub-Sections further discuss the ISA.

Table 5.9 The BA visual pattern and ArchiMate generation

		Functions																															
		F01-Management									F02-Controlling					F03-Customer Affairs					F04-Supporting												
Unit		Manage ment	Legal advisory			Risk management					Internal auditing			Financial control		Retail banking				FI & Gov progra m	HR				IT			Operations		Property and Facility management			
A/R		G. Manager	H. of L.Adv	A of L.Adv	A. of L. Opn	H. of R. mgt.	Mgr. R. Mgt	S. Mgr. Collection	Mgr. Info Sec	Mgr. Credit	Mgr. Compliance	H. of Audit	Mgr. of Int Audit	Rev. of Shariah Compliance	H. F. Cont.	S. F. Mgr.	H. of retail bank	Mgr. Branch	Mgr. Call Ctr	Mgr. Sales	H. of fin inst & Gov prog.	H. of HR	Mgr of HR	Asst Admn Mgr	Ass Mgr. PR.	H. of IT	S. Mgr. IT	Ass Mgr. IT	H. of Op	Mgr of Op	H. of fac mgt	S. Mgr. Proj	Mgr. Sec
Processes	P01-Manage the risk policies and procedures covering lending																																
	P02-Formulate financial report and planning																																
	P03-Provide customer with products and services																																
	P04-Serve administrative and operational functions																																
	P05-Maintain and managing the relation between division																																
		S01-Provision of operational, legal, Risk Mgt									S02-Provision of auditing and control of financial operation					S03-Provision of customer banking services					S04-Provision of Administrative and operational matters												
		Services																															

5.4.1 The ICT Applications

The interviewees responded to this question about the ICT Application of FI-01 and the answers are demonstrated in Table 5.10, The applications were recognized and assigned ID numbers.

Table 5.10 The ICT Applications

App-id	App-Name	App-Description	Vendor	Origin
App01	EFTS eDGE	A fund transfer requirements app of bank within Bahrain that adheres to CBB regulations.	NeST IT	India
App02	EXUS	A suite of software products that manages credit risk along the whole life cycle of accounts.	EXUS	UK
App03	ATM software	This App is used in all ATM machines.	-	-
App04	VOIP	An app to deliver voice communication and multimedia sessions over internet network.	-	-
App05	Customer information file CIF	An electronic file that stores pertinent information about customers personal and account information.	-	-
App06	Bank CRM	Manage the company relationships and interaction with customer and potential customer	-	-
App07	Fraud detection	An App that detects fraud transactions and prevents money or property from false pretenses.	-	-
App08	Chatbot	An AI automate answer machine for conversation.	-	-
App09	Microsoft office	A suite of applications designed to help with productivity and completing common daily task.	Microsoft	USA
App10	Adobe reader	This software is used to deal with PDF file format.	Adobe	USA
App11	Corporate website	A software used for designing and editing website pages to match the business goals.	-	-
App12	HRMS	Human resource management system deals with employees data and information.	-	-
App13	Adobe flash player	Viewing multimedia contents, executing internet apps, and streaming audio & video with flash.	Adobe	USA
App14	Skype for business	A telecommunication app used for video conference and meetings to communicate.	Microsoft	USA
App15	Helpdesk portal	A portal that answers customers questions about products and services, without agent help.	-	-
App16	Payment Aggregator	A payment service provider that allow other business to accept transaction.	-	-
App17	Data archivist comp	A data archive system that digitally stores files including photographs, documents, recordings.	-	-
App18	Sparx system	UML visual modeling and design tool that manage complex information of large organizations.	Sparx	Australia
App19	Netbeans	Tools for java Application development from set of modular software component.	Apache	USA
App20	Anti-virus	A software that is used to protect from harmful attack, trojan, malware, other computer viruses.	-	-

5.4.2 The Applications Component w.r.t support the BS

The interviewees responded to this question about the ICT Applications that support the Units, Services, Functions, and Processes of FI-01, and the answers are demonstrated in Table 5.11. For explanation, the ICT application ID is penetrated by Application service and Application function in specific units, to deliver services that serve functions under this service, reaching all processes. This will connect the

BS layer with the AS layer, Furth more this will link the technology services TS with the AS.

Table 5.11 The ICT Applications w.r.t BU, BS

App id	App- Name	App service	App function	B-Unit id	BS id
App04	VOIP	Providing Communication services	Audio and video calls, auto answer machine, online chat.	Svc01	U01 U02 U03
App08	Chatbot				
App14	Skype for business				
App15	Helpdesk portal				
App11	Corporate website	Development	Application and model editing, web design	Svc02	U04 U05
App18	Sparx system				
App19	Netbeans				
App02	EXUS Financial Suite(EFS)	Operational services for employees	Employee performance measurement, leaves, hiring, training, promoting, daily office tasks	Svc04	U08 U09 U10 U11
App09	Microsoft office				
App10	Adobe reader				
App12	HRMS				
App13	Aobe flash player				
App20	Anti-virus				
App01	EFTS eDGE	Providing Services To client	Customer information record, payment, widthrow, online transaction, deposite, aaccount statement	Svc03	U06 U07
App03	ATM software				
App05	Customer information file				
App06	CRM				
App07	Fraud detection				
App16	Payment Aggregator				
App17	Data archivist comp				

5.4.3 The Application visual pattern

As a result of data analysis to the ISA, Table 5.12 demonstrates the ISA visual pattern matrix. The benchmark criteria are categorized into two varieties: “Not involvement” which are mentioned in White cell color, “Full involvement” which are mentioned in Grey cell color. The key objective of this visual matrix is to express the ICT applications with each BU, A/R, BS, BF, and BP of FI-01. ‘Full involvement’ means that the mentioned unit that contain A/R are using these applications in their process “P-0x” that feed the related function that serve the final service, while ‘Not involvement’ means that these applications are not installed in this unit. This measures the application replication in the diffrent units, by understanding the applications that are installed out but not used by this unit.

Table 5.12 The ISA visual pattern and ArchiMate generation

		Functions																															
		F01-Management									F02-Controlling					F03-Customer Affairs					F04-Supporting												
	Unit	Management	Legal advisory			Risk management						Internal auditing			Financial control		Retail banking				FI & Gov progra m	HR				IT			Operations		Property and Facility management		
	A/R	G. Manager	H. of L. Adv	A of L. Adv	A. of L. Opn	H. of R. mgt.	Mgr. R. Mgt	S. Mgr. Collection	Mgr. Info Sec	Mgr. Credit	Mgr. Compliance	H. of Audit	Mgr. of Int Audit	Rev. of Shariah Compliance	H. F. Cont.	S. F. Mgr.	H. of retail bank	Mgr. Branch	Mgr. Call Ctr	Mgr. Sales	H. of fin inst & Gov prog.	H. of HR	Mgr of HR	Asst Admn Mgr	Ass Mgr. PR.	H. of IT	S. Mgr. IT	Ass Mgr. IT	H. of Op	Mgr of Op	H. of fac mgt	S. Mgr. Proj	Mgr. Sec
Processes	Manage the risk policies and procedures covering lending		App13 App10 App9 App14 App4			App17 App7 App6 App13 App10 App9 App14 App4																											
	Formulate financial report and planning											App17 App16 App7 App13 App10 App9 App14 App4																					
	Provide customer with products and services	App6 App7															App16 App7 App6 App5 App3 App1 Ap13 App10 App9 App14 App15 App8 App4																
	Serve administrative and operational functions																					App17 App16 App7 App13 App12 App10 App9 App19 App18 App11 App15 App14 App8 App4											
	Maintain and managing the relation between division	App13 App10 App9 App14 App4																															
		Provision of operational, legal, Risk Mgt									Provision of auditing and control of financial operation					Provision of customer banking services					Provision of Administrative and operational matters												
		Services																															

5.5 The Technology Architecture (TA) of FI-01

The infrastructure consists of multiple components, to start recognizing these components which are supporting the FI-01 systems and applications, many sub-questions were attempted from the general main question for TA part “What are the IT infrastructures supporting the FI-01?”. The following Sections discuss in detail these components. According to the IT manager of the FI-01, the cost of the applications and technology infrastructures that support these applications are high and consume a big portion of the organization budget, moreover, in some cases, outsourced contractors are hired from specialized IT people to update, implement, maintain, maintenance, training, and support. Considering that most TA data are confidential, however as described by interviewees some applications are hosted externally which are linked to the CBB.

5.5.1 The Tech Strategic obj (ITSO) w.r.t (BSO) of FI-01

The main goal of the framework development is to determine the IT strategic objectives and align them with the business strategic objective. The interviewees responded to this question about the IT objectives w.r.t business objectives of FI-01 and the answers are demonstrated in Table 5.13. FI-01 IT Department has strategic objectives (ITSO), that is aligned with the business strategic objectives (BSO) of whole organization, however IT department has its own individual objectives which are not aligned with the BSO due to differences in the objectives.

5.5.2 The Technology components

The interviewees responded to this question discreetly. The infrastructure that supports the Apps, App Services, App Functions, and App Processes are demonstrated in Table 5.14.

