CRANFIELD UNIVERSITY

SARAH MOHAMMED HUSAIN ALHARTHI

DEVELOPMENT OF A FRAMEWORK FOR CLOUD-BASED ERP IMPLEMENTATION IN DEVELOPING COUNTRIES

SCHOOL OF AEROSPACE, TRANSPORT AND MANUFACTURING
PHD COURSE

PhD
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Supervisors: Dr Ahmed Al-Ashaab & Professor Essam Shehab

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ABSTRACT

This research aims to provide a framework to support organizations in cloud-based Enterprise Resource Planning implementation successfully based on benefits realization (BR) approach. The framework has been developed through benefits realization management with adopting the maturity concept to realize most of the expected benefits.

The methodology covers four stages, namely, understanding context and current practices, data collection and analysis, framework development and validation. The interview technique has been used to collect data from industries in different sectors based on the qualitative research approach and case study strategy. The research methodology was applied on organizations (customer) and cloud service providers in developing countries during different times of cloud-based ERP post-implementation.

The framework integrated maturity and benefit realization (BR) model for better realization; The benefit realization model has four phases, identifying, planning, assessing, and establishing of the benefits. BR approach required a proactive procedure that is maturity which consists of three phases: identification, evaluation, and action. The assessment tools for both models are conducted by using multi-grade fuzzy logic, that will provide indices which shows the organization where they are (maturity index) and where they are going to be (BR index). The developed framework has been validated using assessment tools with industrial experts and the result has been examined by Spearman rank correlation coefficient that shows a perfect positive correlation.

The main contribution of this research focused on integrating the benefits realization approach and maturity concept of cloud-based ERP system implementation in the developing countries. The maturity helps organizations to improve the weaknesses area by assessing five enablers: (leadership, strategy, people, technology, and governance) before starting the implementation, to pave the way for realizing the benefits. While the benefit realization model assess organization to realize the expected benefits (operational, managerial, strategic, technology, and organizational) and establish potential for further benefits lead to investment objectives at the end.

Keywords: Cloud-based ERP benefits realization management, benefits realization management, benefits realization model, maturity approach, multi-grade fuzzy logic, assessment

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LIST OF PUBLICATION

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LIST OF ABBREVIATIONS

APM	Association for Project Management
BDN	Benefits Dependency Network
BM	Benefits management
BR	Benefits realization
BR index	Benefits realization index
BRM	Benefits realization Management
Cloud-based ERP	Cloud-based Enterprise Resource Planning
CRM	Customer relationship management
CSF	Critical Success Factors
CSPs	Cloud Service Providers
ERP	Enterprise Resource Planning
HR	Human resources
IS	Information System
IT	Information Technology
M index	Maturity index
SMEs	Small and mid-size enterprises
TOE	Technological, Organisational and Environmental framework
RI	Relative Importance
CC	Cloud Computing

1. CHAPTER ONE: INTRODUCTION

1.1 Background

In the commercial world, driven by competition for survival, profit, and continuity, businesses use technology and information systems to provide faster services at lower cost for their customers, whether these customers are individuals or organizations (Monk, et. al. 2001; Umble et al., 2003). The competitive market drives organizations to improve their core competitiveness, and this could be through digital initiatives. Organizations try to improve and develop their competitive advantage to improve the offers during providing their e-services much quicker and more reliably.

One of the available technological systems targeted towards the business sector is Enterprise Resource Planning (ERP), which requires substantial budgets and large project teams. Many organizations have already undertaken ERP due to its ability to improve performance and productivity (Sadrzadehrafiei et al., 2013). ERP provides various benefits to firms such as reducing the cost, improve the productivity and quality, enhance customer's experience , superior resource management, amended planning, and empower organizations (Laukkanen et al., 2007). However, this software solution (ERP) has disadvantages in terms of cost, migration of data, and knowledge about the system, etc. However, ERP does have the potential to give organizations the chance to gain value over business processes integration and available resources.

Another technology model received considerable attention and evolved a number of times is cloud computing. Cloud computing is considered to be an enabler for many subsequent technologies such as Fog Computing, Artificial Intelligent (AI) and Internet of Things (IOT); in short, the fourth industrial revolution. Cloud computing provides all the functionalities of IT services whilst changing of the way they are invented, deployed, scaled, updated, maintained and paid for, and then enabled (Oyemike, 2017).

Competitive business environments that create new business models to meet customers' needs as well as improving the productivity and agility of organizations, have end with developing cloud-based ERP (Velumadhava Rao & Selvamani, 2015). Thus, the new

business landscape involving cloud-based ERP warranted the attention of researchers, practitioners, and academia (C. S. Chen et al., 2015).

Providing ERP over cloud computing platforms provides benefits and helps address its shortcomings. Shehab (2004) detailed some of the drawbacks of ERP as: huge storage needs, networking requirements, training overheads, requirement for a large capital investment, pressure on staff and management time, and the lack of a trained workforce. However, the characteristics of cloud computing offers ERP systems a powerful environment for adoption; these include a pay-per-use model (measured service), broad network access, rapid elasticity, on-demand self-service, and resource pooling. These advantages of cloud enable ERP to offset its drawbacks with cost reductions, access to top-end IT capabilities, reducing processing and task time, sharing, backup and recovery, and scalability (Almazroi, 2017).

To ensure short-term business benefits and on long-term investment objectives are achieved, all the factors that encourage an organization to implement cloud-based ERP need to be tracked and realized. Benefits realization management promises organizations review and realization of benefits in the post-implementation phase, even though the process starts before that time. For effective and efficient benefits realization, the maturity of an organization should be examined as a proactive procedure. This research studies the system of ERP on cloud services and developed a robust framework to support efficient cloud-based ERP implementation in the light of benefits realization management.

1.2 Research Motivation and Scope

In the era of digitalization, on-demand services and applications, cloud-based ERP implementation has become one of the fundamentals within businesses. Although the prevailing mindset towards IT projects tends to consider them as purely the responsibility of IT departments, it is in fact a matter for everyone within an organization as it affects most business processes. Furthermore, the return on investment for IT projects has often been unsatisfactory (Carr, 2003; Clegg et al., 2010). However, the costs of ERP were increasing out of control, sometimes exceed millions of bounds. It became clear that ERP solutions are too complicated, increased complication results in increased the budget.

Consequently, research began to address the reasons for failure. This strand of research concentrated on the business value of IT (Schryen, 2013), along with CSFs (Koh et al., 2011; Ram et al., 2013a). From these studies, lack of success was not found to be as a result of technical issues when projects failed to realize the expected benefits (Mir & Pinnington, 2014).

Globally, there has been a trend towards digital transformation programs involving numerous initiatives, including cloud services with different types of services: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). The programs and initiatives have seen investment of money and effort to achieve their objectives and goals. Indeed, they have been implemented for benefits, where no effective approach has been adopted to realize the expected benefits although the early call for that (Ward et al., 1996). In addition, it is worth mentioning that the benefits are not automatically achieved once the projects have been implemented. In developing countries, into which these sorts of systems are imported, more complexities are added to the implementation process. This is because of the challenges of operating them, managing them, and the lack of knowledge and resources in terms of experts.

In developing countries context, where the lack of cloud-based ERP experts and professional employee in contrast with existing of providers via partners. In some countries the partners are separated, where the partner of ERP different from cloud service providers which required accurate selecting, planning, and implementation. For that a proactive procedure is essential to pave the way for any expected or possible benefits. Furthermore, adopting a maturity approach is fundamental for improvement and required changes for successful implementation. In contrast, adopting a benefits realization approach for realizing benefits come through a number of processes within the projects. The framework will enable organizations in developing countries to leverage the level of maturity regarding cloud-based ERP by improving and carry out the required changes before starting the implementation (Pre-implementation). Besides identifying the cloud-based ERP benefits, planning for them, reviewing them for further benefits.

The research scope is on cloud-based ERP implementation in developing countries from

a benefits realization management view. The framework is for different sizes of organization, with different types of cloud services and deployment models. The research output is a framework, which can be used to assess cloud-based ERP maturity by examining the critical success factors and avoiding the challenges in pre-implementation. It also facilitates in assessing the realization of benefits in the post-implementation phase to ensure the success of this phase with evidence from realized benefits and keeping the project on track in terms of investment objectives.

1.3 Research Aim and Objectives

The research aim is to develop a robust framework to support the implementation of cloud-based system in the developing countries by identifying the maturity level in order to realize the benefits of the system.

To achieve aim of the research, the researcher set numbers of objectives as follow:

1) Understand the current practice (AS-IS) of cloud-based ERP implementation
2) Investigate the key drivers for cloud-based ERP implementation to understand the need of organization to the system over cloud;
3) Determine the expected challenges in the implementation of cloud ERP;
4) Determine critical success factors that assist organizations in implementing cloud-based ERP;
5) Employ the critical success factors and challenges in assessing maturity of an organization by means of a maturity model;
6) Employ the key-drivers in assessing the benefits realization by applying a benefits realization model;
7) Develop and validate a framework for cloud ERP implementation.

1.4 Participation Organizations

The organisations participated in the research are: Saudi Arabian Government Investment Authority (SAGIA), Saudi Authority for Accredited Valuers (Taqeem), Saudi Organization for Certified Public Accountants (SOCPA), Elm: International company for digital solutions, Saudi Centre for International Strategic Partnerships (SCISP), Saudi Agricultural and Livestock Investment Company (SALIC), and Saudi Industrial Development Fund (SIDF). SAGIA participated as a customer and provider, ELM as

provider, and SIDF as a consultant body for Saudi factories.

The researcher gained a knowledge about the research subject and the as-is state from the first organization. Where they were awarded for their implementation and their CIO awarded as the best CIO in Saudi Arabia for 2018 according to IDC (International Data Corporation). The rest participated in development of the cloud-based ERP implementation framework.

1.4.1 Saudi Arabian Government Investment Authority (SAGIA)

SAGIA is responsible for assessing investment performance to stimulate local investment. It received a digital transformation plan based on its needs and business strategic goals, as well as following the government digital transformation program launched in July 2017. SAGIA is considered a large size of company in a developing country. It was a client for a respected business application vendor; then, after the digital transformation project was completed, it became a cloud services provider for companies in the same organization.

It was necessary to convert the strategic goals of SAGIA into IT goals to fill the gaps and needs with technology solutions. Accordingly, the strategic imperatives lead to IT imperatives that resulted to a number of solutions: Integration & Consolidation, Business Process Optimization, Online Services & Interaction Centre, Mobility, Interaction Centre, and Big Data Analytics Centre.

After conducting a comprehensive roadmap assessment workshop at SAGIA with focus on Big Data and business analytics, the vendor came to the following conclusion: A centralized data platform is essential as a start for

- Better Data Accessibility
- A holistic view of customer information
- Better data governance
- Better reporting performance

Some departments were fully reliant on Excel for their daily business processes. SAGIA needed to implement a unified customer (Investor) lifecycle management platform to act as both an external Omni-channel engagement platform with the investors and as an

internal unified investor file-management system.

The vendor also concluded that the standardization of the tools used on the systems is essential, as there are too many in-bred / shadow IT solutions. It further concluded that SAGIA needed to consider how to monetize the huge amount of data that it had about all investments being carried out in the Kingdom. This could be done via implementation of several BI driven programs and products that would be provided by SAGIA. SAGIA further needed to consider how to take its investor services to the next level by providing investors with Strategic Managed Services as a Subscription. This could include Managed IT Services as a cloud offering, government relations, business opportunity leads and others.

SAGIA realized the cost of doing nothing is:

- Data management complexity will increase
- One version of the truth will become harder to attain
- Critical insights will remain hidden
- There would be inefficient report generation
- Departments will keep using shadow IT solutions, making governance and scalability harder to achieve

As consequence, an investments services value map was used to identify each service provided. Its values were to be automated in order to successfully deliver the service to end customer. As cloud was one of the technologies currently used, ERP was migrated to it. ERP was already in-house in SAGIA from the same vendor in four modules: Human Resources (HR), Finance, Procurement, Supply Chain, and Asset Management.

1.4.2 Saudi Authority for Accredited Valuers (Taqeem)

Taqeem considers a non-profit and judicial body. It works under the Ministry of Commerce and Investment with an independent budget and its board of directors is chaired by His Excellency, the Minister of Commerce and Investment.

Taqeem aims to regulate and develop the valuation profession, accredit qualified valuers, and apply the International Valuation Standards to increase community trust and awareness in the valuation profession. Taqeem is a small organization around 50 employees; they used to process their transactions manually until SAGIA offered them SaaS ERP, to be integrated in a shared services program with support.

1.4.3 Saudi Organization for Certified Public Accountants (SOCPA)

SOCPA is a Saudi professional membership organization. Through their technical knowledge, skills, and expertise, they provide insight and leadership to the accountancy profession in Saudi Arabia. It was established to promote the accounting and auditing profession and all matters that might lead to the development of the profession and improve its status. SOCPA used to use a legacy system for financial and HR departments. They got an offer from SOCPA to be integrated into a shared services program. The offer included SaaS ERP with support.

1.4.4 Elm: International company for digital solutions

Elm is the leading provider of innovative secure services and solutions, offering services to both public and private sectors in Saudi Arabia. Elm provides readymade e-services, customized IT solutions, governmental support services and consultations. The customer base of ELM contains over 60,000 private and public organizations on top of individual customers, helping them to achieve significant results in increased efficiency in addition to cost and time reduction.

1.4.5 Saudi Centre for International Strategic Partnerships (SCISP)

SCISP is a standalone government entity linked to the Council of Economic and Development Affairs. SCISP was established to coordinate all the Kingdom’s efforts in relation to its international and regional strategic partnerships with partner countries, to build, develop and strengthen such partnerships, as well as coordinate and monitor their programs with relevant agencies, through SCISP's mandate and assigned tasks in the governmental ecosystem.

1.4.6 Saudi Agricultural and Livestock Investment Company (SALIC)

SALIC was established as a Saudi joint-stock company where all its investment activities should be both inside and outside the Kingdom of Saudi Arabia in order to achieve a food security strategy by providing food products and stabilizing their prices. This is done through establishing subsidiary companies or through national, regional, and international partnerships.

1.4.7 Saudi Industrial Development Fund (SIDF)

SIDF was founded to play a leading role in effectuating development policies and programs. The Industrial Fund was set up to operate a vital role in promoting industrial investment opportunities, strengthening local industry, and enhancing its performance. All these measures are realized by contributing to the formation of industrial sectors, boosting competitiveness, and sustaining strategic initiatives.

1.5 Thesis Structure

There are seven chapters within the thesis, as illustrated in Figure 1.1. It began with chapter one where initiates a brief introduction to the research, the research motivation and scope, explaining the questions, and aim and objectives of the research. Chapter 2 presents a literature review related to cloud-based ERP, benefits realization approach experienced and maturity approach. Subsequently, the research gap explained. The selected research methodology and the rationale of the methods and techniques are illustrated in Chapter 3. The procedures undertaken for the data collection, analysis, and framework development are laid out in Chapter 4. Explaining the concept of the maturity assessment model, the methodology used to create the model and its components, the application and model validation are described in Chapter 5 Maturity Assessment Model Design and Development. The benefits realization concept, approaches, and models, besides the methodology, used to create the model and its components, the validation of the model is described in Chapter 6 Benefits Realization Assessment Model Design and Development. The research outcomes and suggestions for future directions are summarized in Chapter 7.