Table 5.13 The IT Strategic Objectives (ITSO) of FI-01

IT Obj id	IT Objective	IT Objective description	B Obj id	B Obj name
ITSO 01	Innovation through technology	Procedural innovation in the use of IT in business by gathering best practices from industry and researchers about new and emerging technologies, and lessons learned from users about their experiences and the ways in which existing IT applications have facilitated the execution of their work.	BSO 01	Provide Social Responsibility
ITSO 02	Data Integration and Analytics	Support an enterprise approach to information sharing that adopts decision-making through the use of analytic technology.	BSO 02	Provide Service Excellence
ITSO 03	Knowledge Management	A systematic approach to capturing, organizing, and retrieving information to support the Department's activities and enhance decision-making.	None	
ITSO 04	IT Service Delivery	Our customers expect an engaging, user-friendly online experience. The Department will continue to implement customer-centric and service-management approaches to smarter IT delivery.	None	
ITSO 05	IT Business Systems	Ensure competent and effective performance of core business functions and services.	None	
ITSO 06	Enabling business continuity	Business continuity has become a primary business driver. Cloud migration accelerate the 24/7 operations in a digitally driven economy.	None	
ITSO 07	Lower total cost of ownership	Cloud migration may be able to reduce total cost of ownership (TCO) per application. Data centre hosting and infrastructure costs can be cut. The cost of unplanned downtime on productivity also can reduce.	None	

Table 5.14 The Technology Architecture

Tec id	Tec –Name	Tec –Description	Tec-service id	Tec-Serv name
Tec01	Desktop	Personal computer for office use	Ts01	Execute processes
Tec02	Laptop	Personal computer for portable use		
Tec03	Servers	Device that provides functionality for other devices called clients		
Tec04	Access point	Network hardware device	Ts02	Network services
Tec05	Bridge	Network hardware device		
Tec06	Gateway	Network device uses to connect VOIP, fax, other communication		
Tec07	Hub	Network hardware device		
Tec08	Modem	Network hardware device		
Tec09	Repeater	Network hardware device		
Tec10	Router	Network hardware device		
Tec11	Switch	Network hardware device		
Tec12	Firewall	Network security hardware device		
Tec13	N.W printer	Machine that makes copies of documents onto paper	Ts03	Output and input of graphic or text
Tec14	Printers	Machine that represent graphic or text on paper		
Tec15	N.W Scanner	Device that scans object and converts it to a digital image		
Tec16	Card printer	Device that print cards such as ATM cards, bussines card, etc.		
Tec17	Queue management system	Device print queue numbers for customer service or teller services linked to the system		
Tec18	Digital banner	A screen used for digital advertise to the bank facilities and offers		
Tec19	Card reader	A data input device that reads data from a card-shaped data storage	Ts04	Security and auth.
Tec20	Fingerprint reader	A data input device that reads data from fingers and store it as biometric authentication data		
Tec21	Digital signature	A device the input handwritten signature via digital pen.		
Tec22	H.S.M	Hardware security module that generate keys for authentication		

5.5.3 Technology components w.r.t Applications

Due to the FI-01 regulations, there is some information that cannot be disclosed, the interviewees couldn't answer all the questions related to the technology component, moreover financial budget is confidential. This limited information's related to the technology layer of FI-01 Prevent connecting the AS to the TS.

5.5.4 The Technology visual pattern

As a result of data analysis to the infrastructure, Table 5.15 demonstrates the Technology visual pattern matrix. The benchmark criteria are categorized into two varieties: "Not involvement" which are mentioned in White cell color, "Full involvement" which are mentioned in Grey cell color. The key objective of this visual pattern is to express the IT components with each BU, A/R, BS, BF, and BP of FI-01. 'Full involvement' means that the mentioned units that contain A/R are using these technology components to run the applications that serve the final service, while 'Not involvement' means that these units are not related to this process.

5.6 The ArchiMate of BA, ISA, and TA

As a result of data analysis to the BA, ISA, TA, Figure 5.2 demonstrates the visual of FI-01 Architecture in detail with the link between the layers. The key objective of this visual express generating is to associate the BA with ISA and TA. By using Archimate 'an open and independent enterprise architecture modeling language'. Each layer has been expressed in summarize overview to get realistic vision of FI-01.

Table 5.15 The Technology visual pattern

		Functions																																			
		F01-Management										F02-Controlling					F03-Customer Affairs					F04-Supporting															
Unit		Manage ment	Legal advisory			Risk management					Internal auditing			Financial control		Retail banking				FI & Gov progra m	HR				IT			Operations		Property and Facility management							
A/R		G. Manager	H. of L. Adv	A of L. Adv	A. of L. Opn	H. of R. mgt.	Mgr. R. Mgt	S. Mgr. Collection	Mgr. Info Sec	Mgr. Credit	Mgr. Compliance	H. of Audit	Mgr. of Int Audit	Rev. of Shariah Compliance	H. F. Cont.	S. F. Mgr.	H. of retail bank	Mgr. Branch	Mgr. Call Ctr	Mgr. Sales	H. of fin inst & Gov prog.	H. of HR	Mgr of HR	Asst Admn Mgr	Ass Mgr. PR.	H. of IT	S. Mgr. IT	Ass Mgr. IT	H. of Op	Mgr of Op	H. of fac mgt	S. Mgr. Proj	Mgr. Sec				
Processes	Manage the risk policies and procedures covering lending		Tec1 Tec2 Tec12 Tec14 Tec15 Tec16																																		
	Formulate financial report and planning											Tec1 Tec2 Tec12 Tec14 Tec16																									
	Provide customer with products and services																Tec1 Tec2 Tec12 Tec13 Tec14 Tec15 Tec16																				
	Serve administrative and operational functions																					Tec1 Tec2 Tec3 Tec4 Tec5 Tec6 Tec7 Tec8 Tec9 Tec10 Tec11 Tec12 Tec13 Tec14 Tec15 Tec16															
	Maintain and managing the relation between division	Tec1 Tec2 tech13																																			
		Provision of operational, legal, Risk Mgt										Provision of auditing and control of financial operation					Provision of customer banking services					Provision of Administrative and operational matters															
		Services																																			

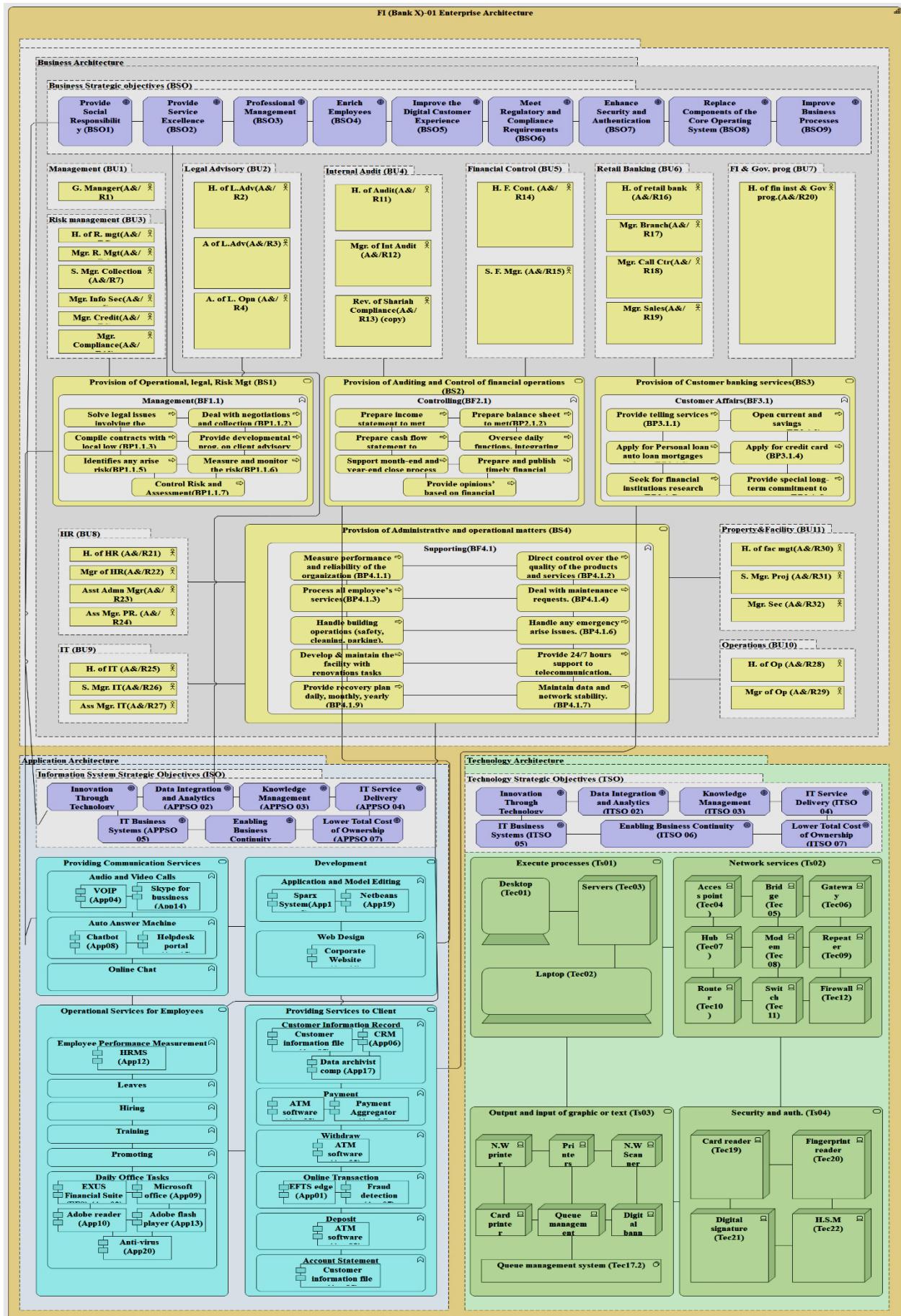


Figure 5.2 The Archimate representation of FI-01 Architecture

5.7 Opportunities and Solution of FI-01

This phase involves identifying the requirements for migration planning. It also involves identifying the opportunities and solutions that will enable the development of the migration EA. Opportunities and solutions proposed at this phase are to adopt the cloud after identifying the gaps in BA, ISA, and TA architecture. The baseline architecture for all FI-01 applications shows that they are performed on different views such as ASs, AFs, and APs. In addition, all FI-01 applications are also supported BSOs and ITSOs of FI-01 as well as performed the BSs, BFs, and BPs views. The Government of Bahrain stated that “all government agencies in the Kingdom of Bahrain will evaluate the cloud-based services when undertaking all ICT procurements” (iGA, 2017). In addition, the Government of Bahrain is “Committed to modernizing government information and communication technologies (ICTs) and will lead by example in using CC services to reduce costs, increase security, increase productivity, and develop excellent citizen services”. As a result, this phase will help migrate most of the applications from the existing status to the target status (TO-BE) to get them into the cloud.

5.8 Migration Planning of FI-01

This phase is the final step before the actual implementation. It involves developing a strategy and implementing a migration plan that addresses the various architectural issues related to the baseline architecture. As suggested in this study based on the insights of Isom and Holley (2012), the six phases of cloud adoption lifecycle are necessary. According to the iGA (2017), “All future government projects should have a clear direction to move to the cloud as stipulated by the approved cloud-first policy for the Government of Bahrain”. Moreover, The Government of Bahrain has signed an agreement with Amazon Web Services to deliver

cloud-based services to its non-profit and government entities. As a result, the cloud-first approach is the strategy that aims FI-01 to reduce the complexity of running a business by adopting a cloud-first approach instead of a traditional approach and by increasing availability of services, rapid elasticity, scalability, and increasing security. Table 5.16-5.17 present the benefits and risks associated with the transformation of FI-01 to the cloud, so the main team for cloud adoption includes the top management, applications owner, cloud service provider, and the ICT team. The selection of cloud deployment and service models is based on the service level agreement (SLA) (Wieder et al., 2011). SLA is established with the following characteristics as demonstrated in Table 5.18.

Table 5.16 The estimation of benefits, risks of FI-01

Estimating the benefits	Ease of access	Resources and services can be accessed from any place and at any time.
	Minimize the expenditure	Having a strong infrastructure in FI-01 requires large capital spending on this structure.
	Minimum maintenance	The absence of needs for installing software and hardware setup, the malfunctions, and faults will be reduced, therefore, no need for technical support staff/maintenance problem.
	Powerful resources	In the CC environment, the FI-01 can use a powerful and developed software and hardware Without any complexity. more storage capacity, and high-speed processing. In addition, the FI-01 can use virtual resources according to the user needs.
	Competitive advantage	Using CC in FI-01 earns a competitive advantage.
Estimating the risks	Security Risks	The security risks are the largest obstacles to cloud adoption. It covers the confidentiality, integrity and availability risks that exist to FI-01 to using cloud: -Infrastructure Security: The use Of Cloud transfers Some/all responsibility for managing infrastructure security from an FI-01's ICT staff to the cloud provider. -Data Storage and Transmission: Transferring and Storing sensitive information in the cloud creates more potential for security incidents. -Incident Response: Vendor incident response programs may not include adequate notification and disclosure of potential security incidents. -Control Verification: It may be difficult to perform audits of cloud providers to validate that controls are in place.
	Operational Risks	-Configuration/Change Management: Vendors may not follow appropriate configuration and change management processes to prevent service issues. -Identity and Access Management: Identity and access management (IAM) integrations with vendors may add complexity and exposure of credentials depending on integration options.

Table 5.17 The estimation of budget, and plan with a timeline of FI-01 (Continued)

Estimating the risks	Legal and Compliance Risks	The use of cloud services introduces and/or highlights a number of legal and compliance risks that must be addressed. FI-01 must ensure that their use of cloud services both complies with any legal, regulatory, or contractual Obligations and provides sufficient legal protection for the institution. -Regulatory Compliance: The use of cloud services introduces new complexities that may prevent FI-01 compliance with legal and regulatory obligations. -Software Licensing: Existing software license agreements may not permit running licensed software in cloud environment or may result in FI-01 being double-charged for the same software.
	Other Risks	Trust and flexibility of the FI-01's IT infrastructure in adopting cloud are main challenges. -Customizability: FI-01 typically use their own in-house applications with a portion that is customized to their own structure. The key concern is the transitioning of applications to the cloud and how much of the customizability will be lost in that process.
Estimating the budget		The total cost of ownership (TCO) is the process of determining direct and indirect costs of cloud adoption (Isom and Holley, 2012). The TCO comparison is key to understanding the possible savings that cloud may bring, and it is important as it is the baseline for comparison between the cloud and On-premise models. The main goal of this is to determine realistic comparison and savings for migrating to cloud services. As explained by ICT director, that the TCO and return on investment (ROI) in Cloud adoption is better than traditional On-premise and there are demonstrable profitability indicators with the adoption of cloud. However, as stated by ICT director, the financial information is confidential, and not allowed to be shared. For that, the calculation of TCO Will not provide in this study.
Initial planning & estimating the timeline	Preparation: (4 weeks)	The following list of activities estimates for the number of required weeks for the execution. This number of days counted in this timescale does not exactly reflect the effective hours but the allocated time range to do the activities. -Conduct the cloud service provider to provide the necessary instructions. -Conduct preliminary review and meetings to assess the user readiness for the implementation of cloud services and identify any actions/items that need to be followed up.
	Assessment: (8 weeks)	-Review the Current practices and systems to decide whether the premise infrastructure supports the compatibility with cloud services and seek for opportunities to improve the practices. -Start to Create the blueprints for specifying the network design and check the availability of the required components.
	Infrastructure setup (16 weeks)	-Deliver all the equipment and physically install all the main and backup power tools, racking, cable, etc., for network setup. -Install circuit and implement integrations with setup.
	Infrastructure testing (2 weeks)	-Perform testing to check the Connectivity of the network. -Perform service failure simulation, such as unplug the connectivity, service overload, etc. -Maintain the issues log and ensure that the open issues have been properly followed up through to completion.

Table 5.18 Characteristics of SLA

No	Characteristics
1.	Clear description about the service.
2.	Level of expected performance of the service.
3.	Service parameters to be mentioned and the format of the monitoring exports.
4.	Penalties when the service requirements are not achieved.
5.	Probability that the cloud services are available in the specific time of utilities.
6.	Cost calculation method – since the billing is based on the utilization of the cloud services, a certain mechanism should be established in order to allow the customer trace their use.
7.	Specific resources are provided in order to facilitate the ease of scaling up and down.
8.	Security and privacy at which sufficient protection over critical data by cloud service providers.
9.	Cloud services are configured flexibly to minimize the system changes performed by customers.

A proof-of-concept (POC) will be held before the production phase, which will enable the end-users to test their application or product in a cloud environment to ensure compliance with the targeted architecture.

5.9 The Implementation Governance of FI-01

This phase refers to the level of details that are delivered according to the efforts involved in the actual architecture implementation. This phase is about monitoring the continuous compliance of the implementation efforts to ensure that they are in line with the established governance framework. It also involves ensuring that sufficient controls are applied to minimize the risks.

5.10 Architecture Change Management of FI-01

Recall from Chapter three, this phase refers to the evaluation of the cloud services that are being delivered in FI-01. This step is carried out to ensure that the architecture is built according to the target architecture. Moreover, a part of this phase also focuses on the drivers of change and how they can be managed. The objective is to identify the changes that are intended to improve or correct the existing capabilities.

5.11 Summary

This chapter presents the results of the current study based on data analysis of the holistic single case study carried out on a Bahraini FI-01. The representatives of FI-01 were requested to introduce their institution in terms of the BA, ISA, and TA components corresponding to the FI-01. In addition, a discussion of opportunities and solutions were carried out, taking into consideration the architecture change management. Finally, the migration plan with the POC of the study was discussed as well.

Chapter 6

Evaluation

6.1 Introduction

This chapter describes the Delphi evaluation method of the developed CCAFF framework. The process involves analyzing the framework's utility based on six predefined criteria. This chapter mainly consists of three main parts: the preparation of the evaluation, the data collection, and the analysis. The chapter is composed of seven Sections. Section 1 introduces the chapter while Section 2 justifies the use of the Delphi technique for the evaluation. Section 3 introduces the various assessment criteria that were performed, while Section 4 introduces the various components of the panel formulation process include: the size and level of consensus, composition, and data collection. Section 5 demonstrates the analytical findings related to the evaluation process based on demographics and criterion measurement, while Section 6 demonstrates the empirical results of the first and second rounds. Alternatively, further discussion was conducted in Section 7. The empirical summary of the entire chapter is presented in Section 8.

6.2 The Delphi method

The CCAFF framework is evaluated using the Delphi technique, which was utilized by IS researchers in various subjects (Keil et al., 2013). According to Habibi et al. (2014), the Delphi technique enables evaluators to deal with complex problems to find the most reliable consensus among experts of a given field, by conducting multiple interviews and getting opinion feedback.

Consecutively, as depicted in Appendix (2), the current survey questionnaire was carried out using an online questionnaire that is designed by Microsoft Forms, at which the link to the survey was sent to the experts via email.