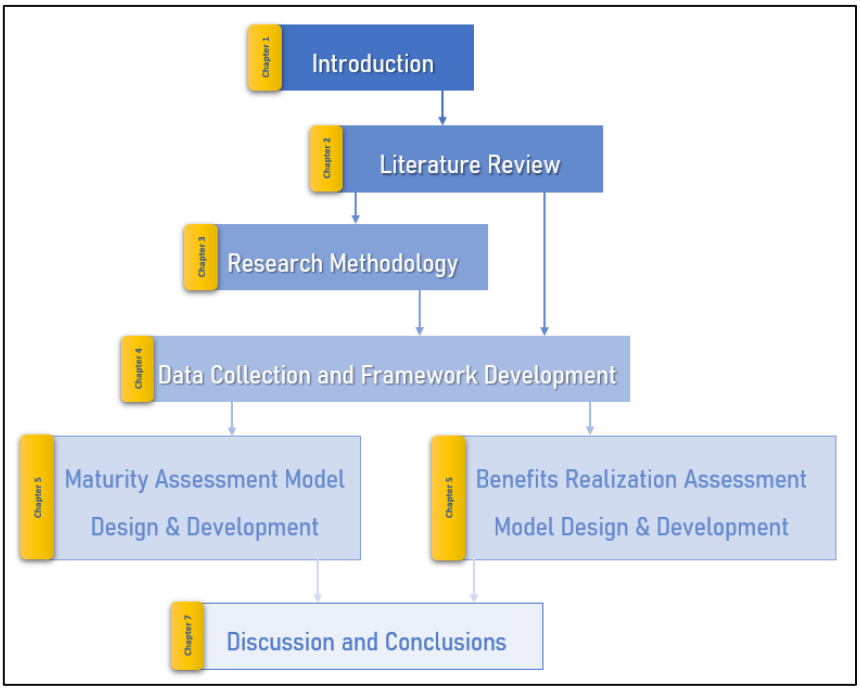


Figure 1.1: Thesis Structure

2. CHAPTER TWO: LITERATURE RVIEW

2.1 Introduction

This chapter addresses cloud computing, its power during the fourth industrial revolution and ramifications of the covid-19 pandemic on business and management (Davies, 2020). In addition, it outlines the cloud with business systems then discusses cloud-based enterprise resource planning, cloud-based in developing and developed countries. The chapter also highlights the success of the IT project: Benefits management of IT investments, Cloud-based ERP Benefits management as demonstrated in Figure 2.1

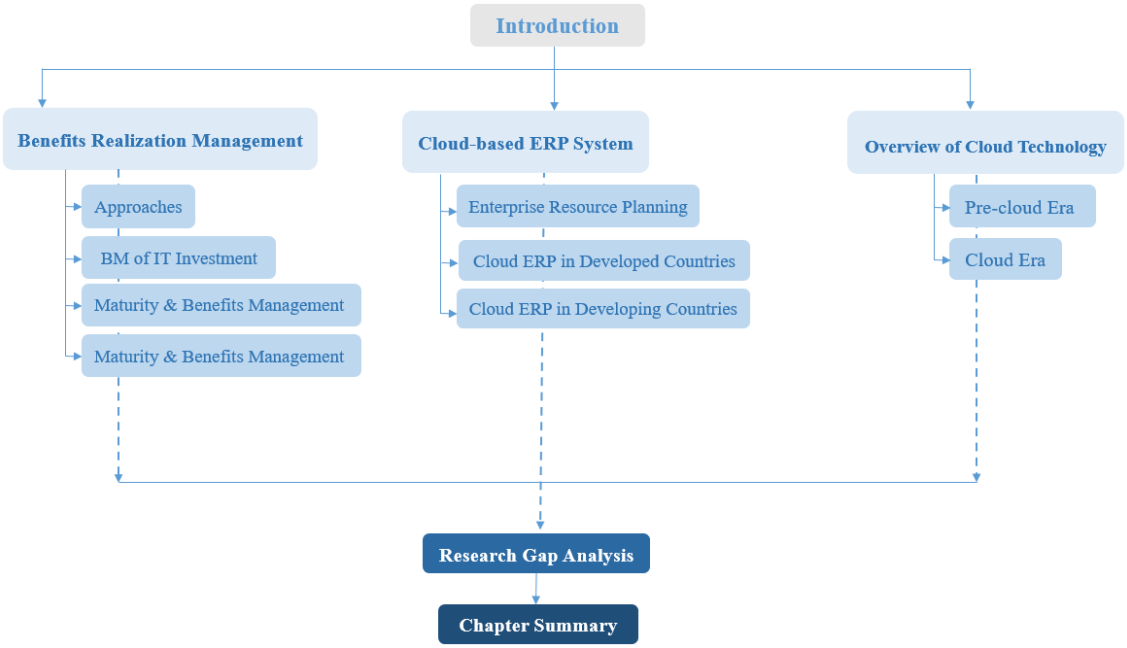


Figure 2.1: Outline of Chapter 2

The aim of this chapter is to give a detailed revision for literature in the area of the success of cloud-based ERP projects in developing countries, as well as determine the research gaps and provide a good review about the investigated areas.

2.2 Overview of Cloud Technology

Cloud technology got attention from the ’60s until the moment and got many evolutions until it stabilized to this form at the end. The current form of cloud is considered as an enabler for many future technologies, such as Fog Computing, Artificial Intelligent (AI), Internet of Things (IoT) and the fourth industrial revolution. Cloud computing provides all IT services functionalities with changing the way IT services used (Oyemike, 2017).

The common factor between the fourth industrial revolution, digital transformation and digital business is cloud technology (Faynberg et al., 2016).

To understand cloud technology, the next section will explain the era before cloud to realize and imagine the important role of cloud afterward.

2.2.1 Pre-cloud Era

To understand what cloud provides to business and the IT industry, it is necessary to address the pre-cloud era. Faynberg, et. al. (2016) examined the pre-cloud era in attempt to explain the significant role of cloud technology in business, management, and the IT industry. Investing in software-based product and services can involve substantial upfront investment, a high risk of losing this investment, slow time-to-market, and considerable ongoing operational costs, incurred from operating and maintaining the infrastructure. Additionally, there was the accountability of the design and implementation of the whole system on developers, where they should select the physical infrastructure, check the reliability of software, their attempts to transform the business into e-business or application. Furthermore, applications deployment on a dedicated infrastructure, and capacity planning was performed separately for each service (Faynberg et al., 2016).

2.2.2 Cloud Era

In the cloud era, which is from the late 1990s onwards, relates to everything that concerned with the internet (Limet et al., 2015). Before considering the cloud era in detail, the cloud concept should be explained. In academia, the definitions of cloud are numerous from academic research experts. However, there is confusion around the concept of cloud, whether by those in business or by individuals (Mullan, 2010).

The first definition of cloud computing was provided by Prof. Ramnath K. Chellappa, in 1997, defining it as ‘a computing paradigm where the boundaries of computing will be determined by economic rationale rather than technical limits’ (Madhavaiah et al., 2012). Buyya et al. (2008) explained cloud computing as ‘a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider

and consumers'.

Kim (2009) described cloud computing as 'able to access files, data, programs and third-party services from a Web browser via the Internet that are hosted by a third-party provider and paying only for the computing resources and services used'. Marks and Lozano (2010) used the definition: 'cloud computing is on-demand access to virtualized IT resources that are housed outside of user's own data centre, shared by others, simple to use, paid for via subscription, and accessed over the Web'.

Marston et al. (2011) defined cloud computing as 'an information technology service model where computing services (both hardware and software) are delivered on-demand to customers over a network in a self-service fashion'. Users pay for the service as an operating expense without incurring any significant initial capital expenditure, with the cloud services employing a metering system that divides the computing resource in appropriate blocks.

Madhavaiah et al. (2012) analysed thirty-six definitions of cloud computing proposed by different researchers and practitioners, using the content analysis methodology, in order to establish areas of 'agreement' and construct a 'general' definition of cloud computing from a business perspective. The study defined cloud computing as 'an information technology-based business model, provided as a service over the Internet, where both hardware and software computing services are delivered on-demand to customers in a self-service fashion, independent of device and location within high levels of quality, in a dynamically scalable, rapidly provisioned, shared and virtualized way and with minimal service provider interaction.

As well as in literature there are several cloud definitions from a business perspective. Gartner defines cloud as 'Massively scalable system capabilities delivered as a service to external users using Internet technologies' (Crahmaliuc, 2014). While the American multinational technology company IBM described it as 'The delivery of on-demand computing resources, everything from applications to data centres over the Internet on a pay-for-use basis'. However, the national institute of standards and technology (NIST) has the most comprehensive definition containing most cloud characteristics. The NIST defines it as 'a model for enabling 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' (Mell & Grance, 2009). The former definitions shows that cloud involves five basic characteristics, three service models, and four deployment models as shown in Figure 2.2.

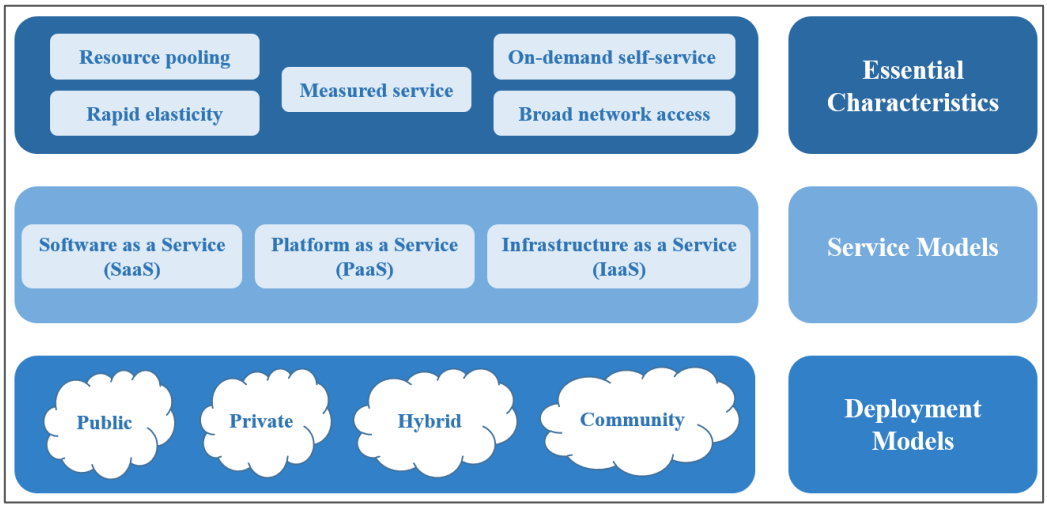


Figure 2.2: Cloud computing models

2.2.2.1 Cloud Characteristics

The above definition forms the concepts of cloud computing that can completely eliminate any claim that cloud computing is the same as traditional hosting services or the Internet itself, which are:

1) *On-demand self-service*: it provides computing resources automatically without interaction of service providers. the customer requested the resources and get it directly through billing model pay-per-use (Denham-smith, 2016; Mell & Grance, 2009; Verma & Kaushal, 2011).
2) *Broad network access: laptops*, tablets, smartphones, workstations, even sensors can access cloud computing services over the internet. The user can get access from any place at any time as long as you the internet is available (Mell & Grance, 2009; Pramod et al., 2013a; Sajid & Raza, 2015).
3) *Resource pooling:* users of cloud platform shared different resources such as workstation, laptops, tablets, and smartphone. Cloud services provides a number of end users at different time, knowing that the physical location of the resources

is not known, beside no control over the location (Verma & Kaushal, 2011).

4) *Rapid elasticity:* the user has the ability to add or remove the resources, they provide rapidly and elasticity with ability to scale them up or down almost automatically (Mell & Grance, 2009; Pramod et al., 2013a; Sajid & Raza, 2015).
5) *Measured service:* the used resources are measured which provided on a pay-per-use model. Resources are provided using specific metrics such as amount of CPU cycles used, amount of storage space used, number of network I/O requests etc. (Mell & Grance, 2009; Sajid & Raza, 2015).

2.2.2.2 Cloud models

As previously mentioned, cloud has three service models, and four deployment models. The service models provide different types of services based on customer requirements and business needs (Dillon et al., 2010; Mell & Grance, 2009; Sajid & Raza, 2013; Verma & Kaushal, 2011).Whereas deployment models represent the cloud environment that the customer would like to deploy the services over, based on size and access. The deployment model also describes the nature and purpose of the cloud (Brohi & Bamiah, 2011; Liu et al., 2011). The following section will explain both models.

2.2.2.2.1 **Cloud Service models:**

- **Software as a Service (SaaS)**

Cloud service providers (CSPs) offer their customers a wide range of software applications, managed and owned by the providers (centrally managed). The customer alone pays the subscription fee via a pay-per-use model. The responsibility of the data, applications, platforms, and infrastructure is under control of the provider as well. This services model is quite common among the two other service model, provided one (product/service) to many customers (Pramod et al., 2013b; Verma & Kaushal, 2011). Examples: WhatsApp, Dropbox, Gmail, Google drive, Microsoft Office 365.

- **Platform as a Service (PaaS)**

The providers in the PaaS model offer platforms with programming tools, without installation, to customers who have their own software or application. The providers manage and control the infrastructure below while the customer allows to maintain the application in a customised way. It is well-known that this model fits to developers' needs

(Bardin et al., 2009). Examples of PaaS include Amazon Web Services, Google App Engine (Python, Java, Go), Microsoft- Windows Azure.

- **Infrastructure as a Service (IaaS)**

CSPs offer outsourcing of basic computing resources (networking components, storage etc.) whilst providers have responsibility for the management and control of the cloud infrastructure. The customer has control over the operating system, applications and storage (Krutz & Vines, 2010; Verma & Kaushal, 2011). IaaS customers pay for the hardware each time they use it. Examples of IaaS: Amazon-EC2 (Elastic Cloud Compute), Microsoft- Private Cloud.

These are the three major common service models of cloud. However, there are other services model that depend on the customers' needs; these include function as a service, security as a service, and data as a service. All these models follow the same payment model (pay-per-use) or (pay-to-what-you-use).

2.2.2.2.2 **Cloud Deployment models**

- **Public Cloud**

The most common deployment model provides massive scale cloud services to members of the public. The location of infrastructure is resident on the CSP's premises. It offers free or paid access according to a pay-per-use model. The cloud resources are available through the internet. Clients of this service model can select and assign the security and service level they required; however, the flexibility is low (Mell & Grance, 2009; Sajid & Raza, 2013). As all users of this deployment model are sharing the same infrastructure, security and privacy are at risk (Dillon et al., 2010; Ren et al., 2012).

- **Private cloud**

The private cloud model dedicated to a single organization and not accessible to the public. The physical location of the infrastructure could be on-site or off-site with a third party. This deployment model is the most trusted types among the three others as the level of security, privacy, and flexibility are high. Whereas the cost is expensive comparing to other deployment models on contrary with the cost. It is used by private firms, public

sector organisations and government bodies within closed user groups (Mell & Grance, 2009; Sajid & Raza, 2013).

- **Community cloud**

It is for users or organizations that gather as a one community, and share common goals, security requirements, or policies. The physical location of the infrastructure can be hosted on or off the premises of organizations. As it dedicated to specific customers, the privacy and security are high; however, it is lower compared to the private cloud model. It could managed and owned by one or multiple organisations in that community (Dillon et al., 2010; Mell & Grance, 2009; Sajid & Raza, 2013; Verma & Kaushal, 2011).

- **Hybrid cloud**

The concept of hybrid comes from the combination of the previous cloud deployment models, especially the key two of private and public. Organizations use the hybrid cloud model to gain benefits of more than one model simultaneously. The customer generally possesses, manages, operates, and hosts the cloud infrastructure, unless it is managed and hosted by a third party (Dillon et al., 2010). The hybrid cloud is considered an appropriate solution for organizations concerned about confidentiality: they can host an application with their confidential data on a private cloud, and link the application with other software in a public cloud (Rani & Ranjan, 2014; Zhang et al., 2010).

Having explained the concept of cloud and its models, the next section will illustrate the values the cloud adds to business when adopted, i.e., the power of cloud technology that empowers a business in the market.

2.2.2.3 Value added of cloud to the business

Cloud as a technology adds value to business by its characteristics, for different industries, as well as offering a solution for different size of organizations enterprise and SMEs. The literature mentioned the value of cloud and the benefits of cloud computing as drivers, opportunities, promises and factors. Where at the end of these terms, it reflects the values that cloud add one way or another. Businesses with cloud are able to share information, data storing, and perform database mining and management (Sultan, 2010). Cloud computing enhances the operational efficiency of a business, it becomes more productive

as the focus is more on core business aspects (Sahandi et al., 2013). Where before the effort of IT department divided between IT issues and business, even for non-native IT businesses. On the other hand the accessibility and availability of cloud from different platforms and devices at any time, provides businesses with flexibility and agility which enhances efficiency and productivity (Tamburri & Lago, 2011). As the cloud offers pool of resources with availability and accessibility features, it promotes innovation to users so they can fully focus on it (Boss et al., 2007; Sukumaran, 2011). In addition, the most significant characteristic that differentiates in business is elasticity; the business can expand resources up or down according to need. Elasticity support the trend of "working from home" during Covid-19 pandemic period, as it did during high demand seasons (Arora et al., 2020).

Moreover, the payment model that cloud offers to business provides numerous advantages. According to Alnasser GM, Investments & Market Enablement in Ministry of Communications and Information Technology of Saudi Arabia in his talk about Cloud Computing Economics, the savings with cloud involve two facets: hard saving and soft saving. Hard saving are associated with cash as it enables organization to reduce the IT labour cost, upfront cost, infrastructure, maintenance, operating cost, lower total cost of ownership, lower start-up costs, and hardware (Abd Elmonem et al., 2016; Alajbegovic et al., 2013; Fallis, 2013; Riyadh Geeks, 2019; Rohde & Zhong, 2014; Salum & Abd, 2015).

The soft saving result from using advanced technology: cloud environment offers top end technologies with management and support from vendors, who make available a variety of resources and improve the skills of users (Abd Elmonem et al., 2016; Fallis, 2013). Also the rapid implementation of cloud solutions, reuse of services and applications, increase the system's user productivity, and improve customers' satisfaction (Abd Elmonem et al., 2016; Alajbegovic et al., 2013; Fallis, 2013; Rohde & Zhong, 2014; Salum & Abd, 2015).

These benefits associated to cloud, encouraged organizations to implement cloud solutions and link it with other business systems, such as enterprise resource planning (ERP), customer relationship management (CRM), human resources (HR), supply chain management (SCM), financial management etc. Nowadays, with digital transformation

programs and the 4th industrial revolution that involves many technologies, cloud is considered to be the enabler to most of them, including fog computing, edge computing, internet of things (IOT), machine learning, and artificial intelligence (AI),

2.2.2.4 Cloud and business systems (Cloud-based Services)

Cloud technology via its characteristics, promised traditional business systems to inherit them and become more effective and efficient. Cloud empowers the business systems to accomplish the business objectives through couples of benefits. The literature addressed cloud and business systems in general as cloud-based services or cloud based specific business systems such as CRM, HR and ERP.

Sandu & Gide (2018) argued that the benefits of cloud based services are behind the adoption of organizations mainly Small and Medium Enterprises (SMEs). The study focused on Technology, Organisation and Environment factors (TOE) that affect the implementation of Cloud based service. Bearing in mind the importance of SMEs towards Cloud based technology, it tries to find the factors that control the implementation of Cloud based services in Indian SMEs. The paper research about the factors of adopting such a system in Indian SMEs, and the importance of organisational and technological factors.