Moreover, the questionnaire consisted of four Sections that explain the main concepts of the framework. The first introduces the questionnaire, while the second introduced the demographic profile elements of the experts and organizations.

However, the third Section provides various Likert-type scales assessment questions from strongly agree (5) to strongly disagree (1). Each criterion has three to five measurement items, while the fourth Section consists of open-ended questions regarding the views on the proposed framework.

6.3 Assessment criterion

Illustrated in Table 6.1, the proposed CCAFF framework is evaluated on six criteria, which have been utilized in many research studies as ours (El-Gazzar et al., 2016; Alharbi 2017).

Table 6.1 Assessment Criteria

Criterion	Definition
Ease of Use	The degree to which an expert believes that using the framework is free of effort.
Usefulness	The degree to which an expert agrees that using the framework would enhance the Cloud Computing adoption decision-making process.
CC Decision-Making Support	The measurement of how much the framework will provide support for the implementation of CC.
Comprehensiveness	The measurement Of how comprehensive the framework is.
Required time	The measurement of the cost in terms Of time required to complete the framework.
Intention to use	The measurement of how likely the decision-maker will be to use the framework.

6.4 The panel formulation

6.4.1 Panel Size and number

According to Williams and Webb (1994), the identification of the number of individuals and/or panels is arguable. However, panel sizes vary depending on the complexity, time, and money expenses (Van Zolingen and Klaassen, 2003). As per the specialties, Powell (2003) believes in informing individuals of different specialties, at which less than 10 members are qualified (Habibi et al., 2014).

6.4.2 Panel composition

Okoli and Pawlowski (2004) believe that choosing the eligible participants in Delphi is of high importance to the research study at which the procedure was carried out by analyzing the various characteristics of an eligible expert as shown in Table 6.2.

Table 6.2 Delphi experts selection procedure (Source: Okoli and Pawlowski, 2004)

Step	Description
1.	Prepare a worksheet that defines categories and experience/knowledge levels of relevant disciplines, skills, individuals/organizations.
2.	Populate the worksheet with names.
3.	Contact experts and ask them to nominate other experts (snowballing).
4.	Rank and categorize experts based on their availability and qualification.
5.	Invite experts according to the target panel size.

Therefore, 7-panel members were selected based on their academic experience in Banking, experience in IT and/or management, and responsibility on CC adoption relevant processes. The experts were then contacted by email and phone to discuss their willingness to serve on the panel as demonstrated in Table 6.3.

Table 6.3 List of the panel experts for the Delphi evaluation

No.	Participant position	Year of Experience
1	Manager (CEO)	25
2	Financial manager	20
3	IT manager	15
4	IT consultant	12
5	IT project manager	12
6	Professor of IT and EA	26
7	Enterprise CC architect	2

6.4.3 Data collection

The data collection was conducted in two phases. All experts were contacted through email to set up the tasks of the survey. During the survey, experts were asked to respond within one week. emails were sent to remind them that they should submit their feedback. The first round of the survey was held in the first week of November 2021. The experts were asked to answer the survey. The results were returned on time by all panel members. Alternatively, the second round of the Delphi survey started on the second week of November 2021. The experts were asked to answer the questions related to the Delphi survey following the first-round procedure.

6.5 Analytical findings

The results of round-1 were included as feedback to all panel experts in round-2. All experts' panels returned the answers on time. Microsoft Excel is used as a statistical tool to analyze and interpret the data in both rounds to create and analyze the statistical data.

6.5.1 Demographics

Statistics about the various characteristics of expert demographics are discussed below including, gender, age, level of education, position, role, and working experience as demonstrated in Table 6.4.

6.5.2 Criterion's measurement

Depicted in Tables (6.5 – 6.10), the statistics of each assessment criterion are measured, at which the Standard Deviation (SD) and the Mean Difference (MD) are used to evaluate the proposed CCAFF framework.

Table 6.4 Demographics of the expert panel

Variable	Category	Frequency
Gender	Male	56%
	Female	44%
Age	20-30	33%
	31-40	44%
	41-50	22%
	51-60	0%
	Above 60	0%
Level of education	Doctorate	11%
	Master's degree	33%
	Bachelor's degree	56%
	Diploma or associate degree	0%
Organization type	Public	22%
	Private	78%
	Semi-public	0%
Employment status	Full-time	100%
	Part-time	0%
	Contract	0%
Role in the organization	Operational role	44%
	Managerial role	56%
	Executive role	0%
	Other(Academic-Assistant Professor)	0%
Working experience in the organization	Less than 5 years	0%
	5-10 years	89%
	More than 10 years	11%

6.5.2.1 Ease of use measurement

“Ease of use” measures the extent to which the panel experts believe that using the CCAFF is relatively effortless. The analytical findings based on four measurements are demonstrated in Table 6.5.

Table 6.5 Measuring Ease of Use Criteria

Round	Round 1		Round 2	
Items	Mean	SD	Mean	SD
It is easy to perform the phases required by the proposed CCAFF	3.86	0.690	4.00	0.577
I believe interacting with CCAFF is clear and understandable process.	4.29	0.756	4.57	0.535
I find most phases of CCAFF are flexible to interact with.	4.29	0.756	4.43	0.535
The CCAFF is easy to use.	4.00	1.000	4.29	0.951
Average	4.11	0.800	4.32	0.649

Round-1 demonstrates values of (3.86 and 4.29) in Mean and (0.69 and 1) in SD, while the average mean for all items is 4.11 and the average SD for all items is 0.8. However, in round 2, the findings indicate that the mean scores of the measurement items are between (4 and 4.57) in Mean and (0.535 and 0.951) in SD, while the average mean for all items is 4.32 and the average SD for all items is 0.649.

Consequently, the findings of rounds 1 and round 2 indicate that experts find that the CCAFF is expected to be easily utilized by the decision-makers of FI-01.

6.5.2.2 Usefulness measurement

“Usefulness” measures the extent to which the panel experts believe that using the CCAFF would enhance job performance. The analytical findings based on four measurements are demonstrated in Table 6.6.

Table 6.6 Measuring Usefulness Criteria

Round	Round 1		Round 2	
Items	Mean	SD	Mean	SD
Using the CCAFF saves my time.	4.14	0.900	4.43	0.787
Using the CCAFF improves my performance.	3.86	0.690	4.00	0.577
Using the CCAFF improves my productivity.	3.86	0.690	3.86	0.690
Using the CCAFF enhances my effectiveness.	4.14	0.900	4.29	0.756
I find the CCAFF useful.	4.29	0.756	4.57	0.535
Average	4.06	0.787	4.23	0.669

Round-1 demonstrates values of (3.86 and 4.29) in Mean and (0.69 and 0.9) in SD, while the average mean for all items is 4.06 and the average SD for all items is 0.787. However, in round 2, the findings indicate that the mean scores of the measurement items are between (3.86 and 4.57) in Mean and (0.535 and 0.787) in SD, while the average mean for all items is 4.23 and the average SD for all items is 0.669.

Consequently, the findings of rounds 1 and round 2 indicate that experts find that the CCAFF is expected to be useful to decision-makers and helps in improving the way they perform their tasks.

6.5.2.3 Decision-making support measurement

“Decision-making support” measures the extent to which the panel experts believe that using the CCAFF would support the implementation of CC decision-making. The analytical findings based on three measurements are demonstrated in Table 6.7.

Table 6.7 Measuring CC Decision-Making Support Criteria

Round	Round 1		Round 2	
Items	Mean	SD	Mean	SD
Using the CCAFF provides the necessary and sufficient support for the implementation of Cloud Computing.	4.14	0.690	4.43	0.535
The CCAFF is an important supportive tool to the decision making of the Cloud Computing implementation.	4.14	0.690	4.29	0.488
The CCAFF provides adequate support to the decision making of implementing Cloud Computing.	4.00	0.577	4.29	0.488
Average	4.10	0.652	4.33	0.503

Round-1 demonstrates values of (4 and 4.14) in Mean and (0.577 and 0.69) in SD, while the average mean for all items is 4.1 and the average SD for all items is 0.652. However, in round 2, the findings indicate that the mean scores of the measurement items are between (4.29 and 4.43) in Mean and (0.488 and 0.535) in SD, while the average mean for all items is 4.33 and the average SD for all items is 0.503.

Consequently, the findings of rounds 1 and round 2 indicate that experts find that the CCAFF is expected to be supportive to decision-makers in implementing a CC in the bank departments.

6.5.2.4 Comprehensiveness measurement

“Comprehensiveness” measures the extent to which the panel experts believe that using the CCAFF is comprehensive and is composed of all required phases to adopt and migrate to CC. The analytical findings based on three measurements are demonstrated in Table 6.8.

Table 6.8 Measuring Comprehensiveness Criteria

Round	Round 1		Round 2	
Items	Mean	SD	Mean	SD
The CCAFF includes all the required phases for CC adoption and successful migration the cloud.	4.14	0.900	4.14	0.900
The CCAFF provides comprehensive phases that guide to adopt and implement cloud computing.	4.29	0.756	4.29	0.756
The CCAFF is comprehensive.	4.14	0.900	4.43	0.787
Average	4.19	0.852	4.29	0.814

Round-1 demonstrates values of (4.14 and 4.29) in Mean and (0.756 and 0.9) in SD, while the average mean for all items is 4.19 and the average SD for all items is 0.852. However, in round 2, the findings indicate that

the mean scores of the measurement items are between (4.14 and 4.43) in Mean and (0.756 and 0.9) in SD, while the average mean for all items is 4.29 and the average SD for all items is 0.814.

Consequently, the findings of rounds 1 and round 2 indicate that experts find that the CCAFF is expected to be comprehensive to decision-makers and provide all required phases that guide to adapt and implement cloud in FI-01 departments from an EA perspective.

6.5.2.5 Required time measurement

“Required time” measures the extent to which the panel experts believe that using the CCAFF is not time-consuming. The analytical findings based on three measurements are demonstrated in Table 6.9.

Table 6.9 Measuring Required Time Criteria

Round	Round 1		Round 2	
Items	Mean	SD	Mean	SD
The CCAFF requires reasonable time to perform and complete.	4.14	0.690	4.29	0.488
The CCAFF able to provide outcomes at the required time.	4.00	0.577	4.00	0.577
The CCAFF is efficient to complete on time.	4.29	0.951	4.43	0.787
Average	4.14	0.740	4.24	0.617

Round-1 demonstrates values of (4 and 4.29) in Mean and (0.577 and 0.951) in SD, while the average mean for all items is 4.14 and the average SD for all items is 0.74. However, in round 2, the findings indicate that the mean scores of the measurement items are between (4 and 4.43) in Mean and (0.488 and 0.787) in SD, while the average mean for all items is 4.24 and the average SD for all items is 0.617.

Consequently, findings of round 1 and round 2 indicate that experts find that the CCAFF is expected to be a time-saver for decision-makers to perform and complete.

6.5.2.6 Intention to use measurement

“Intention to use” measures the extent to which the panel experts believe they are willing to use and conduct the CCAFF. The analytical findings based on three measurements are demonstrated in Table 6.10.

Table 6.10 Measuring Intention to Use Criteria

Round	Round 1		Round 2	
Items	Mean	SD	Mean	SD
I intend to use the CCAFF in the future.	4.43	0.787	4.43	0.787
I will encourage other decision-makers to use the CCAFF.	4.14	0.690	4.00	0.577
I will use the CCAFF in the near future.	4.14	1.069	4.00	1.000
Average	4.24	0.849	4.14	0.788

Round-1 demonstrates values of (4.14 and 4.43) in Mean and (0.69 and 1.069) in SD, while the average mean for all items is 4.24 and the average SD for all items is 0.849. However, in round 2, the findings indicate that the mean scores of the measurement items are between (4 and 4.43) in Mean and (0.577 and 1) in SD, while the average mean for all items is 4.14 and the average SD for all items is 0.788.

Consequently, findings of round 1 and round 2 indicate that experts find that the CCAFF is expected to be utilized and conducted by decision-makers in the FI-01 in the future.

6.6 Empirical results

Depicted in Figure 6.1, the evaluation process generated positive results in both rounds. The experts stated that the CCAFF framework is easily understood, useful for improving the way they perform their tasks in an organization, well-equipped to support the sufficient implementation of CC in FI-01 departments, complete in a time-efficient manner, and the experts are intentionally willing to use it in their respective FIs.

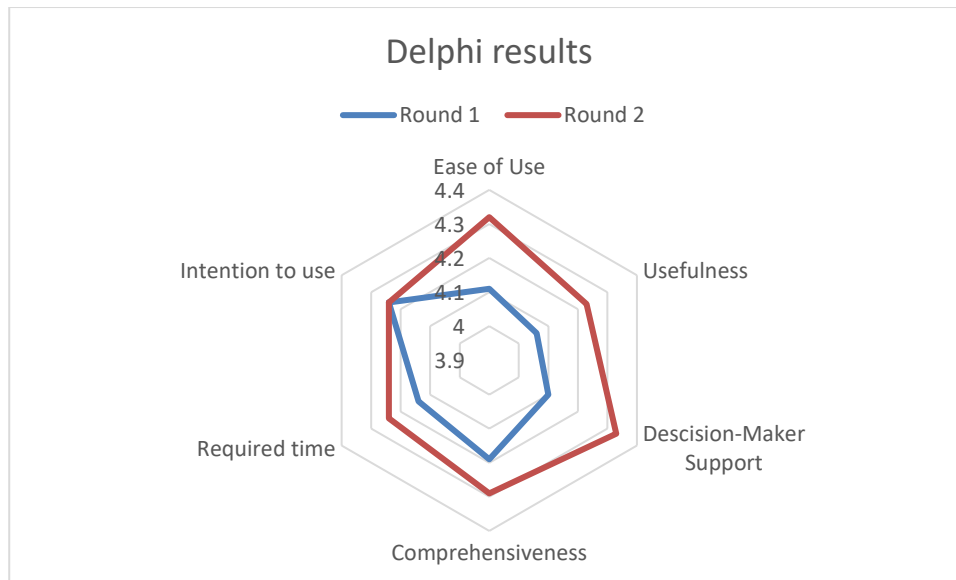


Figure 6.1 The Delphi empirical findings

6.7 Discussion of the findings

This research focused on developing and evaluating a CCAFF framework that would enable banks in Bahrain to perform CC ADOPTION from an EA perspective. This thesis was following the steps of the DSRM by Peffers et al. (2012).

The framework was successfully developed using the TOGAF-ECAS approach targeting FI-01 to create an artifact as a real case study. The CCAFF framework was evaluated using the Delphi technique. This procedure involved a panel of experts to thoroughly review the framework's reliability and accuracy.

The findings reveal that the CCAFF framework is highly comprehensive (85.8%) and provides sufficient support for the establishment of CC in the FI industry in terms of ease of use (86.4%). Moreover, the findings of the survey revealed that (84.6%) of experts agreed that the framework is useful and helpful, in addition (86.6%) of them also agreed that the framework was eased to use by decision-makers for improving the performance of tasks in CCA. However, most of the panel experts agreed that the framework required time to finish (84.8%). In

addition, the majority of them (84.8%) also believe that the framework should be intentionally used in their FIs.

As a result, the artifact has provided useful guidance for implementing CC in the context of the retail banking industry, plus It can be modified to fit specific requirements.

6.8 Summary

This chapter presented the carried-out process of evaluation to the proposed CCAFF framework using a Delphi technique. The evaluation process assessed the framework and obtained a 7 panel expert's feedback on the utility of the CCAFF framework based on six specific criterians created based on the insights of Alharbi (2017) including, comprehensivness, ease of use, usefulness, decision-making support, required time , and intentional usage.

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Chapter 7

Conclusion and Future work

7.1 Introduction

This chapter provides an overview of the research questions, theoretical and practical implications, and future work of the entire thesis. The implications of the research are discussed from the theoretical and the practical perspectives. The research limitations of the study are also discussed to formulate the barriers under which the research has undergone. Finally, the recommendations for future works are addressed to highlight possible potential outcomes. This chapter is composed of six thematic Sections. Section 1 highlights the entire chapter, while Section 2 provides an overview of the research questions. Section 3 is dedicated to the theoretical and practical ones. Section 4, however, is concerned with the research limitations, while Section 5 thoroughly demonstrates the expected recommendations and future work suggested by the author.

7.2 Overview of the research questions

The following research questions were developed as in Table 7.1.

Table 7.1 The thesis's questions and answers

Research_Obj	Q.	Research questions	Done	Ch	Method of investigation
This study is aimed at developing and evaluating CCAFF acting as a cloud computing adoption framework for the financial institutions banks in Bahrain from the perspective of Enterprise Architecture (EA).	RQ1	<i>What is the best EA architectural development method that can be utilized for the CC adoption in FI (Banking) sector?</i>	√	CH2	-By understanding the FI environment in terms of services, function, process, etc. -Comparative studies to analyze the gap in this area. -Following the SLR method to ensure high-quality-related Academic papers, journals, conferences, and books.
	RQ2	<i>How can a Bank migrate from the baseline (As-Is) state to the target (To-Be) state?</i>	√	CH3 CH4	DSRM+TOGAF+ECAS Documentation Depth single case study Data collection Semi structure interview
	RQ3	<i>How to evaluate the developed CCAFF framework for implementation?</i>	√	CH5 CH6	Data analysis +Delphi techniques evaluation+ questionnaire.

7.3 Implications of the study

The following sub-Sections present the theoretical and practical implications of the research.

7.3.1 Theoretical implications

This research study aims to develop an artifact as a strategic framework for the CC ADOPTION in the Bahraini FI banking sector from an EA perspective, which is critically important to the country's financial industry. It focused on the various aspects of CC adoption in the Bahraini retail bank sector. The research study used a wide variety of literature sources to formulate these findings for successful adoption.

Second, this research study aims to support the government of Bahrain strategy by effectively implementing CC ADOPTION in the public and private sectors.

Third, many studies have focused on the use of CC ADOPTION in other industries except Financial such as education, telecommunication. This research study addresses the gaps by focusing on FI CCA, this helps the researcher to gain a deeper understanding of how CC ADOPTION works in Financial specifically and EA generally.

7.3.2 Practical implications

The findings of this research study help decision-makers in making the best decision when it comes to adoption CC in the Bahraini FIs bank sector, by providing a comprehensive framework that helps in effectively planning and implementing a successful CCA. Moreover, this research study explains the important phases and identifies the factors that influence a successful CC ADOPTION and how FIs Architecture can be utilized to improve its operations, efficient and effective planning in the organization. The findings of implementing CCAFF have implications for reaching the

business strategic objectives of a FI by following the provided guidelines in this research.