While Mydyti et al. (2020) addressed cloud-based services as an accelerator to the digital transformation. The core advantages of cloud services in empowering digital transformation via cost, work efficiency, elasticity, agility, scalability, and security. The approach is based on cloud-based services, offer different capacity and enhancing functions on demand services, with empowering businesses to transform digitally.

Lin et al. (2014) elucidates the organizational benefits of CRM in this emerging field. This study focuses on understanding the feasibility of applying cloud CRM and exploring the enterprise value of CRM services by using Means-End Theory and interpretive structural modelling ISM Approach.

In the context of cloud-based HR, Fouladi & Navimipour (2017) tried to evaluate the quality of the human resources (HRs) depended on trust, reputation, agility, expertise and cost over cloud. To evaluate some quality control (QC) factors, a model based on the

SERVQUAL is used. The findings revealed that the hierarchical structure improves the quality and speed rating of HR.

2.3 Cloud-based ERP System

2.3.1 Enterprise Resource Planning (ERP)

Enterprise Resource Planning passed through long journey of evolution started in early 60s as Material Requirements Planning (MRP) system for only manufacturing industry to manage materials by identifying requirements for quantification, that for organisational and scheduling tool only (Shehab et al., 2004). MPR offered couples of benefits such as inventories reduction, enhanced customer satisfaction, better operations (Siriginidi, 2000a). In 80s, MPR evolved and expanded in MRPII to integrate primary functions and other functions into the planning for improving to the manufacturing operations (I. J. Chen, 2001; Hwa Chung & Snyder, n.d.; Mabert et al., 2001). Since that it was available on mini and microcomputers (Siriginidi, 2000b). In mid of 90s, the start of mature ERP, where its evolution involved the back-office functions then with time included front-office functions. Enterprise resource planning Shehab et al. (2004) defined it as a system for business management that integrate sets of software and businesses applications. ERP via functional unit in organization; integrates, manages, coordinate, records, collects, and delivers data and information as a thorough software packaged to consolidate all business processes (Abd Elmonem et al., 2016). ERP is adoptable and implementable for different size of organizations in various industries (manufacturing, health, information system, education, ecommerce ... etc.) (Salum & Abd, 2015) although it considers high expenditure model for SMEs (Al-Johani & Youssef, 2013a). ERP provides organization varieties of benefits such: data sharing and transparency, meet the customer needs due its rapid responses, available global competitiveness, improve business operations and processes (Aisha Momoh, 2015). Marchand and Peppard (2013) asserted that the main objectives of ERP is beyond automating business process to improve efficiency, lower costs, and increase productivity. In literature ERP has three categories of deployment models (Figure 2.2) , On-premise ERP; which required loading the purchased system of ERP onto serves and computers in-house organization (Duan et al., 2012). Hosted ERP; that refer to a services provided to organization or individuals to host the system onto external physical servers through network (Abd Elmonem et al., 2016). Cloud-based

ERP; offering the system over the internet to the user without installing. It could be provided by two of cloud deployment models (privet or public) as well as it might be delivered as software as a service, platform as a service, or infrastructure as a service. It should be provided with cloud characteristics to be cloud based ERP not host ERP (Abd Elmonem et al., 2016; Duan et al., 2012).

Many important works have been conducted on ERP since last decade, from different perspective. Ram et al. (2013b) the study argued that success in implementing an ERP system and in gaining performance improvement are related to each other. The empirical findings revealed that project management (PM) and training & education are critical success factors for implementation success. The researchers asserted that the CSFs were critical to help an organisational achieve performance improvement.

Esteves (2009) in his paper addressed the benefits of ERP via developing a plan for ERP benefits realisation in SMEs. The paper explained that ERP benefits realisation continuum cycle over post-implementation.

In the same vein, Badewi et al. (2018) focused on ERP resources and organizational complementary resources (OCRs) to identify group of benefits. The result of the paper developed a framework; that shows each group of benefits requires ERP resources and OCRs to enable firms to gain innovation benefits.

Although the benefits of ERP and the CSFs that could enhance the success of ERP implementation, Venkatraman & Fahd (2016) described some general challenges, such as cost effectiveness, alignment between software and business processes, customized governance and training, which form the major SME constraints for ERP system adoption. Because of the competitive nature of SME businesses, best practice guidelines for an SME's ERP implementation could be arrived at through closer investigation of its business requirements to get out of misfits. The study identified key success factors of ERP implementation in an Australian SME as a case study. These success factors compared to the actual outcomes achieved. Factors such as business process alignment with the ERP system, meeting customer and stakeholder needs and reducing recurring and maintenance costs were CSFs of ERP implementation in Australian SME. In particular, the IT and business strategy alignment with a customer focus and flexible reporting features of ERP systems has resulted in business agility. Likewise, Momoh et

al. (2010) focused on enterprise resource planning (ERP) implementation failures, through critical failures factors (CFFs). The paper based on an in-depth literature review (1997-2009), by keywords relating to the subject. The result of the research revealed about nine factors are found to be critical in the failure of ERP implementations: customisation, integration, lack of identifying of implications and requirements, lack of change management, poor data quality, misalignment of IT with business, hidden costs, limited training and lack of top management support (Momoh et al., 2007).

Enterprise resource planning offers the business many benefits, by enhancing the critical success factors during the implementation that could improve the performance of organization. However, complexity of the implementation lead to projects failure (Momoh et al., 2010; Supramaniam et al., 2014). Al-Johani & Youssef (2013a) believe that Implementing ERP in cloud environment is a promising technology because of the integration and accessibility over cloud. thus enable the organization of reduce the cost and share information within secure environment.

Likewise, Navaneethakrishnan (2013) asserted in the research Cloud architecture provides ERP systems the flexibility due to its availability beside the efficiency of the system.

2.3.2 Cloud-based ERP in developed countries

Ruivo et al.(2013) aimed to measure how organization perceived the impact of cloud-based ERP on user productivity. Theoretical grounded on a research framework, 2000 web-survey was emailed out to European Small and Medium-sized Enterprises (SMEs) from Denmark, Portugal, Spain and Sweden to accesses user productivity amongst the four top cloud-based ERP (Microsoft, SAP, ORACLE and SAGE). The survey measured user productivity via six factors: system Compatibility, system Complexity, transactional Efficiency, embedded Best-practices, online Training, and employee Empowerment. The findings reveal that overall executives on average rated user experience with Microsoft Dynamics NAV more favourably. Furthermore, while system compatibility, online training and embedded best-practices achieve higher scores amongst Dynamics NAV, employee empowerment scores higher for SAP All-in One and transactional efficiency

attain high score for ORACLE JDE. Moreover, SAGE X3 was scored as having the highest system complexity.

2.3.3 Cloud-based ERP in developing countries

In the context of India, Gupta et el. (2017) illustrate that technology and organisational factors could affected by external factors in SMEs at the implementation phase. Similarly, Rajan & Baral (2015) argued that cloud ERP implementation is based on organisational factors, compatibility, and the knowledge of IT systems. Where that influences the employees' performance. Furthermore, factors like reducing upfront, and improving efficiency and flexibility, encourage the micro, small and medium scale Indian organisations to adopt cloud ERP (Vidhyalakshmi & Kumar, 2016).

In Pakistan, the rate of cloud ERP implementation in its early stages. The current system is old, expensive, IT infrastructure not compatible. So cloud-based ERP is not an proper option due to the environment status (Ul Hassan et al., 2016).

In Vietnam, Nguyen et al. (2014) assert that cloud-based ERP add value to the business due to the benefits of costs, scalability, accessibility, and support innovation. Nevertheless, there is no doubt in facing challenges of infrastructure, integration, and security.

In Malaysian manufacturing companies, although using cloud ERP is considerably beneficial, there are some concerns regarding necessary improvements to the supply chain of processes (Shatat & Udin, 2013). Sallehudin et al. (2018) revealed that technological, organisational and human characteristics' factors have an impact on CC adoption.

African organisations tend to lag behind in the adoption and use of Information systems because of the lack of capital to purchase and maintain these ICT tools (Pekane & Tanner, 2017). In Morocco, the cloud ERP systems are rarely or never needed or used by Moroccan SMEs (Achargui & Zaouia, 2016). In Nigeria, a study explored the factors of cloud ERP adoption and its relative advantage to SMEs. The study used TOE and DOI frameworks and resulted in the cost, lack of support, and knowledge about the technology; could affect the adoption of cloud-based ERP(Usman et al., 2019).

In Iraq, Mohammed & Burhanuddin (2018) explain that cloud ERP implementation is not possible recently due to unreliability of providers. Furthermore, the study addressed the factors for SME to adopt cloud-based ERP that involve the characteristics of cloud such as accessibility, security, vendor support ... etc.

In the context of Jordan, developing strong ICTs and cloud computing is required and applicable, but still in the early stage of implementing cloud ERP (Al-Hujran & Al-dalahmeh, 2011; Al-Jaghoub & Westrup, 2003). Zamzeer et el. (2020) highlighted several critical success factors to adopt cloud ERP in Jordanian SMEs: vendor support, cost reduction, innovation, security.

In the UAE, cloud ERP promising where 70 percent of start-up businesses in Dubai use cloud ERP(Abbas, 2017). The study addressed the factors that encourage organisations to adopt cloud-based ERP, such as accessibility enhance productivity, improve financial performance, and support decision-making (Alsharari et al., 2020).

The market in Saudi is considered an interesting case: The Kingdom is one of the first countries to adopt specific regulations and regulatory frameworks for cloud service providers. In October 2020, the Ministry of Communications and Information Technology published and implemented the "Cloud Computing First Policy", which aims to encourage government agencies to adopt cloud services instead of Traditional Information Technology solutions (Plan et al., 2014). Plan et al. pointed out that this policy is in line with the digital transformation witnessed by the Kingdom's Vision 2030 to enhance the quality of services through the use of more innovative solutions across government services. This reduces the total cost of ownership by improving the exploitation of information technology and emerging and advanced technologies, eliminating duplication of government spending, and improving robust cybersecurity, enabling interoperability between various parties.

AlBar & Hoque (2015) studied the factors behind implementing cloud-based ERP such as the competitive environment, infrastructure, relative advantage, government regulations, and IT skill and top management support. Whereas, compatibility, culture of organization and trialability are not significant factors.

Alhammadi et al. (2015), investigated the effect of the implementation of cloud ERP adoption in Saudi Arabia: the study showed that such use is advantageous to the performance of Saudi Arabia organisations. Al-johani & Youssef (2013) compared the ERP before and after moving to cloud, and then proposed a generic framework for cloud-based ERP. Finally, the feasibility and efficiency of the proposed framework were tested.

Yamin & Makrami (2015) claimed Saudi Arabia is a developing country but at the same time, has a reliable infrastructure. Alsafi & Fan (2020) identified the barriers of SMEs during cloud computing adoption, as infrastructure, lack of support, vendor lock-in, and security.

From previously mentioned studies, cloud ERP in developing countries is still in its early stages, albeit with a few success stories. The novelty means that the studies state the case of implemented cloud ERP without any sign of applying a benefits management approach, although most studies acknowledge the role of cloud ERP in improving the organisations' performance and productivity.

On the other hand, some studies reveal the benefits of cloud ERP in the context of identifying, classifying or exploring, with the benefits described with various terms such as drivers, promises, and opportunities. Salum & Rozan (Salum & Abd, 2015) identified the barriers and drivers that should be considered by SMEs who want to implement cloud ERP. The study covered the drivers that influence the adoption of cloud ERP among SMEs. Abd Elmonem et al. (Abd Elmonem et al., 2016) discuss how cloud ERP provides companies with many benefits, such as relative advantages and low cost of resources. The authors assert that implementing and running cloud ERP offers significant advantages and benefits, despite the inherent challenges.

Johansson et al. (2015), in their particular context, described benefits as opportunities. The study identified and classified opportunities and concerns often associated with cloud ERPs with respect to organisational size. The results of this study show that SMEs, and in particular small companies, can best exploit cloud ERPs, as many of the benefits are more relevant for them. At the same time, many of the concerns associated with cloud ERPs are not seen as important for SMEs. Large organisations, on the other hand, have severe concerns related to size in the form of complexity and specific demands. The

promises were: lower upfront & operating costs, information transparency, lower TCO, relative advantages, integration, using advanced technologies, and focus on business.

Despite, the literature reporting some studies about the benefits of cloud ERP implementation, there is a lack depth regarding managing benefits of cloud ERP implementation via benefits management approach. The next section discusses the benefits realisation management approach, benefits realisation with IT projects and cloud ERP.

2.4 Benefits Realization Management

Benefits Realisation Management (BRM) or Benefits Management (BM) are the two sides of the same coin; both refer to realising the benefits that accompany change. The idea developed in the 1980s and 1990s as a branch of project management in order to understand the return on investment from IT investments (Bradly, 2006). Benefits realisation is not all about cost and money, although Breese (2012) illustrates that working on the effective use of public money, could be a benefits realisation. In the literature, there are a couple of benefits realisation definitions. Ward & Daniel (2006a) refer to BM as "The process of organising and managing such that the potential benefits arising from the use of IS/IT are actually realised". Bradley defines a benefit as 'an outcome of change which is perceived as positive by a stakeholder'. Conversely, disbenefits are outcomes of change perceived as negative. Where Bradley defines BRM as 'the process of organising and managing, so that potential benefits, arising from investment in change, are actually achieved', Ashurst & Hodges, 2010; Bradley, (2006), describe 'Benefits Realisation Capability' in the context of IT as the capability to succeed with transformation and change. The Association for Project Management Group (APMG) international (2014) defined benefits as 'the measurable improvement from change, which is perceived as positive by one or more stakeholders, and which contributes to organisational (including strategic) objectives'; while identifying BM as 'the identification, quantification, analysis, planning, tracking, realisation and optimisation of benefits'.

2.4.1 Approaches

The literature describes many approaches that form and guide the process of managing benefits until they are realised. Following paragraphs outline the key Benefits

Management Frameworks in the literature: the most popular framework for practitioners and academics being the Cranfield model (Breese et al., 2015).

In the early 2000s, the Association for Project Management (APM) integrated BM as part of its Programme Management Accreditation (Managing Successful Programmes (MSP)) beside PMI accreditation in Programme Management (PgMP) (Breese et al., 2015). In 2010, Benefits Management became professionalised as the Association for Project Management (APM) launched a certificate in Benefits Management TM in 2012 (Jenner & APMG, 2014a).The first approach in 1995 by Leyton Developed the first approach; Active Benefits Management ABM, which focuses on a continuous flow between benefits and organisational and business change.

The second approach in 1996, developed by Ward and Daniel from Cranfield University, was the Cranfield Process Model of Benefit Management which focuses on a continuous process that flows from defining potential benefits, structuring them, planning for achievement, executing this plan, evaluating results, and identifying potential benefits.

The third approach Benefit Realisation Approach by Thorp in 1998. It is a business-oriented framework, which focuses on delivering business results in a consistent and predictable way. The fourth approach Active Benefit Realisation (ABR) by Remenyi and Sherwood-Smith, in 1998. A continuous process for managing and evaluating information system development. The fifth approach OGC in 2003 Developed Benefits Management Framework – Gateway Process that focuses on identifying potential benefits, planning, modelling, and tracking the results. The sixth approach developed in 2006, Benefit Management Approach PMI by identifying, analysing, planning, realizing, and transiting benefits. The seventh approach in 2009, APM developed Benefits Management Lifecycle is a loop consisting of modelling benefits, benefits profiling, benefits strategy, benefits management plan, base lining, targeting, and benefits realisation review.

The eighth approach developed by Barclay and Osei-Bryson in 2009 was the Multi-Objective Realisation Method (MORE) Framework Aims at providing a measurement framework to assess the strategic contribution of the programme to its stakeholders. This framework is based on 4 processes: identification, definition, analysis, and realisation. The ninth and last approach is Change Management Process for realising benefits by

Bradley in 2010). It is Continuous process consisting of setting vision and objectives, identifying the benefits and changes required to achieve the objectives, defining the required initiatives to make the changes, optimising these initiatives together, managing these initiatives, and finally managing the performance for achieving these benefits.

2.4.2 Benefits Management of IT Investments

As explained previously, benefits realisation started and focused on IT spend purpose at the beginning, although it is relevant to different professions and disciplines. Searching for an accurate criterion of the success of cloud ERP implementation was beyond the BM approach. As Lech (2013) claims, “delivering an IT project on time within a budget does not necessarily indicate that it will have affected an organisation's capabilities”. Cloud ERP as a project affects most of an organisation’s processes, so the success of it can enhance the organisation's capabilities by its use, which is considered project investment success (De Toni et al., 2015). The change that occurs with cloud ERP are not those of delivering the system on time and within the budget. Information systems business success is more about the strategic and efficient use of the system to deliver that benefits (Amgad Badewi, 2014; Burton-Jones & Grange, 2013).

From this perspective of BRM, the literature was not rich about BRM of cloud ERP. where there is a consensus that lack of empirical studies on actual benefits realisation practices (Colin Ashurst et al., 2012; Haddara & Päivärinta, 2011; Ward & Daniel, 2006b)

Haddara & Päivärinta (2011) claimed that the benefits of IT investment are self-evident and too obvious to justify efforts required for their use, Although Lin & Pervan (2003) argued that their study show some value in the use of formal methodologies, benefits measurement, formal reviews, and allocation of specific responsibilities.