7.4 Research limitations

One of the main limitations of this research study is the need for people with specialized skills and expertise to successfully implement the cloud computing lifecycle. Gewald and Helbig (2006) show that the adoption of cloud computing depends on the right combination of people and processes. the other limitation is the actual implementation, due to restriction from the enterprise about some information's which are confidential, also the cost and budget of the IT and ISA.

Moreover, this framework is only applicable to one case study, as a result, the research findings are only applicable to this specific case study FI-01, whoever it can be used in a similar bank type. COVID19 pandemic has blocked some interviews and limited Face-to-face communication, many responses were delayed, many employees were working from home, and other pandemic circumstances.

The research study is limited to the bank industry. Other FI such as insurance companies should be considered and compared with the outcomings of the study.

The concept of CCAFF is a combination of cloud strategy and practical processes. This framework aims to provide an approach to enable organizations to transform their operations to the cloud.

While some phases of TOGAF overlooked the maturity measurement which can help identify areas of improvement. the maturity assessment helps organizations identify areas of their operations that require more attention and resources. It can also be used to formulate a cloud strategy that works seamlessly.

7.5 Conclusion

During the LR several gaps were found in CC ADOPTION in terms of: several CC methods, strategies, or frameworks. EA is claimed to be a leading information and business management discipline to develop an architecture that guides the transformation of an enterprise from a baseline state to a target state. To address those gaps, this thesis aims at developing a framework for a Bahraini Bank FI-01 as an FI to guide it for the CCA. Six phases DSRM are employed to design the research report, guide, and develop the CCAFF. Delphi technique was employed at which seven experts in two rounded panels contribute for the evaluations, findings demonstrated promising results in term of: the degree to which an expert believes that using this framework is free of effort, the degree to which an expert agrees that using this framework enhances the CC ADOPTION decision-making process, the measurement of how much support does this framework provide for the implementation of CC, The measurement of how comprehensive does this framework be utilized in the entire FI sector, The measurement of the time required to complete this framework, and the measurement of how likely the decision-maker will use the CCAFF.

7.6 Recommendations

Further analysis is needed to improve this framework and make it more robust and suitable for the variant type of FIs. Speaking about other recommendations: the specification of the critical roles in a cloud project will help identify the appropriate technical and soft skills requirements for the selected team member.

The maturity assessment covers both the EA project management and the cloud-service management can be used to determine if the management should improve or not in certain critical areas. Moreover, one of the most

interesting aspects of cloud computing is inter-organizational collaboration, this will help assess the various factors that have an impact on the development and operation of cloud computing.

In addition, the various types of cloud services such as PaaS, IaaS, and SaaS are so important to choose from, and the deployment model is to suit the organization effectively. In Addition, to achieve the desired results, some important steps should be more considered than others. Some of these include the legal aspects of the contract, the business-fitness justification, and the SLAs.

Furthermore, the justification provided for each step in the cloud strategy can help the management in deciding the critical actions that need to be taken to successfully implement the cloud strategy.

7.7 Future Work

The following guidelines are for future researchers who are looking into the adoption strategy of CC in the FI sector.

This research study was carried out for retail banks in Bahrain. As a result, the study can help building an enhanced CCAFF framework version for other FI sector's types. However, multiple case study strategies should have been employed .

Based on the previously mentioned results, the central bank of Bahrain (CBB) can utilize the CCAFF to move their current Architecture from the non- cloud based baseline (AS-IS) state to the cloud based (TO-BE) state.

Moreover, despite the fact that this study is primarily focusing on the adoption strategy framework for the FI bank sector in Bahrain, it could also be applied to other sectors such as education, telecommunications, manufacturing, and many others, domestically and internationally. However, multiple case study strategies shoyld have been employed.

7.8 Summary

This chapter overviewed and demonstrated the theoretical and practical implications and proposed future work recommendations of the entire thesis. The research limitations of the study were also discussed to shape the boundary of the thesis.

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Appendices

Appendix 1- Interview request letter

Date: 06/11/2020

Interview Request

My name is **Bader Ali Saeed AlSaeed**, (ID #: 20170046), an M.Sc. student in the College of Information technology, University of Bahrain. I am carrying out a study of Development of cloud computing adoption framework for financial Bahraini enterprise.

My work will mainly be studying your business and IT strategy, functions, services and processes; and identifying the supportive IT technologies (mainly application systems and infrastructure).

The final outcome will be the development of an IT cloud adoption framework for financial institutions in Bahrain.

This study is expected to contribute to our knowledge of what financial practices (higher financial institutions) are like in Bahrain, thus aiding the further development of the practice and financial of Cloud computing and Enterprise Architecture in Bahrain. The interview and data collection is not expected to take long; 2-3 visits to your firm with 2-3 hours in each visit.

Please be assured that the interview is completely anonymous. The information will be treated in strict confidence and results will only be published in an aggregated form.

Looking forward to approving my request.

Sincerely yours,

Researcher

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Appendix 2 The Delphi Questionnaire

Delphi Questionnaire-Round 1

* Required

Dear Respondent,

I am a postgraduate student at the University of Bahrain conducting a study as in partial fulfillment of the requirements for my Master's degree in Information Technology. The purpose of this study is to develop and evaluate a cloud computing adoption strategy framework (CCASF) as an artifact for the financial institution (FI) Banking sector in Bahrain from an Enterprise Architecture perspective.

Your participation is on a voluntary basis, below are the conditions of voluntary participation:

- Confidentiality.
- Anonymity.
- Not asked to divulge any business sensitive information.

The survey will take approximately 10 minutes to complete.

Your participation in this survey is highly appreciated.

If you have any questions or suggestions, please do not hesitate to contact researcher through Email: abdulaziz@uob.edu.bh or Mobile: 99331115

Rader Alsaedi
M.Sc. Researcher at Information Technology College- University of Bahrain

Proposed Framework

The research framework is developed based on ACM cycle of TOGAF as proposed by The Open Group (2008) and Enterprise Cloud Adoption Strategy (ECAS) as proposed by Iorn and Holey (2012) as depicted in below Figure and explained in the following paragraphs.

Phase B: The preliminary phase in TOGAF defines the preparatory stage of the initial actions required to understand the enterprise model in order to help develop the new architecture. This phase is missing in the ECOS, in which the initial step is directly about the context for enterprise cloud adoption rather than the general vision or framework within an organization. Therefore, in the suggested framework (CCASF), this phase is still required to comprehend better the general operational and policies in an FI.

Phase A: Architecture vision in TOGAF describes the scope of new architecture, the stakeholders, and the creation of architecture vision. These explorations are addressed in the ECOS during initial planning (stage1) and intensive capabilities and cloud vision (stage7), at which stage1 is concerned with envisioning new opportunities when cloud computing is implemented, while stage7 provides an understanding of overarching abilities needed to support the implementation of cloud.

Phases B to D in TOGAF are concerned with the development of business architecture (BA), information system architecture (ISA), and technology architecture (TA). These three phases are aligned with Stage3: Target architecture and cloud enablers in ECAS, especially in the phase for target architecture and cloud enablers.

Phase E: The opportunities and solution phase is concerned with the required steps involved in the creation of implementation and migration plan as in phase F of TOGAF. Identification of technical gaps between the baseline and target architectures, ECAS is mapped to this phase throughout Stage4: Gap analysis and transition planning, at which it performs Gap analysis for identifying the shortfall between the actual and potential performance, and the creation of a change management plan.

Phase F: Migration planning is concerned with the creation of detailed plans for the real implementation and migration from the baseline to the target architectures. In relation with the cloud adoption, the implementation and migration processes are carried out by the cloud providers. Therefore, "evaluating the desired requirements from the targeted architecture is essential to provide an input for vendor's SLA, arrangement, the cloud setup including the network configuration, and the integration requirements for the interoperability with other clouds."

Phase G BH: Implementation governance and Architecture change management in TOGAF are dedicated to defining the architectural oversight by ensuring that the delivery of transition plan complies with the defined architecture and providing a cohesively continual monitoring over the changes to the architecture. From ECAS perspective, the governance stage is dedicated to decision rights and responsibilities, evaluating the decisions, creating accountabilities, and management. Therefore, for the continuance of the BA maintenance, phase G and H of TOGAF are adapted to include their steps and deliverables.