Ward & Daniel (Ward & Daniel, 2006b) assert that there are benefits from benefits management in clearer planning for the investment, improved relationships between IT and business staff, wiser investments and an increase in the realised benefits. On the other hand, Anaya (2019) explained that using two separate management approach, one for the ERP implementation process and the other for the realisation, is challenging and may not be appropriate to realise benefits effectively. The author suggested a comprehensive and

integrated process combining both disciplines, ERP, and benefits management, as a viable solution to realise benefits from ERP systems.

Peppard et al. (2014) presented an approach for managers in benefits identification and planning. This approach required an alignment between IT and business managers to creating business value from IT-enabled change.

Greenwell et al. (2014) studied the BRM of cloud investments through case studies to describe several organisations' approaches to benefits realization via cloud computing. The finding of the study reveals that smaller organisations can create rapid growth using strategies based on cloud computing. Larger organisations have used utility approaches to reduce the costs of IT infrastructure. While Shang & Seddon (2000) introduced a framework for assessing the business benefits of Enterprise Resource Planning (ERP) systems. The paper provides a framework of five benefit dimensions. The framework classified the types of benefit that firms achieved ERP.

Many research addressed the benefits of cloud ERP from different perspectives and industries, however the literature still lack to search about cloud ERP from benefits management approach.

2.4.3 Maturity and Benefits Management

Jenner & APMG (Jenner & APMG, 2014b) claim that the maturity of organization for a project/ programme/ portfolio is essential in realizing business benefits. Maturity where prepare the organization to the change project as an improvement approach, it is a preview of understanding where organizations have been, where they are, and what processes they need to implement, aiming to continue the implementation. The word maturity is used to define, assess and form a standard and a foundation for evaluating the progress in organization (Bandara et al., 2019)

Gomes & Lisboa (2015) claimed that merging BM and Maturity approaches can improve the success of strategic projects and enhance stakeholders confidence to the investment . BR enable organization of avoiding spending on no values investments as increasing of realizing expected benefits. Gomes et al.(2013) emphasised that the linking between maturity and BM is affecting positively the performance of organization and adding

values on the business. Measuring maturity in organization helps in recognizing investment benefits in organization's practice of project management.

Gomes et. al. (2015) asserted that associating maturity, benefits and project management methodologies, enable organization of improving the weakness area and enhance the strength with focusing on organisation’s objectives and benefits.

Proença & Borbinha (2009) analyses the current practice on maturity models for information systems, by analysing and collection of maturity models from literature. The collected and analysed maturity models via 3 aspects: model structure, model assessment, and Model support.

Furthermore, in the research explained the view of authors about limitation of the maturity assessments which were: (1) Overly simplistic in relation to reality; (2) Lack of fundamentals; (3) concentrate on a single path to achieve maturity (4) Its applicability may be constrained by internal or external factors (5) similarity among models; (6) no clear of information about development method. The author of this research believe that the limitation of maturity models is reasonable and acceptable as usually they tailored for specific aim and change. Furthermore, these maturity models almost are built upon the CSFs that support the success of implementation.

The concept of maturity models in literature based on levels that allow organization to improve their maturity level by level. Basically, the whole idea of MM started from critical success factors as a checklist then it developed.

2.4.4 Multi-grade Fuzzy Logic for Assessments

Maturity assessment is considered via a linguistic assessment: does the organization mature or not? It is based on expert impressions and subjectivity about maturity for cloud-ERP, and for that fuzzy logic was used (Werro, 2015). Fuzzy logic, also called fuzzy logic or fuzzy logic theory, is the same as the human reasoning system; therefore, it can cope with the uncertainties in the data of experts' impressions. It is an extension of Boolean logic based of the degrees of truth sitting between 0 and 1 or true/false. Fuzzy logic is based on the theme of degree, inaccuracy, linguistic and observation (Thakkar et al., 2021). As Werro (2015) illustrates that there are different aspect of ambiguity,

Incompleteness, Homonymy, Randomness, Imprecision, and Fuzziness. Fuzziness that associated to words, the ambiguity of semantics where it represents the meaning that the research adopted.

Fuzzy logic has proven to be an effective multi-criteria decision-making method (Klir & Yuan, 1995; Velasquez & Hester, 2013; Yang & Li, 2002). In fact, ambiguity is the main issues in the qualitative research method that might not be expressed numerically. For that, Fuzzy multi-attribute is the core of determining the value of the weights for each measure/attribute, then ranking process to select from the alternatives that have been provided (Deni, et. al., 2013).

Multi-grade decision making, as Kahraman (2008) observes, is a branch of operations research models that transact with decision issues under the presence of several decision criteria. To clarify, Multi-grade decision making refers to screening, prioritising, ranking, or selecting a set of alternatives under usually independent, incommensurate or conflicting criteria (Belton & Stewart, 2002; Fenton & Wang, 2006). This contrasts with AHP that is based on a comparison among the alternatives, and AHP that is based on network relation among the alternatives. Multi-grade decision-making is used to resolve a problem with numerous alternatives and priorities for various attributes. It is a popular approach and has widely been used in several fields, including engineering, economics, management, etc.

The multi-grade fuzzy logic approach has been used extensively in different contexts such as lean, agility, and sustainability. Vinodh and Chintha (2011) developed an index using the multi-grade fuzzy approach for measuring the leanness of an Indian electronics manufacturer. Elnadi and Shehab, (2014) developed an index for evaluating the degree of Product-Service System leanness using a multi-grade fuzzy approach. Almutairi et al. (2018) built an index by using multi-grade (multi-attributes) fuzzy logic for leanness measurement, assessing the successful implementation of lean principles and tools for the supply chain in healthcare. Also, Vinodh and Prasanna (2011) created an index to evaluate the agility in the supply chain. Likewise, an index has been developed for assessing the sustainability of an organisation using a multi-grade fuzzy approach was developed.

2.5 Research Gap Analysis

The review of cloud-based ERP implementation literature reveals that this kind of IT project implementations faces numerous challenges. Although academics and practitioners carried out extensive research in this field, focusing on cases in developing countries case, some researchers believes that the area of ERP implementation is in its early stages (Albar, 2017; AlBar & Hoque, 2015). However, the literature review revealed some gaps in knowledge that are discussed in this work.

With the increasing numbers of digital transformation initiatives, and COVID-19 pandemic that has accelerated implementation, there is an increasing need for a methodology that leads to a successful cloud-based ERP implementation. Section 2.3 illustrate that cloud-based ERP implementation process could accumulate many non-value-adding activities, which requires extra budget and more time.

Benefits Realization Management (BRM) is a framework aimed to boost the success of IT projects (Ashrust & Doherty, 2003; Breese, 2012) as mentioned in section 2.4.2 although there is little empirical evidence to prove the positive impact of benefits management on the most popular reasons of IT projects failure. In addition, working on maturity of organization regarding cloud ERP project can achieve a comprehensive benefits realization with ability to review more benefits for future as explained in section 2.4.3.

This literature review provided a comprehensive picture about cloud-based ERP to set the state of art of cloud-based ERP and benefits management. where the cloud-based ERP in literature considers as change project in different sectors. Throughout reviewing the literature, the researcher summarise the main observations as follows:

- Since cloud-based ERP implementation is considered complex and challenging, limited cases of organizations succeed in their implementation journey. The success of cloud-based ERP implementation needs a well-planned framework to support organization in realizing the benefits of the project
- The implementation requires an assessment procedure as proactive step where it considers a complex project, for that it is crucial recognizing CSFs beside the expected challenges

- As an IT project, cloud ERP need effective success concept, instead of the common one (deliver project on time within budget), that achieve the business value of these kind of projects
- The key-drivers of cloud ERP, that encourage organization to move ERP system to cloud are representing the benefits of the project at the end. So, it should be tracking to be realized

The main research gaps identified by means of this literature review are summarised as follows:

- A well percentage of cloud-based ERP projects fail to accomplish their intended goals. That support the need to well-designed implementation frameworks to raise the success rate
- Most of cloud-based ERP practitioners have limited knowledge of Benefits Realization Management (BRM) especially in developing countries. There is a need to introduce BRM model within IT projects context. This will help implementers in preparing the organization for the major shift
- It is essential to assess organizational maturity for cloud-based ERP, although the studies have developed some maturity assessments, the literature shows that no model has been utilized within benefits management perspective

2.6 Chapter Summary

This chapter explored the literature review through several areas, moreover, to identify the research gaps of cloud-based ERP implementation through benefits realization management. The chapter covers three main parts: the first part covers the cloud-based ERP implementation. The second part investigates the concept of benefits management, its implementation with IT investment and maturity models within benefits realization management. The third part presents the research gap and the objectives.

The main topics are summarised as follow:

- To form a clear understanding for the cloud-based ERP system, the chapter presented an introduction about cloud technology through pre-cloud era, and cloud era with descriptions of cloud models (services & deployment)

- The introduction to cloud ERP starts with Enterprise Resource Planning system then cloud-based ERP, and its state of art in developing countries
- The concept of benefits realization management is examined where its definition is documented, and its approaches were presented in detail. The state of benefits management of IT investment
- The relation between BM and maturity of organization in project success with presenting of maturity models in literature

3. CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The chapter outlines the researcher's way of studying and understanding the cloud-based ERP research area. In the light thereof, the paradigm, research approach, and research strategies are identified to answer the research question and fill the research gap. The structure of this chapter is illustrated in Figure 3.1 .

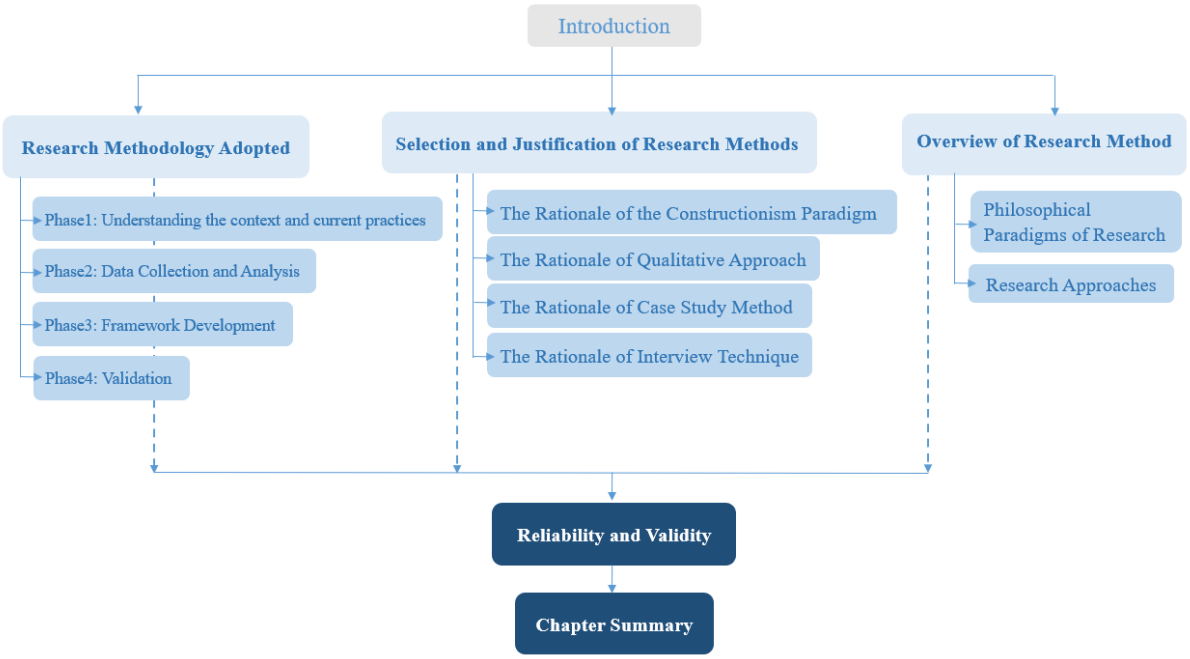


Figure 3.1: Outline of Chapter 3

3.2 Overview of Research Methods

Among the many research methods in social science research, the key reason for choosing one must be that it is the best for answering the research question. This section highlights an explanation of several terms used in the research context, such as paradigm, worldview, ontology, epistemology, research approaches, research design, qualitative, quantitative, and mixed methods research.

3.2.1 Philosophical Paradigms of Research

According to Sekaran (2003), research is "the process of finding solutions to a problem, after study and analysis of the situational factors". Meanwhile, a research paradigm refers to "a basic set of beliefs that guide action" (Sekaran, 2003). It can also designate the various approaches to research (Guba & Lincoln, 1994). It is worth mentioning that 'paradigm' and 'worldview' are synonyms in this research (Lincoln, et. al., 2011). The word 'paradigm' may cover assumptions to do with ontology and epistemology.

Ontology: focusing on the philosophy of existence and beliefs associated with it; the questions here are always about the nature and form of reality (Willis, 2007; Saunders, et. al., 2009; Lincoln, et. al. , 2011).

Epistemology: the word "episteme" is a Greek word, meaning "knowledge" (Willis, 2007). Thus, this aspect of philosophy concentrates on knowledge, acquiring knowledge and the process of thinking, together with the relationship between what we know and what we see. The questions here are, 'What is knowledge?' and 'How do we acquire knowledge?' (Lincoln et al., 2011).

The following subsections introduce the three paradigms as attitudes to reality: positivism, constructionism (interpretivism), and critical theory.

3.2.1.1 The positivist paradigm

The oldest of the three paradigms is based on the assumption about reality is that it is unified and universal. The properties of a given external world's should be measured objectively, not interpreted subjectively (Guba & Lincoln, 1994). Positivists believe that reality is external and independent of observers and that facts which are verifiable through our senses, say, by seeing, hearing, or touching (John J. Macionis, 2012) need to be gathered by empirical means. They break down our observations into variables hypotheses, and research questions. In positivism,

human understanding expresses itself in theories; then data to verify the theory are collected and it is revised for further assessment. The process uses deductive logic (John W Creswell, 2012).

Regarding ontology, positivists suppose that the observers are separated from the reality and that epistemological assumptions put the knowledge of reality beyond the human mind (Klein & Myers, 1999; Weber, 2004).

3.2.1.2 Social Constructionism (Interpretivism paradigm)

This paradigm focuses on people and their understanding; reality is attached to the social world, and for this reason it is subjective. The constructionists believe that reality is multiple, and varies according to the context. Research by constructionists is done by cooperating with others; hence, researchers learn from the contacts they make in their everyday lives and the researcher is inescapably part of the research (Macionis, 2012).

3.2.1.3 Critical theory paradigm

The paradigm of critical theory is something conducted when there is a need for transformative social change. It is affected by pairs of factors, for example, ethical, cultural, social, gender, economic and political factors. The approach of its questions concentrates on moral and political aspects (Macionis, 2012). In the critical theory paradigm, the participants can design questions, collect and analyse data, and, where it is a collaborative paradigm, gain from the research outcome (John W Creswell, 2012).

3.2.2 Research Approaches

Research approaches of enable the researcher to choose the means of processing knowledge. Data may be processed by words (Qualitative) or by numbers (Quantitative) or both (mixed methods).

In social research, each study asks one or more questions, and the researcher should adopt a consistent approach to answering the research questions. The research approach is the way in which the researcher collects, analyses and uses knowledge to deliver the best answer to the research question. There are three approaches, the data processing methods listed above: qualitative, quantitative, and mixed-method (pluralistic research) (Saunders et al., 2009). It is worth mentioning that the two approaches (qualitative and quantitative) are not mutually

exclusive but rather that most research tends to be more qualitative or more quantitative. The last approach (mixed methods) should be between the other two (John W Creswell, 2012).

3.2.2.1 Qualitative social research

Qualitative research concern on collecting and analysing data that expressed with words instead of numbers (Johnson, P. and Harris, 2002). Qualitative researchers study individuals' understanding of their social reality. Their techniques describes, decodes, translates, and get the meaning of words, not the frequency, of specific phenomena in the social world (Van, 1983). These techniques characterise a range of strategies: case studies, ethnographic studies, grounded theory, phenomenological research, and narrative research.

Case studies: the case could be a situation, individual, group, organization, or whatever the researcher is interested in. Time and complexity limit the number of cases, and the data are collected using various data collection procedures over long time of period (Stake, 1995).The techniques in use are for instance interviews, observations, questionnaires, documentation, archival records, and physical artefacts (Benbasat et al., 1987; John W Creswell, 2012).

Ethnography provides descriptions and interpretations of the culture and social structure of a social group (Robson, 2011). Creswell maintains that the researcher studies an intact cultural group in a natural setting over a long time by collecting, primarily, observational and interview data (JOHN W. Creswell, 2014)

Grounded theory the term itself reflects the meaning: research formed by this approach seeks to generate a theory related to a specific situation. In this case, the researcher starts by collecting qualitative data that are analysed and collected again before being labelled with codes that will later be categorised. The theory is built from these categories whereas the collecting data process continue until data emerging stopped then added to the development of theory (JOHN W. Creswell, 2014; Saunders et al., 2009; Spencer et al., 2003).

Phenomenological research: the key in this strategy is human experience – the researcher sets out his/her own experiences to understand those of the participants in the study. The procedure involves studying a small number of subjects for a long time through extensive engagement to develop patterns and relationships of meaning (JOHN W. Creswell, 2014).