10/27/2021

3

Level of education *

- ☐ Doctorate degree
- ☐ Master's degree
- ☐ Bachelor's degree
- ☐ Diploma or associate's degree
- ☐ Other

4

Organization type *

- ☐ Public
- ☐ Private
- ☐ Semi-public

5

Employment status *

- ☐ Full-time
- ☐ Part-time
- ☐ Contract

10/27/2021

Section two: (The model design)

According to the 5-Point Likert Scale, Please indicate how strongly you agree/disagree with the following statements:

8

Ease of Use: The degree to which an expert believes that using the framework (CCASF) is free of effort. *

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
It is easy to perform the phases required by the proposed framework (CCASF).	☐	☐	☐	☐	☐
I believe interacting with CCASF is clear and understandable process.	☐	☐	☐	☐	☐
I find most phases of CCASF are flexible to interact with.	☐	☐	☐	☐	☐
The CCASF is easy to use.	☐	☐	☐	☐	☐

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6

Role in the organization: *

- ☐ Operational role
- ☐ Managerial role
- ☐ Executive role
- ☐ Other

7

Years in current positions *

- ☐ Less than 5 years
- ☐ 5-10 years
- ☐ More than 10 years

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9

Usefulness: The degree to which an expert agrees that using the framework enhances the Cloud Computing adoption decision making process. *

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Using the CCASF saves my time.	☐	☐	☐	☐	☐
Using the CCASF improves my performance.	☐	☐	☐	☐	☐
Using the CCASF improves my productivity.	☐	☐	☐	☐	☐
Using the CCASF enhances my effectiveness.	☐	☐	☐	☐	☐
I find the CCASF useful.	☐	☐	☐	☐	☐

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Experts' Profile and Organization Information:

Please select only one answer that matches the correct option:

1

Gender: *

- ☐ Male
- ☐ Female

2

Age (Years): *

- ☐ 20-30
- ☐ 31-40
- ☐ 41-50
- ☐ 51-60
- ☐ Above 60

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10

Cloud Computing Decision Making Support: The measurement of how much support the CCASF will provide for the implementation of Cloud Computing. *

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Using the CCASF provides the necessary and sufficient support for the implementation of Cloud Computing.	☐	☐	☐	☐	☐
The CCASF is an important supportive tool to the decision making of the Cloud Computing implementation.	☐	☐	☐	☐	☐
The CCASF provides adequate support to the decision making of implementing Cloud Computing.	☐	☐	☐	☐	☐

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Appendix 3 The Interview Questions

تاريخ 26-2-2021

Dear Mr.

In regard of the case study entitled “development of a cloud computing adoption strategy framework for a financial enterprise from Enterprise architecture perspective”, I’d highly appreciate your cooperation in answering the following sections.

1. هل قمتم بالتحول الى CC CLOUD COMPUTING ؟
ان كان الجواب نعم, هل بالامكان تزويدي بالخطة الاستراتيجية الخاصة بذلك؟

Part1

1. What is your organizational structure? الهيكل التنظيمي
برجاء تزويدي بمخطط شجري رسومي للهيكل التنظيمي للمؤسسة؟
2. What are the current strategic objectives of the organization?
ما هي الاهداف الاستراتيجية الحالية للمؤسسة؟ ما هي الاهداف الاستراتيجية
3. What are the future strategic objectives (in regard of cloud computing migration) of the organization?
ملة التحول للبيئة السحابية؟
4. What are the units (departments\division) in the organization?
ما هي الادارات التي تتكون منها المؤسسة؟
5. Who are the employees (job roles) of the units (departments) in the organization?
من هم الموظفين (دورهم الوظيفي) التي تتكون منهم ادارات المؤسسة؟
6. What are the services (end service) that each department offers?
ما هي الخدمات التي تقدمها كل ادارة من ادارات المؤسسة؟
7. What are the functions that each department offer?
ما هي الوظائف التي تقوم بها كل ادارة من ادارات المؤسسة؟
8. What are the processes in each department?
ما هي خطوات العمل التفصيلية الموجزة لكل وظيفة من الوظائف الخاصة لكل ادارة من ادارات المؤسسة؟

Part2

1. What are the strategic IT objectives?
ما هي الاهداف الاستراتيجية الحالية لل IT
2. What are the future IT strategic objectives (in regard of cloud computing migration) of the organization?
ملة التحول للبيئة السحابية؟ IT
3. What are the used applications including: brief description of each one, and which department/s is using this application?
4. What is the applications portfolio w.r.t. B-Units?
5. What is the applications portfolio w.r.t. B- A/Roles?
6. What is the applications portfolio w.r.t. B-Functions?
7. What is the applications portfolio w.r.t. B-Services?
8. What is the applications portfolio w.r.t. B-Processes?

Part3

1. What are the available Technology (infrastructure resources) used in the organization?
ما هو العتاد اضافة الى نظم التشغيل المستخدمة حاليا بالمؤسسة؟ بسم الله الرحمن الرحيم

Appendix 51 Template of Bu., ISA, Tec. collection

Se c #	Topic	Content																	
1	Temp late (I)	A. Organizational Strategic Objectives <table><tr><td>BSO_ID</td><td>BSO_Description</td><td>ITSO_ID</td><td>ITSO_Description</td></tr><tr><td></td><td></td><td></td><td></td></tr></table>	BSO_ID	BSO_Description	ITSO_ID	ITSO_Description													
		BSO_ID	BSO_Description	ITSO_ID	ITSO_Description														
		B. Organizational Structure and Units <table><tr><td>U_ID</td><td>U_Name</td><td>U_Parent</td><td>U_Description</td><td>A/R_ID</td><td>A/R</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	U_ID	U_Name	U_Parent	U_Description	A/R_ID	A/R											
		U_ID	U_Name	U_Parent	U_Description	A/R_ID	A/R												
		C. Business Functions <table><tr><td>U_ID</td><td>F_ID</td><td>F_Name</td><td>F_Description</td><td>F_Classification</td><td>BSO_ID</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	U_ID	F_ID	F_Name	F_Description	F_Classification	BSO_ID											
		U_ID	F_ID	F_Name	F_Description	F_Classification	BSO_ID												
		D. Functional Decomposition <table><tr><td>U_ID</td><td>Business Sub- Function ID</td><td>Business Sub- Function Name</td><td>Sub- Function Description</td></tr><tr><td></td><td></td><td></td><td></td></tr></table>	U_ID	Business Sub- Function ID	Business Sub- Function Name	Sub- Function Description													
U_ID	Business Sub- Function ID	Business Sub- Function Name	Sub- Function Description																
E. Business Services <table><tr><td>S_ID</td><td>S_Name</td><td>S_Description</td><td>F_ID</td></tr><tr><td></td><td></td><td></td><td></td></tr></table>	S_ID	S_Name	S_Description	F_ID															
S_ID	S_Name	S_Description	F_ID																
F. Business Processes <table><tr><td>P_ID</td><td>P_Na me</td><td>P_Descrip tion</td><td>P_Cl ass</td><td>P_I/ P</td><td>Supplier of Input</td><td>Process Outputs</td><td>Consumer of Output</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	P_ID	P_Na me	P_Descrip tion	P_Cl ass	P_I/ P	Supplier of Input	Process Outputs	Consumer of Output											
P_ID	P_Na me	P_Descrip tion	P_Cl ass	P_I/ P	Supplier of Input	Process Outputs	Consumer of Output												
G. Business Function to Business Process Matrix <table><tr><td>U_I D</td><td>F_ID</td><td>Contract</td><td>P_ID</td></tr><tr><td></td><td></td><td></td><td></td></tr></table>	U_I D	F_ID	Contract	P_ID															
U_I D	F_ID	Contract	P_ID																
2	Temp late (II)	A1. Baseline Applications <table><tr><td>A_ID</td><td>A_Name</td><td>A_Version</td><td>A_Description</td><td>A_Vendor</td></tr><tr><td></td><td></td><td></td><td></td><td></td></tr></table>	A_ID	A_Name	A_Version	A_Description	A_Vendor												
		A_ID	A_Name	A_Version	A_Description	A_Vendor													
		B1. Application Portfolio Summary <table><tr><td>A_ID</td><td>U_ID</td><td>F_ID</td><td>A_Name</td><td>A_Description</td><td>Business Owner</td><td>A_Status</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	A_ID	U_ID	F_ID	A_Name	A_Description	Business Owner	A_Status										
		A_ID	U_ID	F_ID	A_Name	A_Description	Business Owner	A_Status											
C1. Application Portfolio Details <table><tr><td>F_ID</td><td>P_ID</td><td>A_ID</td><td>Functional Component</td><td>Primary Users</td><td>A_Type</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	F_ID	P_ID	A_ID	Functional Component	Primary Users	A_Type													
F_ID	P_ID	A_ID	Functional Component	Primary Users	A_Type														
3	Temp late (III)	IT Infrastructure <table><tr><td>Tech_ID</td><td>Tech_Na me</td><td>Tech_Desc ription</td><td>Tech_V endor</td><td>Tech_Origin</td><td>Tech_S_ID</td><td>Tech_S_N ame</td><td>A_ID</td><td>A_Name</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	Tech_ID	Tech_Na me	Tech_Desc ription	Tech_V endor	Tech_Origin	Tech_S_ID	Tech_S_N ame	A_ID	A_Name								
		Tech_ID	Tech_Na me	Tech_Desc ription	Tech_V endor	Tech_Origin	Tech_S_ID	Tech_S_N ame	A_ID	A_Name									