Narrative research. This strategy is based on the stories of individuals which they narrated to the researcher. The researcher then retells the information thus obtained into narrative

chronology involving views of individual lives and the researcher's life (John W Creswell, 2012).

3.2.2.2 Quantitative social research

This approach considers numeric data by using methods such as surveys, laboratory experiments, formal methods and numerical, notably mathematical, methods (Myers & Avison, 2002). The typical features of this research are measurements and quantification, where accuracy and objectivity are sought. Thus, statistical analysis of the data is expected. Quantitative research focuses on behaviour, so it follows objective ontology and assumes that human behaviours are predictably produced by one or more causes (Johnson, B. & Christensen, 2008). The main instruments of quantitative research methods are surveys and experiments (JOHN W. Creswell, 2014).

The survey uses a questionnaire or structured interview to collect data from a sample as a representation of a population, ultimately for generalization purpose (John W Creswell, 2012).

Experimental research: subjects are grouped into control and experimental groups to examine the impact of treatment on an outcome. Treatment is given to one experimental group and withheld from a second group. According to Creswell (2012, p 29), "experiments include true experiments, with the random assignment of subjects to treatment conditions, and quasi-experiments that use nonrandomized designs. Included within quasi-experiments are single-subject designs" (John W Creswell, 2012).

3.2.2.3 Mixed methods (pluralistic research)

This approach gathers data in ways typifying the two previous approaches (qualitative and quantitative) in one study. The reasons for combining two approaches are as follows:

- improving the validity of findings
- answering different research questions
- explaining findings
- developing instruments
- enhancing the credibility of findings
- presenting diverse views
- enhancing findings

The methods used for this approach may be convergent, embedded or exploratory (J. W. Creswell & Clark, 2007).

Convergent methods collect and analyse qualitative and quantitative data simultaneously and combine the results of interpretation. These methods are used to understand the research problem better, complement the weakness of one method with the strength of the other, compare quantitative with qualitative findings, or explain quantitative findings by qualitative results. The researcher should have expertise in qualitative and quantitative research methods (J. W. Creswell & Clark, 2007).

Embedded: as above, both quantitative and qualitative data are collected and analysed but "within a traditional quantitative research design or qualitative research design" (J. W. Creswell & Clark, 2007). They are used when resources are limited to give equal importance to the two types of data. They may also be used when too little is known about the supplemental method, or when the researcher is satisfied to drive the research by either a qualitative or quantitative orientation (J. W. Creswell & Clark, 2007).

Exploratory: this type of design starts with a quantitative design in the first phase and uses qualitative design in the second phase to explain the quantitative findings (J. W. Creswell & Clark, 2007). This design is mainly for researchers interested in the investigation of trends and relationships within quantitative data who want to open up the reasons behind the outcome, for researchers whose research problems are quantitatively oriented, or who know the variables of interest and can get the quantitative instrument to measure the variables; or similarly to generalise qualitative findings in the first phase with data from a larger sample collected in the second phase (J. W. Creswell & Clark, 2007).

The three types of research design (quantitative, qualitative, and mixed methods) are compared in Table 3.1.

Table 3.1: Comparison of Three Research Approaches (Adopted from Johnson and Christensen, 2008)

	Quantitative Research	Mixed Research	Qualitative Research
Scientific Method	Confirmatory or "top-down" The researcher *tests* hypotheses and theory with data	Confirmatory and exploratory	Exploratory or "bottom-up"
Ontology	Objective, materialist, structural, agreed upon	Pluralist; appreciative of	Subjective, mental, personal,

	Quantitative Research	Mixed Research	Qualitative Research
(i.e., nature of reality/truth)		objective, subjective, and intersubjective reality and their interrelations	and constructed
Epistemology (i.e., theory of knowledge)	Scientifically realist searching for truth; justified by empirical confirmation of hypotheses; universal scientific standards	Dialectically pragmatic; pragmatically justified (what works for whom in specific contexts); with a mixture of universal (e.g., *always* be ethical) and community-specific needs-based standards	Relativist; justified by individuals and groups ps; varying standards
View of human thought and behaviour	Regular and predictable	Dynamic, complex, and partially predictable Multiple influences include environment/ nurture, biology/nature, freewill/agency, and chance/fortuity.	Situational, social, contextual, personal, and unpredictable

	Quantitative Research	Mixed Research	Qualitative Research
Most common research objectives	Quantitative/ numerical description, causal explanation, and prediction	Multiple objectives; provide complex and fuller explanation and understanding; understand multiple perspectives	Reliant on qualitative/subjective description, empathetic understanding, and exploration
Interest	Identify general scientific laws; inform national policy.	Connect theory and practice; understand multiple causation, nomothetic (i.e., general) causation, and idiographic (i.e., particular, individual) causation; connect national and local interests and policy.	Understanding and appreciativee of particular groups and individuals; informed by local policy.
"Focus"	Narrow-angle lens, testing specific hypotheses	Multilens focus	With wide-angle and "deep angle" lens, examining the breadth and depth of phenomena to learn more about them
Nature of observation	Studying behaviour under controlled conditions; isolating the causal effect of single	Studying multiple contexts, perspectives, or conditions; studying	Studying groups and individuals in natural settings; seeking to understand insiders'

	Quantitative Research	Mixed Research	Qualitative Research
	variables	multiple factors as they operate together.	views, meanings, and perspectives.
Form of data collected	quantitative data based on precise measurement using structured and validated data collection instruments.	multiple kinds of data	qualitative data typically from in-depth interviews, participant observation, field notes, and open-ended questions. The researcher is the primary data collection instrument
Nature of data	Variables	Mixture of variables, words, categories, and images	Words, images, categories
Data analysis	To identifying statistical relationships among variables.	Using qquantitative and qualitative analysis separately and in combination.	Using descriptive data; searching for patterns, themes, and holistic features; and appreciating difference/variation.
Results	Generalizable findings providing representation of objective outsider viewpoint of populations	Provision of "subjective insider" and "objective outsider" viewpoints; presentation and integration of multiple dimensions	Particularistic findings; provision of insider viewpoints

	Quantitative Research	Mixed Research	Qualitative Research
		and perspectives	
Form of final report	Formal statistical report (e.g., with correlations, comparisons of means, and reporting of statistical significance of findings)	Mixture of numbers and narrative	Informal narrative report with contextual description and direct quotations from research participants

3.3 Selection and Justification of Research Methods

This section, with the above discussion in mind, provides the paradigm, approach, strategy, and data collection technique that were selected from the present thesis, together with the rationale for the research methodology, as shown in Figure 3.2.

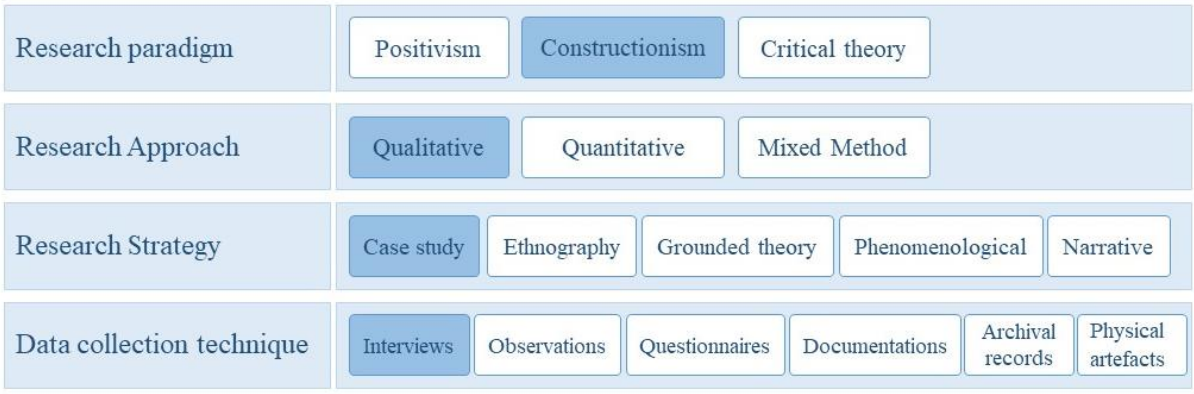


Figure 3.2: Research Choices

3.3.1 The Rationale of the Constructionism Paradigm

To revert to research aim, the researcher aimed to "develop a successful framework for cloud-ERP implementation in developing countries". This aim demanded an understanding of cloud-ERP implementation in developing countries.

The constructionism paradigm helped the researcher to understand the phenomena of technology systems over the cloud in an organization and realized the benefits to aspects of business. This was compatible with the nature of the constructivist paradigm. The researcher could interact with key people, face challenges, elicit the reasons for implementing this technology, and reveal the success factors.

3.3.2 The Rationale of the Qualitative Approach

If the objective reality that the researcher seeks is not visible or even definable, it requires further exploration through interacting with people to get an idea and go through the research objectives. Especially with regard to the cloud in the present study, the market is still not mature but is very demanding and needs more research in depth.

Moreover, the topic requires to be explored in depth by collecting data from, through individuals in their natural situation, far from controlled environment (Miles & Huberman, 1994).

3.3.3 The Rationale of the Case Study Method

First, the case study is a method which suits this research; Gerring (2006) nominated it for the business studies area, which is the present area of study. This research tries to determine the effective implementation for cloud ERP, because the cloud at this critical time is required technology and ERP as a business system is the backbone of an organization.

Second, the approach is appropriate for capturing experts' experience and developing theories from it. Since the developing countries are looking to transcend automation to reach the digital transformation phase, it was necessary first to identify current practices from their implementation by team members.

Third, in developing countries the phenomena of benefits management for cloud ERP or IT projects are still delayed or not applied. The confusion between automation and digital transformation needs to be researched in depth among organisations that have already moved to the cloud and use these information systems. This thesis seeks to underline the crucial benefits of projects, the used strategies, and addressing the major challenges faced and factors to help repeat the experience successfully in other countries and disseminate cloud-based ERP projects. Benbasat et al. (1987) consider that the case study strategy is a proper strategy to capturing practitioners' knowledge and developing theories. It is important for researchers to

formalise the findings to the testing stage, before employing case studies in documenting the practices and experiences (Benbasat et al., 1987).

Holistic multiple-case designs are used for cross-case analysis in the present research rather than single-case designs to extend the theory. The advantage of studying multiple cases is that it provides common research findings and ensures conditions and processes in one setting, however well-described, can be applied more widely than those of an individual case. The cases will consist of five projects from different industries that have implemented the cloud-based ERP.

3.3.4 The Rationale of the Interview Technique

The semi-structured interview has been used as the primary data collection technique. Interviews are the most basic tool that helps the researcher probe to the desired depth of response (Robson, 2011). Besides, the semi-structured approach enables the interviewee to be more flexible and expand enormously on some points. Furthermore, face-to-face interviews allow the researcher to collect the interviewee's authentic opinion without mediation (Robson, 2011).

This research calls for collaboration with experts from academia and industry, i.e., cloud-based ERP vendors/Cloud service providers (CSPs)/ consultants/users from different industries.

3.4 Research Methodology Adopted

Following identifying the selected research paradigm, research approach, and research strategy, the research methodology detailed in this section was adopted. Figure 3.3 presents the design of research methodology, indicating the approach, data collection/development and data analysis and validation stages. The four phases of the adopted research methodology are discussed below.

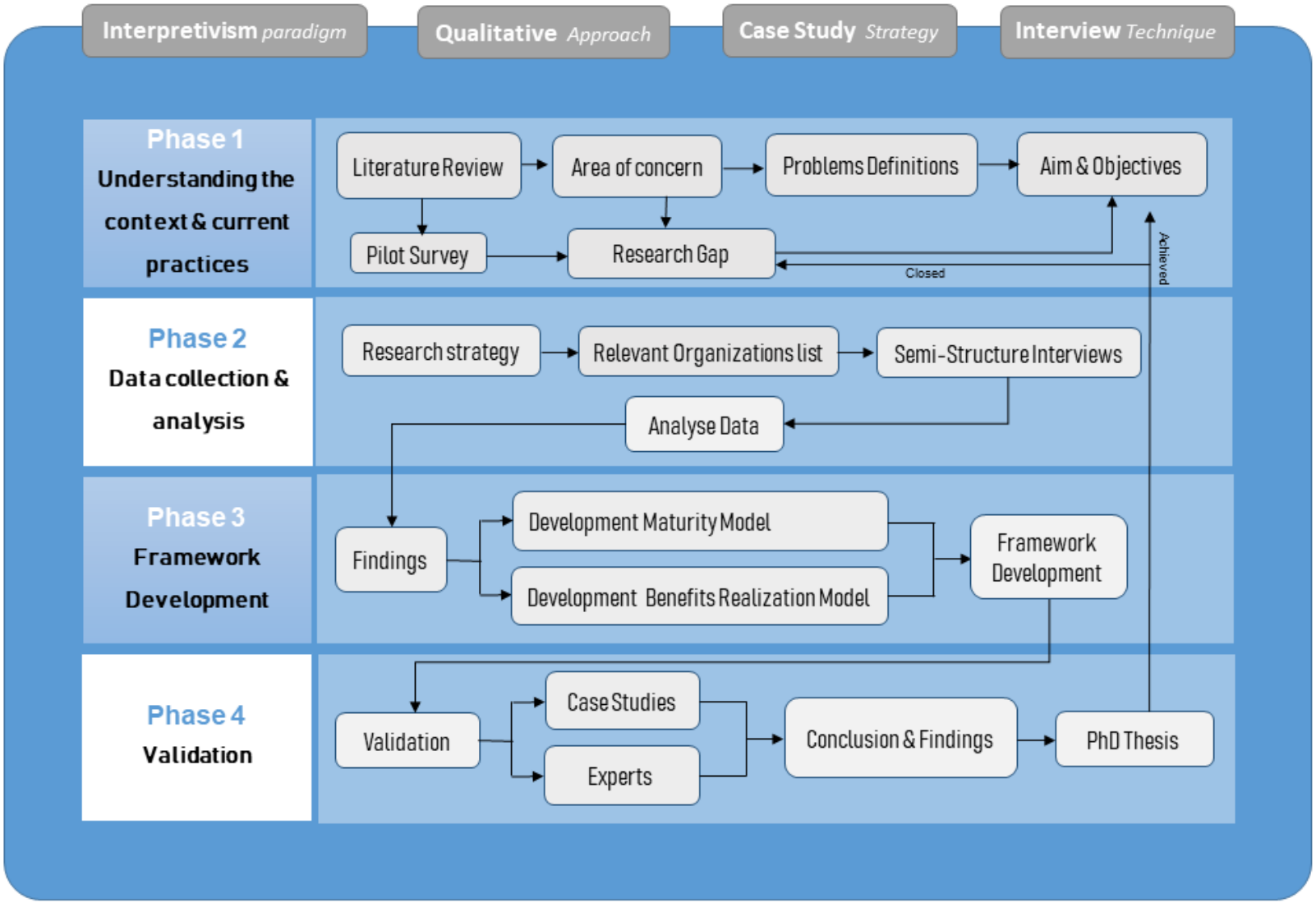


Figure 3.3: Research Methodology

3.4.1 Phase 1: Understanding the context and current practices

For the first phase, the researcher needed to appreciate the background of the topic from previous studies that examined the key drivers, critical success factors and challenges that affect the implementation of cloud-based ERP. Understanding the phases of cloud-based ERP projects, and which phase made a substantial contribution to industry or academia was also required. This procedure helped the researcher to identify areas of concern, set the aim and objectives, identify the knowledge gap, and contribute to knowledge.

Subsequently the context was further understood by establishing a knowledge base for the topic from a comprehensive literature review. The following factors were considered: How the cases encountered the challenges of cloudERP, how they managed the factors to implement cloudERP successfully, and finally, how they tracked the key drivers as realized benefits. The search used different scenarios in different industries.

Based on data from the literature, the researcher tailored a pilot survey targeted at cloud service providers (CSPs), ERP vendors, consultants (external or internal), clients (large organizations or SMEs), and users of cloudERP systems. The aim of conducting the survey was to learn more from the organizations' experiences and the knowledge in the literature. Building on the latter and the results of the pilot survey led to the next phase: contacting industrial experts (stakeholders) and arranging meetings with them.

The output of this phase: identifying the research gap, setting an aim & objectives, articulating the contribution to knowledge, listing the challenges, key drivers and critical success factors, and using background knowledge about the topic to shed light on the next phase.

3.4.2 Phase 2: Data Collection and analysis

The researcher identified the adopted research paradigm, research approach, and research strategy. This phase required selecting relevant organizations and the key sources of information. Meetings were scheduled, and interviews were conducted as a practical tool for applying a qualitative strategy. Cloud services providers, organizations (clients) that had implemented cloud ERP, and consultants were interviewed. To hear what people with different perspectives had to say, the interviewees were chosen from different industries and differently sized organizations. As in the previous phase, the semi-structured

interviews were arranged to yield information about four areas: the background of the participants, since experience in this sort of project is required; the key drivers who encouraged the organization to migrate the ERP to a cloud environment; the challenges to the process; and the critical success factors. The interviews were subjected to scrutinised thematic analysis.

The output comprised analysed data, results, and findings.

3.4.3 Phase 3: Framework Development

After analysing the data, the original framework was revised to adjust the developing findings. The collected data from the semi-structured interviews was used to develop two models. The first was the benefits realisation model (post-assessment model); the second was the maturity model (pre-assessment model), where organization maturity was required for process of benefits realisation.

The model was developed via a frequent process of reviewing the literature, across semi-structured interviews with cloud-based ERP experts in academia. The research methodology used to develop the assessments models is discussed in detail in Chapter five. The model was used to evaluate the organization's maturity level regarding cloud-based ERP, which facilitated the realisation of the benefits of cloud-based ERP. The benefits model enables the organization to realise cloud-based ERP benefits.

The output is a development framework.

3.4.4 Phase 4: Validation

The findings and the development framework should be validated in two stages. The first stage applies the framework to organizations to make certain the quality and accuracy of the present findings, and the effectiveness of the framework for business. The second stage validates the framework by the judgement of industrial experts in evaluating 3 modules: module 1 for maturity assessment, module 2 for benefits assessment, and module 3 for the whole framework.

The output is the validated framework.

3.5 Reliability and Validity

The degree of reliability, validity, trustworthiness, quality, and rigour differentiate a 'good' from 'bad' research. Reliability and validity in qualitative research concern the purpose of research: it should be focused on the understanding of the research topic (Golafshani, 2003). In addition, Stenbacka (2001) describes the notion of reliability and validity as one of the quality problems in qualitative research, which need "to be solved in order to claim a study as part of proper research" She has suggested the notion of result generalization (p. 551) (Stenbacka, 2001).

Robson (2011) illustrated the threats of validity and reliability; at the same time, explained several strategies to deal with, as shown in Table 3.2.

Table 3.2: The main threats to validity & reliability and the suggested strategies

Threats	The Effect of Strategies
Reactivity: how does the researcher present and interfere with the case.	Prolonged involvement: the time spent by the to adjust the case and understand its culture.
Respondent bias: provide an answer in a way to please the researcher or consider the researcher as a threat.	Triangulation: usage of different methods and sources to enhance the rigour of research
Researcher bias: stand to the beliefs of researchers that drove them to choose specific participants who will lead to the desired results.	Peer debriefing and support: debriefing meetings could help to face the researcher bias
	collecting applicants' feedback and process them, maintain the credibility.
	Negative case analysis: work on the analysis up to illustrating the cases
	Audit trail: following the activities of the research
	Purposive sampling: provide a chance of control to the researchers to the selection bias inherent in pre-existing groups

The strategies adopted by the researcher to achieve the reliability and validity in the research were Triangulation, Peer debriefing and support, Member checking and Purposive sampling.

3.6 Chapter Summary

This chapter defines the methodology of the research that was used to ensure that its design was suitable for providing the answer to the research questions and would attain the research aim and objectives. It begins by summarising the research overview, which consists of the research paradigms, research approaches, and research strategy. Three research paradigms are outlined, and their characteristics noted. The possible research approaches (qualitative, quantitative and mixed-method) utilized for getting information are summarised.

Through the qualitative research perspective, the chapter demonstrates a range of research strategies: case study, phenomenology, ethnography, grounded theory and *narrative research*.

The chapter also presents a justification of the way in which the research methods were selected, illustrating the rationale for selecting the research strategy.

Lastly, the chosen methodology is described, covering four stages, namely, “Understanding context and current practices”, “Data Collection and Analysis”, “Framework Development” and “validation”, emphasising the nature of the steps in the research. The next chapter illustrates the development of framework.

4. CHAPTER FOUR: DEVELOPMENT OF FRAMEWORK FOR CLOUD-BASED ERP IMPLEMENTATION

4.1 Introduction

The purpose of this chapter is to detail the procedures undertaken for the data collection, analysis, and framework development. To this end, Section 4.2 explains the pilot study conducted at early stage of this research. Then, in Section 4.3, the data collection procedures that include selecting organizations and interviewees, required procedures, and conducting interviews. Section 4.4 illustrates data analysis procedures that involve; thematic analysis for collecting data, interview result, benefits categories, and maturity categories. Section 4.5 concerns the proposed cloud-based ERP framework for developing countries that includes a review of relevant models; framework of cloud-based ERP implementation in developing countries, benefits dependency network framework, cloud-based ERP maturity model, change management, cloud-based ERP implementation, and benefits realization models. Finally, in Section 4.6 there is a summary of the chapter. The five sections of this chapter are demonstrated in Figure 4.1.

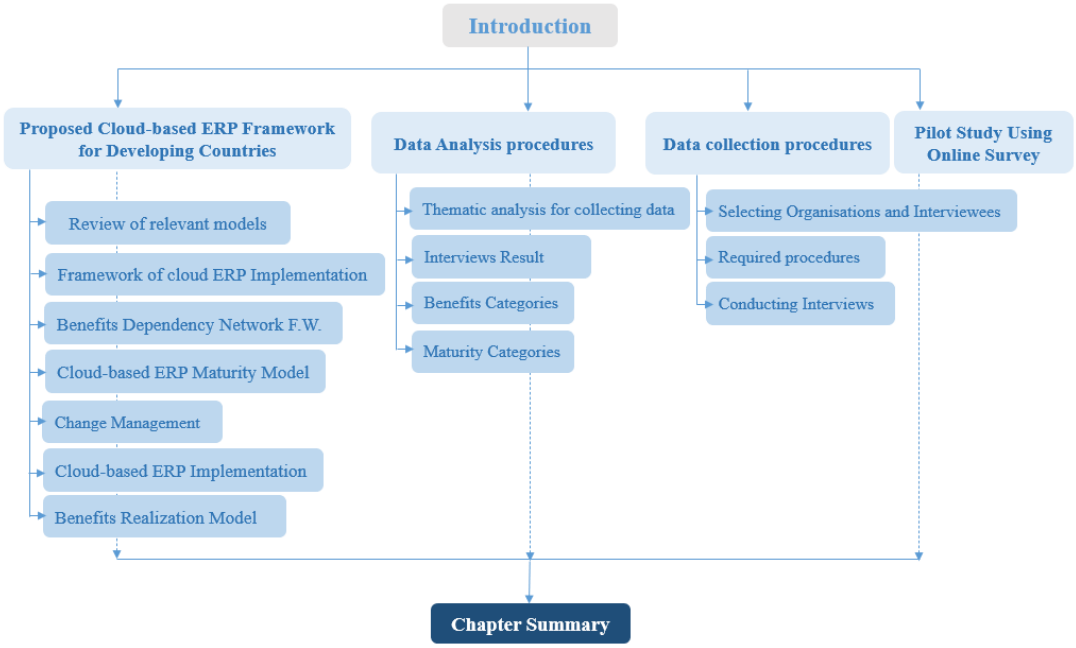


Figure 4.1: Outline of Chapter 4

4.2 Pilot Study Using Online Survey

A pilot survey was conducted at an early stage of the research. This e-survey was conducted to identify the perceptions of practitioners in industry, and to gather initial insights regarding cloud-based ERP implementation. The e-survey was divided to four sections. The first section concerned the participants' backgrounds: the positions, organization category, size of organization, and years of experience. The second section explored key-derivers that motivated an organization to implement ERP over cloud. The third section related to challenges and was twofold: one part rated the complexity of each challenge; the second examined which stages faced the most challenges. The fourth section concerns the critical success factors. Moreover, the survey was directed towards cloud service providers (CSPs), ERP vendors, clients (both IT and business personnel end-users) and consultants.

Above all, the surveys make the researcher aware of some potential obstacles that were not expected before the actual initial data gathering began. The most relevant mean for collecting data is using web-based surveys, then send the e-survey link to email list and other social media platforms such as LinkedIn and Twitter. Cranfield University offers Qualtrics Survey Software https://www.qualtrics.com/uk/ that allows the user to develop, deploy, and analyse surveys via the Web, as illustrated in Figure 4.1. This approach heled to get a positive response from 29 respondents.

The pilot survey was examined and verified by means of an informal pre-test, with questions previously discussed with the researcher's supervisor and fellow colleagues at Cranfield University. The comments received helped to refine the survey into its final form.

This survey was conducted with reference to the literature, supporting the collection of data. The first section concerned participants' backgrounds: their positions, organization category, size of organization, and years of experience. Another section related to challenges and was twofold: one part rated the complexity of each challenge; the second examined which stages faced the most challenges. The survey was directed towards cloud service providers (CSPs), ERP vendors, consultants, clients, and users of Cloud ERP systems (Alharthi et al., 2019a).

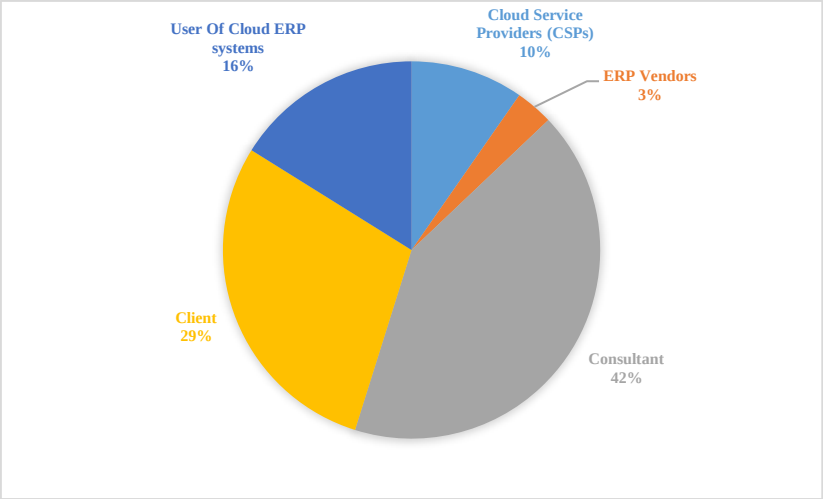


Figure 4.2: Demographic of Participants in the Survey

As shown in Figure 4.2 most participants are consultants (41.94%); followed by clients from the organization that will adopt ERP over the cloud (29.03%); then users of cloud-based ERP system (16.13%); cloud service providers (CSPs) come next (9.68%); and finally, ERP vendors (3.23%).

Most of respondents were from the private sector (62.07%), then the public sector (34.48%). There was also a small percentage in the survey (3.45%) categorized (from the comments they made) as others, which could be from semi-government organizations, as shown in Figure 4.3:

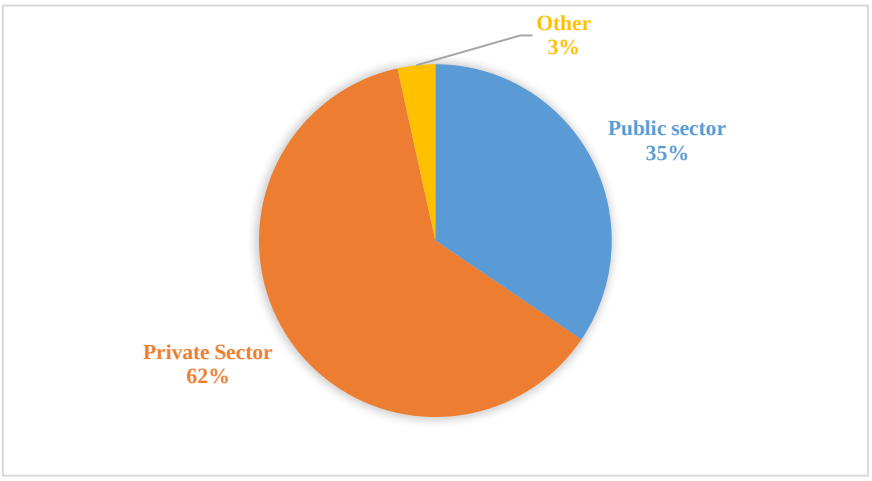


Figure 4.3: Organization Category

Regarding organizations' sizes, which refer to staff headcount, the majority of respondents were from large organizations (72.41%); this was followed by medium-sized enterprises (13.8 %) then small enterprises (13.79 %) as illustrated in Figure 4.4:

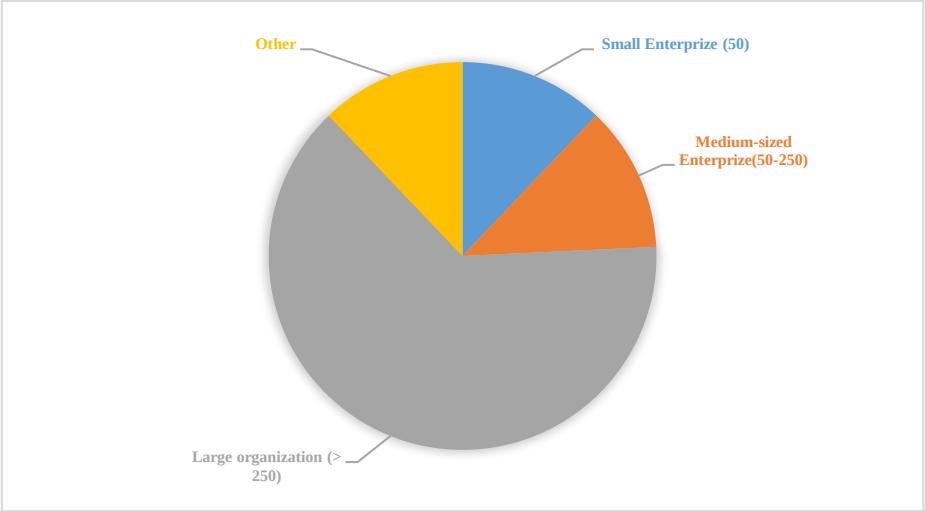


Figure 4.4: Size of organisation

The majority of respondents have worked on the implementation of cloud-based ERP for less than 1 year (48.28%); then more than 1 year to 5 years (44.83%); from 6-10 years and more than 10 years are equal (3.45%), as demonstrated in Figure 4.5:

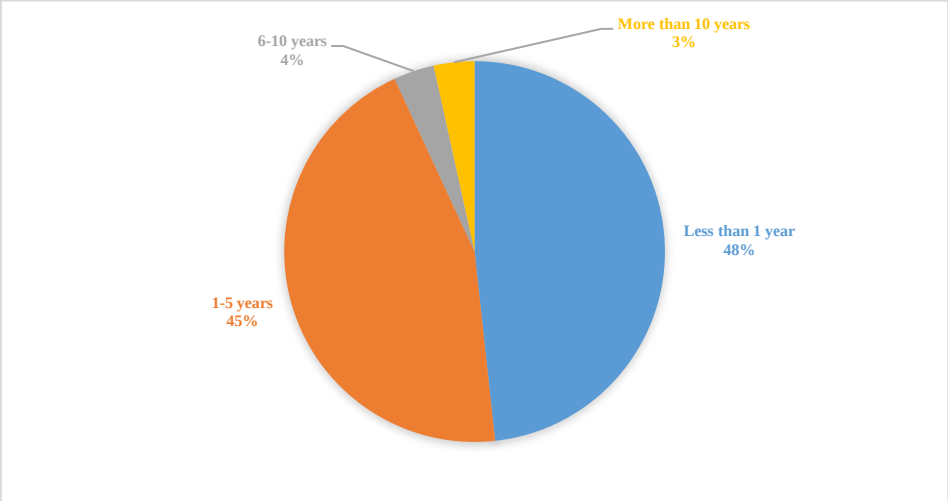


Figure 4.5: Participant Experience

The list of challenges that were examined in the survey covered security concerns, excessive customization, high level of standardization in cloud solutions, hidden costs, low performance, compliance and physical location, poorly defined SLAs, IT department resistance to change, vendor lock-in, reengineering of business processes, and the shortage of competent consultants. A company may also see a decline in its internal IT capabilities. The following section illustrates the occurrence of each challenge and in which of the stages, they become evident.

4.3 Data Collection Procedures

4.3.1 Selecting Organisations and Interviewees

The selection of cases and interviewees for this research were made through purposive sample, which is familiar in qualitative approach. This is because the research cases is limited to projects with ERP systems that have been migrated to cloud services. It targeted service providers and organizations as a client, within the developing context.

Selecting an organization does not require a criterion to choose each case; the only condition is that the organization has implemented cloud-based ERP.

The participants in the research include:

1) Organization 1: Saudi Arabian Government Investment Authority (SAGIA).
2) Organization 2: Saudi Authority for Accredited Valuers (Taqeem)
3) Organization 3: Saudi Organization for Certified Public Accountants (SOCPA)
4) Organization 4: Elm: International company for digital solutions
5) Organization 5: Saudi Centre for International Strategic Partnerships (SCISP)
6) Organization 6: Saudi Agricultural and Livestock Investment Company (SALIC)
7) Organization 7: Saudi Industrial Development Fund (SIDF)

The researcher identified the key interviewees, based on their interest and participation in the cloud-based ERP project whether they were clients or providers. The researcher used the snowball technique, by asking the initial interviewees to invite other with similar characteristics. Table 4.1 describes the interviewees in detail.

Table 4.1: The interviewee's detail

No	Job role	Organization Name	Org. no.	Years of experience
1	Chief information executive	SAGIA	Organization 1	20 years
2	Strategy and planning director			11 years
3	Business solutions director			18 years
4	Senior data officer			4 years

5	Technical support			8 years
6	IT business analyst & ERP consultant			4 years
7	HR consultant	Taqeem	Organization 2	4 years
8	Financial consultant			5 years
9	IT business analyst			2 years
10	HR consultant	SOCPA	Organization 3	8 years
11	HR consultant			6 years
12	Financial consultant			15 years
13	HR consultant & developer			4 years
14	Chief executive officer	ELM	Organization 4	10 years
15	Head of ELM in Jeddah branch			25 years
16	System analyst	SCISP	Organization 5	5 years
17	IT DB	SALIC	Organization 6	8 years
18	Academic and industry consultant			5 years
19	ERP consultant			20 years
20	Head of industrial information unit	SIDF	Organization 7	15 years
21	ERP consultant			20 years

Naturally, interviewees were chosen from different categories to enrich the research. According to the Saudi transformation program, there are varieties of organizations that automate their business processes and are migrating their systems to cloud services

following the Saudi vision and mission for 2030. In addition, the availability of case studies existed in different spheres: Public sector**,** Private sector, and Service Provider.