Appendix 67 The SLR Literature articles

	Title	Author	Year	Article Type						Keywords														
				A-E:Article Type	Conference paper (2)	Book	Book Chapter	Thesis	Journal/Conference Name		Publisher	Cloud computing	Cloud Adoption	literature review	EA	TOGAF	Design science	Adoption Model (Theory/ Conceptual)	Applied Model	SME	finance/ financial / bussiness	Case Study	Country	
1	Factors Influencing an Organisation's Intention to Adopt Cloud Computing in Saudi Arabia	Alkhatir, N., Wills, G., & Walters	2014	x																			KSA	
2	Factors influence the adoption of cloud computing: A comprehensive review	Hashim, H. S., Hassan, Z. B., & Mahmoud, W. H. A.	2015	x					International Journal of Education			x	x	x							x			
3	Strategies for Cloud Services Adoption in Saudi Arabia	Mahmoud, W. H. A.	2019					x				x	x					x	DOI		x	x		KSA
4	EMPIRICAL STUDIES ON CLOUD COMPUTING ADOPTION: A SYSTEMATIC LITERATURE REVIEW	Saleh, A., Drus, S. M., & Sharif	2017																					
5	An Integrated Theoretical Framework for Cloud Computing Adoption by Small and Medium-Sized Enterprises	Saedi, A. and Iahad, N.A.	2013	x					PACIS			x	x							x		x		MALYSIA
6	Enterprise architecture: creating value by informed governance.	Op't Land, M., Proper, E., Waaijenburg, S., & van der Kamp, J.	2008			x				Springer Science & Business Media					x	x	x			x				
7	Cloudrise: exploring cloud computing adoption and governance with the TOE framework	Borgman, H.P., Bahli, B., Heier, R., & Kuhl, S.	2013	x					Hawaii International Conference on System Sciences	IEEE		x	x						TOE					
8	Modeling enterprise architecture with TOGAF: A practical guide using UML and BPMN	Desfray, P. and Raymond, G.	2014			x				Morgan Kaufmann					x	x	x							
9	Cloud Computing Adoption by firms	Espadanal, M. and Oliveira, T.	2012	x					MCIS			x	x		x		x		DOI TOE					
10	Understanding the determinants of cloud computing adoption	Low, C., Chen, Y. and Wu, M.	2011	x					Industrial Management & Information Systems	Emerald Group Publishing		x	x						TOE					TIWAN AND CHINA
11	An adaptive enterprise architecture framework and implementation: Towards global enterprises in the era of cloud/mobile IT/digital IT	Masuda, Y., Shirasaka, S., Yamashita, K., & Kato, T.	2019	x					International Journal of Information Management	IGI Global		x	x		x	x						x		
12	Migrating Applications to Clouds with BPM and TOGAF Framework	Lin, J.	2012									x	x				x							
13	Newer approach to create flexible business architecture of modern enterprise	Gromoff, A., Kazantsev, N., Kozlov, A., & Kozlov, A.	2012	x					Global Journal of Flexible Systems Management		x				x						x			
14	Enterprise Architecture Planning Information System Based On Cloud Computing Using Togaf	Kwek, D., Maulana, D., Kaburu, J., & Kwek, D.	2019	x					INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT			x	x		x	x					x	x		
15	Enterprise architecture for cloud-based ERP system development	Gunawan, A.I. and Surendro, H.	2014		x				International Journal of Information Management	IEEE		x			x				ERP					
16	A Design Of Government Enterprise Architecture Framework Based On G-Cloud Services	Rakhman, R.A., Anggraini, N., & Anggraini, N.	2019	x					INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT	researchgate		x	x		x	x								indonesia
17	Business Cloudification-An Enterprise Architecture Perspective	Noran, O. and Bernus, P.	2017		x				Noran, O. and Bernus, P.	researchgate		x	x		x						x			
18	Enterprise application architecture development based on DoDAF and TOGAF	Tao, Z.G., Luo, Y.F., Chen, C.X., & Tao, Z.G.	2017	x					Enterprise Information Systems						x	x			DODAF SOA			x		
19	Agile enterprise architecture: a case of a cloud technology-enabled government enterprise transformation	Gill, A.Q., Smith, S., Beydoun, R., & Gill, A.Q.	2014		x				Pacific Asia Conference on Information Systems			x	x		x									Australia
20	Integrating mobile IT/cloud into enterprise architecture: a comparative analysis	Masuda, Y., Shirasaka, S. and Yamashita, K.	2016		x				Pacific Asia Conference on Information Systems	Association for Information Systems		x	x		x	x			SOA					
21	Information System Architecture Designing of Automatic Transformation from Cloud-based E-Portfolio to E-Assessment Using Integration of TOGAF	Wanotayapitak, S. and Wannatayapitak, S.	2018	x					Science and Technology Research Journal			x			x	x	x					x		
22	Cloud Computing Adoption Strategic Planning Using ROCCA and TOGAF 9.2: A Study in Government Agency	Anggraini, N. and Legowo, N.	2019		x				The Fifth International Conference on Information Management	Procedia Computer Science		x	x		x	x						x		
23	Design and implementation of government cloud computing requirements: TOGAF	Alghamdi, B., Potter, L.E. and Alghamdi, B.	2017		x				International Journal of Information Management	IEEE		x	x		x	x			GOVERNMENT			x		Saudi Arabia
24	Tailoring TOGAF Architectural Development Method to Cloud Adoption Strategy	Utomo, D. and Wijaya, M.	2020		x				International Journal of Information Management	IEEE		x		x	x	x	x							
25	Designing enterprise architecture framework for non-cloud to cloud migration using TOGAF, CCRM, and CRMM	Santikarama, I. and Arman, A.	2016		x				International Journal of Information Management	IEEE		x	x		x	x			CCRM					
26	A study of Adopting Cloud Computing from Enterprise Perspective using Delone and Toulmin Model	Bassam Al-Shargabi, Omar Saad, & Bassam Al-Shargabi	2016	x					International Journal of Information Management	IJCSIS		x	x		x		x							jordan
27	Financial institutions management	Saunders, A.	2014			x				Macmillan Press											x			
28	Fundamentals of financial management	Brigham, E.F. and Houston, J.F.	2021			x				Cengage Learning											x			
29	Cloud computing in financial services	Nicoletti, B.	2013							Springer		x	x								x			
30	Cloud Computing Adoption Challenges in the Banking Industry	Singh, M., Tanwar, K.S. and Srivastava, S.	2018		x				Computing and Information Science	IEEE		x	x				x	TOE		x				india
31	Perspectives Of The Cloud Computing For Financial Institutions	LUCOVIĆ, Damir	2015	x						University of Novi Sad												x		
32	Role of information communication technology (ICT) in Nepalese banking industry	Sapkota, N., Paudel, N., Subedi, N., & Sapkota, N.	2018	x					Global Society for Information Science	American Science												x		
33	Towards a cloud oriented technological reference model of Bahrain	Adwan, Ehab J	2019							researchgate		x	x					x	reference model					
34	Enterprise Architectural Design Based on Cloud Computing using TOGAF	Osadhani, Y., Maulana, A., Rizki, A., & Osadhani, Y.	2019		x				International Journal of Information Management	IEEE		x	x		x	x	x		reference model				x	

الملخص

دفعت المزايا العظيمة التي تقدمها الحوسبة السحابية جميع القطاعات الاقتصادية في العالم وبخاصة قطاع المؤسسات المالية وعلى رأسها البنوك الى تبنيها. ولكن وعلى الرغم من انشاء بعض القطاعات الاقتصادية لأطر عمل متعددة ولقطاعات متعددة لتبني الحوسبة السحابية الا ان الامر بالنسبة للعديد من الدول ومن ضمنها مملكة البحرين يعتبر جديد نسبيا اذ يحتاج تصميم إطار العمل الى دراسة أكاديمية صارمة للقطاع المعني. على الجانب الاخر، يبرز فرع البنى المؤسسية كأحد فروع نظم المعلومات والذي يعمل كمنهجية متكاملة تطبق في جميع قطاعات الاعمال الحكومية والخاصة بمختلف تخصصاتها وبخاصة قطاع المؤسسات المالية وبجميع أحجامها بهدف تحقيق الأهداف الاستراتيجية، حيث يمكنه ومن خلال اجراء تعديلات على منهجية توجاف للبنى أن يعمل كإطار عمل فعال لتبني الحوسبة السحابية في قطاع البنوك.

تهدف هذه الدراسة الى انشاء وتقييم إطار عمل شامل (CCAFF) لتبني الحوسبة السحابية في البنوك في البحرين من منظور فرع البنى المؤسسية وذلك بتعديل منهجية توجاف للبنى المؤسسية. اتسمت الدراسة بكونها استكشافية متبعة الاسلوب الاستقرائي وعليه فادتنا الدراسة الى تبني النمط النوعي والذي مكننا من انشاء إطار العمل من خلال الاستعانة بمنهجية البحث العلمي التصميمي (DSRM) بمراحله الستة كأداة لتصميم البحث وتطبيق دراسة حالة متعمقة على أحد البنوك في البحرين. ولضمان جودة مراحل الدراسة بدءا بالمنهجية والادوات والاجراءات وانتهاءا بالتحليل والنتائج فقد تم تطبيق مقياسي الصدق (صدق المفهوم والصدق الداخلي) والثبات في مرحلة جمع البيانات. أما لتقييم إطار العمل فتم تطبيق منهجية دلفي لاستطلاع آراء لجنة مكونة من ستة خبراء في بناء على ستة معايير.

أظهرت الدراسة نتائج ايجابية وواعدة للإطار من حيث الشمولية (85.8%)، دعم اتخاذ القرار (86.6%)، وقت التنفيذ (84.8%)، سهولة الاستخدام (86.4%)، الفائدة المرجوة (84.6%) والرغبة في اعادة استخدام الإطار مجددا (84.8%).

الكلمات المفتاحية: تبني الحوسبة السحابية، إطار عمل استراتيجي، المؤسسات المالية\البنوك، البنى المؤسسية، توجاف، مملكة البحرين.



انشاء إطار عمل إستراتيجي لتبني الحوسبة السحابية في قطاع المؤسسات المالية في البحرين من منظور البنية المؤسسية

أطروحة مقدمة كجزء من متطلبات الحصول على درجة الماجستير في تقنية المعلومات

اعداد

بدر علي سعيد السعيد

20170046

اشراف

الدكتور إيهاب جمعة عدوان

أستاذ مساعد

جامعة البحرين

مملكة البحرين

يناير 2022