4.3.2 Required Procedures

To meet and interview practitioners and experts in cloud-based ERP, prior permission should be sought from three departments: organizations, as they are the host of the researcher; the Saudi Arabia Cultural Bureau (SACB), as they are the sponsor; and Cranfield University. The researcher was supported by many documents including:

- An authoritative letter from Cranfield University registry about the course information, duration of training, type of training (theoretical or experimental), and contact details
- Report of researcher plan, including aim, objectives, and how the interviewee could participate effectively
- A formal acceptance letter from the Saudi Cultural Bureau in UK
- A brief presentation oriented to the case study team, in which the researcher illustrated why the research is important, and how could they participate effectively.
- An Arabic and English copies of the questions of the interviews
- The list of the potential interviewees
- A formal letter from the organizations in Saudi confirming the date when the researcher would finish

4.3.3 Conducting Interviews

The initial process of finding a case study was via the Twitter platform, after the CIO of organization (1) tweeted about their ERP transformation to cloud. The researcher then made contacted and sought acceptance. There were a couple of call meetings with the CIO, and then the researcher was directed to the HR department to arrange the science trip. Organization (1) had the authority to allow the researcher to contact more organizations, including organizations (2) and (3). All the meetings were under Organization (1)’s supervision. Other organizations were contacted through Cranfield academic colleagues and supervisor’s students.

4.4 Data analysis procedures

The raw data collected (direct recording application, field notes, case study portal, and official documents) were cleaned appropriately ready for analysis by transcribing the phone records. The researcher took notes, quotes, and comments. Most of the interviews conducted in Arabic then translate it into English, especially as most interviewees used terminology common in IT and project management. Furthermore, the researcher interpreted meanings rather than literal translation and use exact words. Since it is a qualitative analysis, it was important to take note of word emphasis, facial expressions, and explanatory gestures, that for having to come up with conclusion around interviews. To explain this point more, the researcher noticed a question about the challenges, is difficult to get an answer, where some of interviewees got it as a drawback of the project.

4.4.1 Thematic analysis for collecting data

Qualitative research provides knowledge based on human experience (Sandelowski, 2016). To become of value, it is necessary to conduct it in a rigorous and methodical manner (Attride-Stirling, 2016) and use trustworthy tools to analyse the data gathered. In the literature, the thematic analysis is considered as a foundational method for any other forms of analysis, as well as translator among qualitative and quantitative analysis users (Braun & Clarke, 2006). There are advantages that encourage the researcher to use thematic analysis such as flexibility; it is a relatively easy and quick method to learn and do. it provides a chance to process data in terms of differences and similarities as well as use the data as description of other data in a theme. Finally, it is useful for producing qualitative analyses suited to informing policy development (Nowell et al., 2017).

The first step of thematic analysis is to become familiar with the data; this is achieved by being immersed in it, through repeating, reading, or listening to the records and documents. As the questions of interviews revolve around key-drivers, challenges, and CSFs of cloud-based ERP, and the targeted interviewees are experts from organizations (customer), cloud service providers (vendors), and consultants, the researcher divided the data into three categories (key-drivers, challenges, and CFSs), from three sources (customer, provider, and consultant) as illustrated in

Table 4.2: Example to how the analyst classified the answers of interviews for them to become familiarized

. Answers were tabulated to become more familiar. For example, two of the CSFs that supported cloud-based ERP implementation are “support project team”, “understand the concept of cloud” from top management side (Braun & Clarke, 2006).

Table 4.2: Example to how the analyst classified the answers of interviews for them to become familiarized

Success Factors		
Customer	Vendor/Provider	Consultant
• Vendor support where the market is not mature for cloud, the reputation of the vendor makes them supportive and not want to let the customer down? • Great project team	• Change management by inviting someone who have project management concept, technology practitioner, and expert in ERP system • Understand cloud concept to meet expectations	• Capabilities (no knowledge) • Training • Road map • Gradual movement to cloud
• Top management should support project team • Vendor support • Vendor reputation: as mentioned before the market is not mature so selecting a well-known provider is a CSF in cloud-based ERP implementation. For more explanation, vendors in developing countries are classified into two categories, vendors represent themselves, no partner represented them (e.g., SAP), and partners who are represented by vendors in region (e.g., Microsoft & Oracle). As Gartner said: vendor will not let you down. • Capabilities of resources and consultants is essential in cloud ERP implementation to face challenges and get benefit of this innovation.	• Training of key people in organization • Top management support from client side • Change management it is vitally important in the early stages	• Involve stakeholder • Limited customization

The second step involves generating initial codes that identify the features of the data that look significant to the analyst and indicate that which can be evaluated. In addition, the codes differ from the units of analysis, which are called themes. To explain further, the previous example of CSFs “support project team” and “understand the concept of cloud”

can be “encourage excellent teamwork spirit” and “true understanding of cloud concept and its features”, explained more.

Table 4.3: Data extract, with codes applied

Critical Success Factors	Coded for
• Vendor support where the market is not mature for cloud, the reputation of the vendor makes them support and never let the customer down • Great project team • Change management by inviting someone who understand the project management concept, technology practitioner, and expert in ERP system • Understand cloud concept to meet expectations • Training of key people in organization • Top management support from client side • Change management it is critically important in the early stages • Capabilities (no knowledge)	• Vendor support • Project team • Change management • project management • True Understanding of cloud concept • Training • Top management Support • Expert with cloud

The third step is to create a theme that begins the analysis at the broader level by collecting all coded data in themes. To illustrate this, the two critical success factors “encourage excellent teamwork spirit” and “true understanding of cloud concept and its features” belong to the top management or leadership. Therefore, the theme to each code related to the top management will be under the theme “Leadership” and so on (see Figure 4.6).

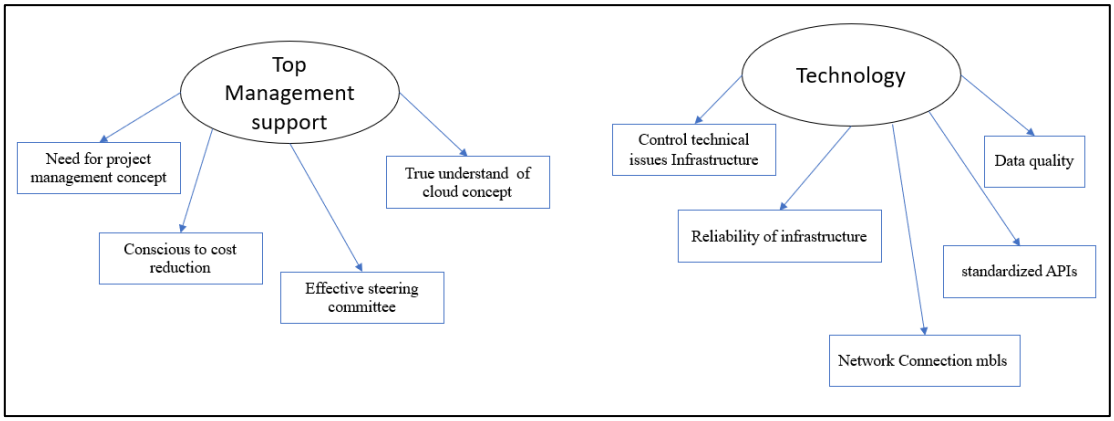


Figure 4.6: Initial Thematic map, showing two themes

The fourth step, do revision on themes, commences with devising a set of candidate themes, and includes the refinement of those themes. With reviewing the themes, the analyst will delete ones or merge others; data should be grouped properly, while there

should be clear distinctions among themes. The fifth step, defining and naming themes, define and further refine the themes to be presented for the analysis, and analyse the data within them. The sixth step is producing the report about fully worked-out themes; this involves the final analysis. The task of the write-up of a thematic analysis is to inform the complex story of the data in a way that proves the reader of the validity of the analysis.

4.4.2 Interviews Result

The result of interviews come up with numbers of CSFs, challenges, and key-drivers. The components of the maturity assessment which assess the maturity of organization and the readiness towards cloud-based ERP project are getting from the CSFs and challenges. However, the components of benefits assessment are getting from the key-drivers that form the reason behind implementing cloud-based ERP as illustrated in Table 4.4. Thus, according to the thematic analysis, the result should be in themes or categories. Worth to mention that the interviews' answers have different aspects not pure technology or management, as well as it were not from one stakeholder perspectives only. For that the researcher create her own categories based on literatures in a way compatible with the result got.

Table 4.4: the result from the interviews of critical success factors, challenges, and key-drivers

	Critical Success Factors	Challenges	Key-Drivers
1	Top management support	Lack of project management concept	Cost reduction
2	Vendor support	Lack of capability (resources)	Vendor support
3	Great project team	Poor Infrastructure	Relative advantages to cloud
4	Training	User resistance	Security
5	Planning	vendors issues	Resources
6	Capabilities	Technical issues	Digital transformation project
7	Change management	Data Quality	Top-end technology
8	Identifying Business needs	Customization	Facilitate shared service project

9	Cost: define financial value	Compliance standards & regulations	Optimize operations
10	Employee acceptance	High level of Business expectations	Governance regulations
11	Compliance standards & regulations		
12	Gradual movement to cloud		
13	Control technical issues		
14	Infrastructure		
15	Limited customization		
16	Reliability		

4.4.3 Benefits Categories

The categories of benefits explained in detail in chapter 6, which were: operational, managerial, strategic, technology, and organisational where been called benefits. In the same chapter the indicators of each benefit were also explained and their attributes, that collected from interviews and expanded from literature with some modification during the validation.

4.4.4 Maturity categories

In chapter 5 more clarification for the categories of critical success factors and challenges that been used in maturity assessment design. leadership, strategy, people, technology, and governance where been called enablers. Also, in chapter 5 the criteria of each enabler and the attributes of each criterion were illustrated in detail. Worth to mentation that the enablers with its criteria and attributes gained from the interviews through asking about the challenges and CSFs.

4.5 Proposed Cloud-based ERP Framework for Developing Countries

In Chapter 2, a critical review of the literature regarding cloud-based ERP was shown and delivered a better interpretation of literature examined. Therefore, the objective of this section is to present the framework development in developing countries. The developing of the framework has been done across thorough review of the relative models, a

combination of literature that has addressed the cloud-based ERP implementation in the developing countries context, and the collected data from industry and experts.

Throughout the data collection phase, common questions for the most participants were "do you realize the benefits that you migrate the system to cloud for?" and "did you meet the key-drivers that you migrate ERP to cloud environment for?" The response was an emphatic "No".

Cloud ERP considers an IT project; it could be an independent project or an initiative within a program, such as digital transformation. These kinds of projects need project management practices regardless of the methodology used; whether Prince2, the Project Management Body of Knowledge (PBMOK), ISO 21500, ITIL, Agile project management, etc. Project management methodology exists to increase organisational value and to achieve the highest success rate in the way of tangible deliverables (Ghosh et al., 2012). There are popular criteria of project success; from a traditional PM point of view, exceeding the project scope, budget or schedules, are considered failures (Atkinson, 1999). However, in IT projects the story is completely different: cloud ERP is not an automation project of the business process, it is a way to achieve the investment objectives by return on investment and realizing the expected benefits. Organizations depend on IS/IT investments to realize benefits after go-live. However, implementing IS/IT projects are not guarantee the desired benefits (Peppard et al., 2007). Although organisations keep on making substantial investments in IS/IT, the successful realization of benefits has consistently been reported as a challenge.

Benefits management has been addressed in Chapter 2 and Chapter 6 in more detail. For this chapter the main discussion around benefits management models is how to guarantee the success of cloud-based ERP implementation by realizing the benefits of the innovation. Benefits Management (BM) is a different framework used to improve the IT projects' success (Collin Ashurst & NF Doherty, 2003; Breese, 2012; Melton et al., 2008). Whereas the project delivers outputs, benefits management delivers outcomes (the benefits from the project).

Some studies suggest that IS/IT investments deliver minor benefits and it is self-evident to justify the required efforts to use (Strassmann, 1997). Haddara & Päivärinta (2011) and other studies demonstrated a positive relationship between the performance of

organisations and IS/IT expenses (Lee & Barua, 1999). During the data collection phase, there were no techniques to track the benefits that ultimately lead to the investment objectives. Cloud-based ERP is a temporary project and has a delivery date, so after that no one will be responsible for realizing the benefits; with the benefits management approach there is a benefits owner who is in charge.

In the context of benefits management, there is a similar affirmation of maturity of organizations before starting the change project as an improvement approach. It is a preview to figure out where organizations have been, where they are, and what processes are required, with the aim of finishing the implementation fruitfully by realizing the benefits.

The studies claimed that merging BM and Maturity approaches can affect positively on the success of projects and reassure sponsors regarding ROI (Gomes & Lisboa, 2015). The literature emphasised that the integration of a maturity model and BM is the most effective strategy to gain value and performance improvements in both the short and long terms (Gomes et al., 2013).

The critical success factors and challenges, that project pose, help organizations to carry out the initiatives and projects successfully. Gomes et al.(2015) claim that combining benefits, maturity and PM methodologies will allow effective support to get the business expectations and fast respond to competitive market. This multi approaches allows organisations to focus on the objectives and benefits and working on initiatives alignment with strategy.

From this base, the proposed framework developed to involve a maturity model and benefits model. The maturity model was created by the critical success factors of cloud-based ERP and the challenges that face the project team during the implementation. For the benefits model, the researcher collected the reasons behind adopting cloud-based ERP that ultimately shaped the key-driver of implementation. These reasons (key-drivers) shape the benefits that the organization would like to achieve through the innovation.

The proposed framework has four phases as shown in Figure 4.7, that should be applied to achieve successful cloud-based ERP implementation. Phases 1 and 4 incorporate the contribution of this research. These phases are confined to the maturity phase that starts

during pre-implementation stage with applying the maturity model (Phase 1) and benefits realization phase (Phase 4) that applying the benefits realization model during post-implementation stage. Phase 2, the change phase, is about applying any of the change management models, and depends upon the project's type and the nature of business or industry. Phase 3 is related to implementing the project; it is known that each provider has their own methodology and process, but in general, they have many processes in common. For that, having a methodology itself is an indispensable step in making the implementation successfully, although most of the implementation processes are similar.

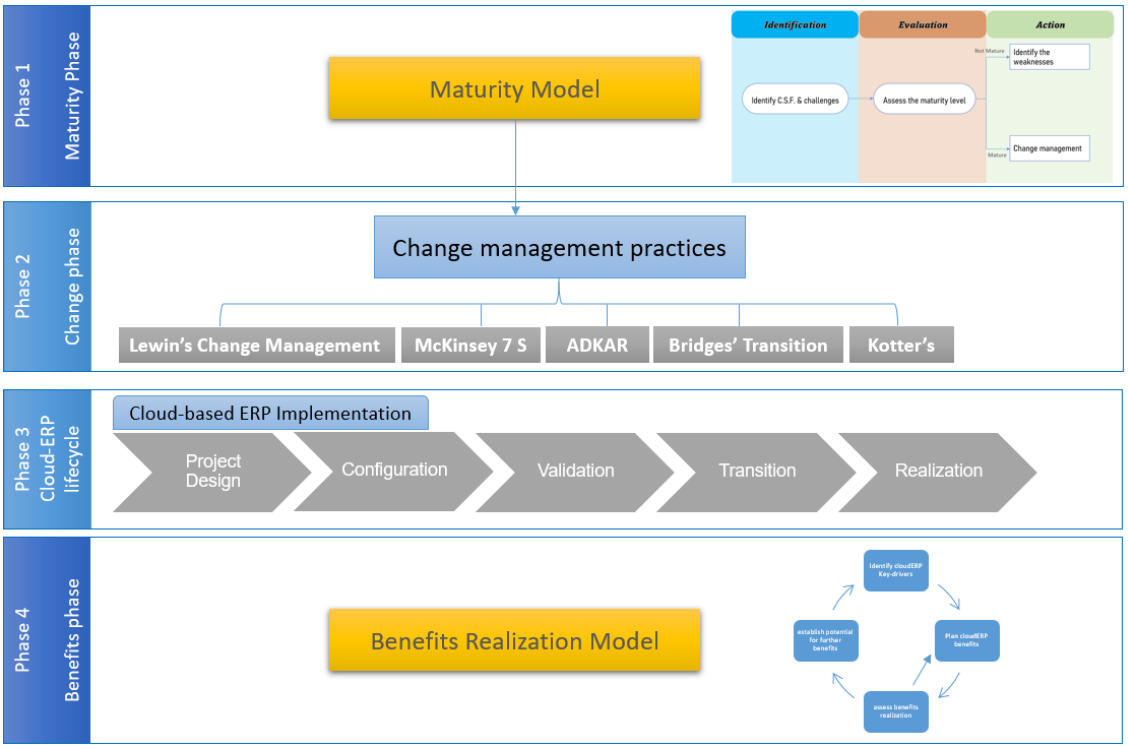


Figure 4.7: Cloud-based ERP framework for benefits realization

4.5.1 Review of Relevant Models

Valuable work has been conducted on ERP in developing countries from a technical perspective, such as in Saudi Arabia where Al-Johani & Youssef (2013b) attempted to integrate ERP and CC benefits, for cost reduction and implementation delays through a suggested framework. The study made a comparison traditional ERP and cloud ERP. Based on the previous comparison, a framework was proposed for "Cloud-based ERP systems" for SMEs.

Badewi et al. (2018) focused on ERP resources and organizational complementary resources (OCRs) to realise each set of benefits, as well as the response of organizations towards possible value when ERP is realised. The paper studied 12 firms then validated the results with eight consultants. The result of the paper was development of an ERP benefits realization capability framework. It asserts that there are certain resources (ORC) for each set of benefits that enable organizations to realize the innovation benefits.

4.5.2 Framework of cloud-ERP Implementation in developing countries

The proposed framework contains four phases. This part concentrates on two phases: the first phase that should start with the maturity model; and the last phase (the fourth) that starts with the benefits realization model. The maturity model starts during the pre-implementation phase as it uses factors to prepare the project for implementation. The benefits realization model starts in post-implementation to start realizing the short-term benefits; and then the long-term benefits, with time to review for any potential benefits.

4.5.3 Benefits Dependency Network framework (BDN)

This framework designed by Ward and Daniel (2006b) could be considered as tool. BDN linked the investment objectives and the business benefits with business, organizational, and IS/IT changes required for the purpose of realizing those benefits. The framework shown in Figure 4.8 starts from left to right by identifying: IT/IS Enabler, Enabling Changes, Business Changes, Business Benefits, and Investment Objectives, which are explained in more detail below:

- ***IT/ IS Enabler***

It is the innovation or the information system/technology that support the identified benefits realization. For this research the IS Enabler is cloud-based ERP.

- ***Enabling Change***

The variety and types of changes needed that enable cloud-based ERP to realize the identified benefits. They need to be identified before the implementation, or shortly thereafter. These enabling changes could be identified by the CSFs of cloud-based ERP

and the challenges. For example, leadership or top management support is one of the CSFs of cloud-based ERP, so it can be an enabling change. Furthermore, the challenges faced from a lack of top management support might shape the attributes of this factor in more detail.

- ***Business Change***

The process of business should be done in different way in the future. These changes differ from company to company and depend on the nature and size of the business. Fundamentally, business change is difficult to identify unless the business and sector is known, as it is very specific. For example, adoption of new processes, assignment of new employees, etc.

- ***Business Benefits***

Ward and Daniel define the business benefits as "an advantage on behalf of particular stakeholder or group of stakeholders. An important attribute of the benefits is that they should be specific to an individual or group" (Ward & Daniel, 2006b). Several benefits could lead to one of the investment objectives, so there should be a link between benefits and the investment objectives. The business benefits for this research have been identified by the key-drivers gathered during the data collection phase.

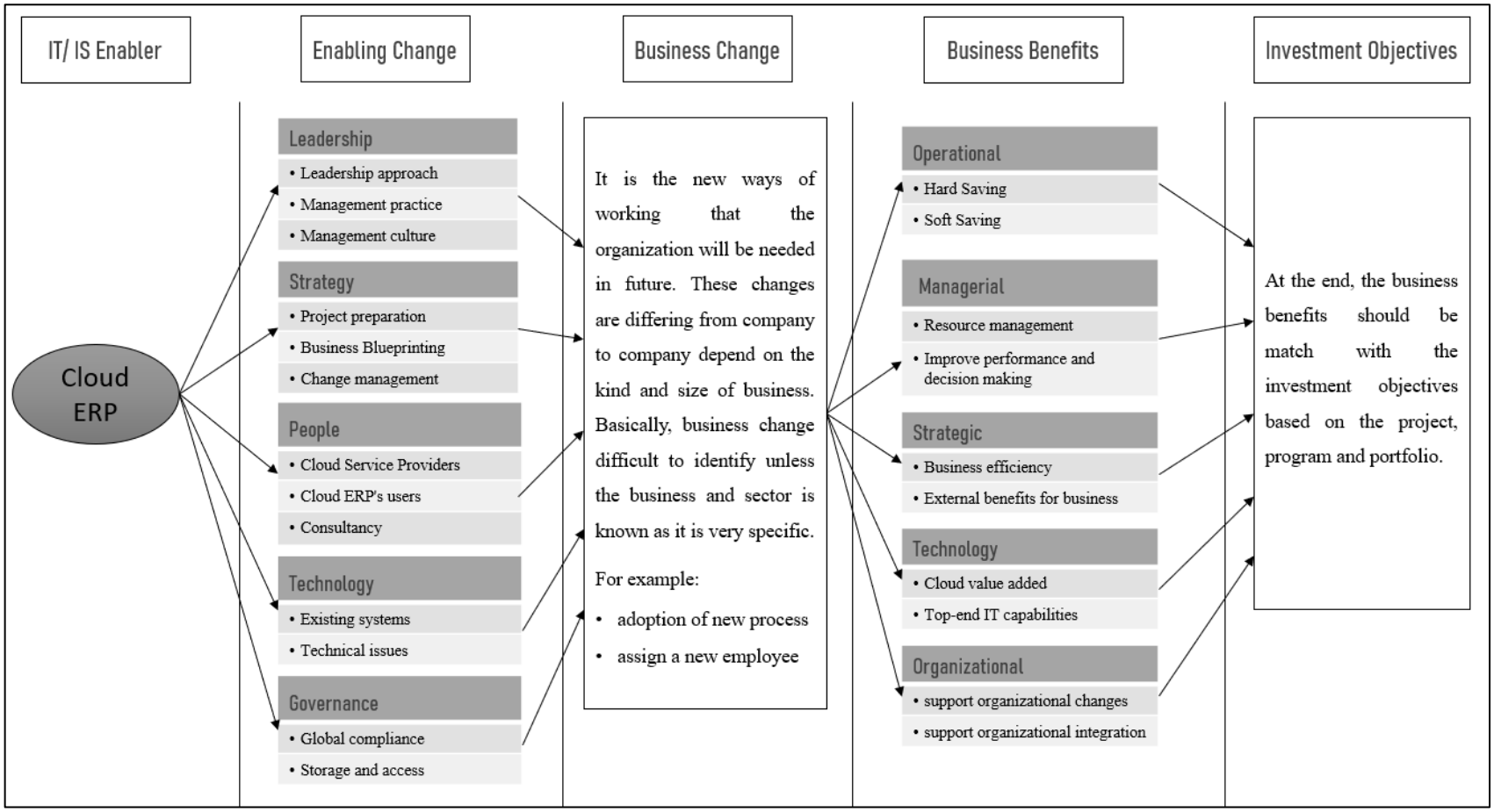


Figure 4.8: Preview of benefits Dependency Network for cloud-based ERP

4.5.4 Cloud-based ERP Maturity model

Organizations aim to boost their ROI by benefits realization and enhance competitive value. This could occur by using an effective standard to assess where they are stand, from a BM viewpoint. Thus, organizations need a powerful Maturity Model, that enable them to draw a roadmap for BM by improving their weaknesses before applying the benefits approach.

4.5.4.1 Maturity model Concept

The term maturity is defined as the condition of being complete, perfect, or ready: the purpose of a maturity model is to describe, assess, and shape the roadmap for evaluating the state of a business regarding a change project (Schumacher et al., 2016). The main idea of a maturity model is to identify the degree of maturity related to different aspects of an organisation's progress in improving performance (Gökalp et al., 2017). According to the literature, most of the maturity models proposed are to assess the maturity levels in different industries on widen broad not for specific project such as cloud ERP.

4.5.4.2 Maturity Models

- Organizational Project Management Maturity Model (OPM3)

Using OPM3 guidelines to evaluate the existence of best practice, targeted goal is realized (PMI, 2013). The levels of the models are: 'standardize', 'measure', 'control', and 'improve'. Where the steps of OPM3 cycle are acquire knowledge, process assessment, manage improvement, and repeat process to compare, design, and improve organizational project management in ten knowledge areas of project management. OPM3 could be used with portfolios, programs, and projects to prepare the maturity roadmap. The focus here on strategy, business value, the impact of business and value performance analysis (Proença & Borbinha, 2009).

- P3M3 (Portfolio, Programme and Project Management Maturity Model)

P3M3 – version 3.0 (Axelos, 2015) which is primary maturity models issued in 2015, concern on system rather than prosses. P3M3 has five levels: awareness; repeatable; defined; managed; and optimized process (Axelos, 2015). The strategy of this model is to take into consideration a specific business area separately. Each sub-model includes

seven perspectives: organizational governance, management control, benefits management, risk management, stakeholder management, finance management, and resource management.

- Software Engineering Institute Capability Model Integration (CMMI)

The CMMI, published by the CMMI institute is a maturity model for software process level improvement. It has five levels: 'initial', 'managed', 'defined', 'quantitatively managed', 'optimizing' (De Carolis et al., 2017). Benefits realization in software projects is expected through aligning stakeholders' requirements with project deliverables. (Safaie, 2017).

4.5.4.3 The proposed maturity model for cloud-based ERP

The concept of maturity models in the literature is based on levels that allow organizations to improve their maturity level by level. The idea of MMs started from critical success factors as a checklist, and then developed from there. Hence, the model created was based on the critical success factors of cloud-based ERP represented in the benefits dependency network (BDN) as "enabling change". The model was explained in detail in Chapter 5.

4.5.5 Change management

Organisations face massive obstacles to response to the disruptive change; and mitigate the risks. The impact of that change identified over and organisational culture and the type of change that could be gradually or radically.

Basically, the change emerges once the external forces created as marketplace, technology, government regulations, and economics. Change can begin with and be led by a powerful group of people within an organisation. In organization, the change negotiable to apply the practices in a way help to avoid its impact. Another type of change is initiated by top management, where they need to take major reactive steps to important changes in the market, albeit with minimal planning.

In the business environment, each organization is seeking for competitive advantage, and leadership is urged to develop an adoptive a culture. This kind of culture could help in dealing the risk of resistance. Kotter, (2007) asserts that every tangible improvement in business performance within the change project is an essential objective.

The literature is full of different models of change management practices. Where the papers outline the features and usage of the different models and frameworks; then highlight the applicability in industry.

4.5.5.1 Change management models

- Lewin's Change Management Model

It is a model for understanding the change process and consists of three stages: unfreeze, change, and refreeze. The first stage (unfreeze) is about the change recognition and why we need change; ensuring the support of top management; focussing on the behaviours and attitudes that must be changed or replaced; and managing concerns and doubts. Change is the second stage and involves the actual problem diagnosis, the plan of action, and implementation; and it considers how to help employees learn new concepts or points of views. The final stage (refreeze) refers to the act of stabilizing and reinforcing the new conditions after the change (Longo, 2011). Lewin's model is generally used in organizations with a traditional approach, that have small units with a slow change timeline (Management & 2015, 2015). It is providing a fully supporting summary with justifications, however requires full engagement of employees to get information (Burnes, 2004).

- McKinsey 7 S Model

This model is for analysing company change via focusing on seven important internal components: strategy, structure, systems, shared values, style, staff and skills (Jurevicius, 2013). Strategy is about how to support the vision, mission, and values of change via plans; structure is how to define accountabilities and enhance transparency in the change framework. Systems are about the daily business activities and decision-making. Skills are related to the employees' abilities and their performance towards the organizational change and its effect on them. Staff is where the focus is on recruitment, training, and rewarding policies for the employees. Style is the actions of top-level management, as well as their communication policies down the line. The key element of this model is Shared Values: determining standards, rules, and regulations to guide employee behaviour and organizational culture. The advantage of this model is that it enables communication and coordination inside the company (Jurevicius, 2013). In addition, the

difficulty represented in the need of harmonization in all the components for effective implementation. The McKinsey's 7S model examine the readiness for change in companies (Alshaher, 2013).

- ADKAR model

This model was developed by Hiatt (2006) for organizational change, with clear objectives and outcomes. It delivers a change implementation structure and direction which facilitate the change. There are two dimensions for change here: business (project)and people. The people side of change includes awareness as a first phase; denoting the reason for change and is related to outcomes of initial interactions related to the organizational change. The second phase is the desire to engage with employees to participate in the organizational change, beside the management of resistance encountered by organizational change. The third phase concerns the knowledge that is related to information regarding change and employee training and developing new skills. The fourth phase (ability) is to realize and implement the organizational change at every organizational level. However, the business/project dimension of change involves phases such as the identification of a business requirement or opportunity; defining scope and objective of change; design the solution including new procedures, systems, and structure; developing new systems and processes and implementing them. The model summarises the business and people dimension but does not include the role of leadership (Hiatt, 2006).

- Bridges' Transition Model

This Transition Model was developed by Bridges in 1991. It is a model of transition more than actual change, and where change does happen there is no consensus. Transition is internal and accrued gradually in three stages: ending zone, neutral zone, and new beginning (Brisson-Banks, 2010). Ending Zone is marked with resistance that needs good management for successful change implementation. The second stage, Neutral Zone is the bridge between new and old; it includes higher workloads, new processes, new systems, and new ways of working. The last stage, New Beginning, includes acceptance of the change initiative, training, skill development and renewed commitment for the job.

The model offers an awareness of people's attitudes about change, and its psychological effects (Brisson-Banks, 2010).

- Kotter's Change Model

Kotter´s model was created in 1996, and then further developed in 2012 with eight steps. The first step starts by evaluating market situations, competitors, and new opportunities. The second step is forming a powerful guiding coalition such as assigning change leader (a person or group). The third step is developing a vision that can help in guiding the change vision. The fourth step consists of effective communication of the vision to staff by using available channel. The fifth step is preparing a plan and dealing with obstacles, changing systems or structures. The sixth step is defining short term goals like performance improvement. The seventh step stresses on sustaining the improvements made. The eighth step is supervising the change process and reinforcing the change (Todnem, 2007). The model for change and transition process, however it is a bit mechanical process.

4.5.6 Cloud-based ERP implementation

Cloud-based ERP projects implementation is very costly and involves complexities because of the different changes it brings, and it affect most of organization processes that related to different functions of organization. Each cloud service providers (CSPs) have their own activities for implementation phase, however there are a similarity in general phases and activities. This section will present the cloud-based ERP implementation of three CSPs that were the providers of the organizations that the researcher has collected the data from.

4.5.6.1 SAP cloud-based ERP (S/4Hana) implementation

The implementation that will address in this section is for S/4Hana implementation process as it was the application used in one of main organization that became a provider for other entities with the organization. The implementation methodology contains six phases that are: discover, prepare, explore, realize, deploy, and run. The implementation starts with discovery assessment in discover phase then sign the contract and moving to other phases. Cloud-based ERP project team implement six steps. First Step, Setup and Enablement define milestones and scope. Second Step, Fit-to-Standard Analysis by

configuration or business expert, beside identify scope for specific business area. Third Step, System Provisioning, based on the previous step. Fourth Step, configure the solution by using iterative agile approach. Fifth Step, Testing the configuration expert runs the pre-delivered test scrip. Sixth Step, Data Migration (Musil, 2019).

4.5.6.2 Microsoft cloud-based ERP (Azure) implementation

The Microsoft Cloud-based ERP (Azure) framework is created to assist in implementation for the business and technology strategies. Azure enables organizations to align business with technological strategies for success. The process of the implementation includes ten steps: Align stakeholders, Align partner support, gather data and analyse assets and workloads, make a business case, create a migration plan, build a skills readiness plan, deploy and align a landing zone, migrate the first 10 workloads, hand-off production workloads to cloud governance, and handoff production workloads to cloud operations (Microsoft, 2021).

4.5.6.3 Oracle cloud-based ERP implementation

The cloud-based ERP project passes through five phases, starting from project design and ending with the realization phase. The project design phase contains eight activities: plan project, conduct meeting, organize workshops, functional design workshops, conduct design review, develop security and validation strategies & plans, and implementation checkpoint. The configure phase also contains eight activities: setup applications, validate configuration, load & validate data, build & validate integrations, apply & validate extensions, and extensible items, implement security, prepare cutover strategy, and conduct implementation checkpoint. Validate phase consists of seven activities: update setup, prepare validation scripts, load & validate data conduct End-to-End review, prepare for training, conduct Train-the-Trainer workshops, and conduct implementation checkpoint. Transition phase starts with migrate configuration to production, migrate integration & extensions to production, load, reconcile & validate data in production, conduct final validation review, verify production & operational readiness, begin production use, and conduct implementation checkpoint. The final realization phase contains five activities: manage transition to steady state operations, post Go-live support, handoff to client relationship manager, gain acceptance, and close project (Oracle, 2016).

4.5.7 Benefits Realization Model

4.5.7.1 Benefits realization model Concept

Benefits Realization Management (BRM) is a framework with a clear purpose and concern to increase the success of IT projects (Collin Ashurst & NF Doherty, 2003; Breese, 2012; Melton et al., 2008; Serra & Kunc, 2015). The concept of (BRM) was established in the 1980s and 1990s to justify investment in IT projects (Bradley, 2006b). In Chapter 2 there are different definitions of BM, but the main point is the relation between BM and project management. (A. Badewi, 2015) introduced Project Benefits Management as "the initiating, planning, organising, executing, controlling, transitioning, and supporting of change in the organisation and its consequences as incurred by project management mechanism to realise predefined project benefits".

4.5.7.2 Benefits realization models

There are eight major Benefits Management Frameworks in the literature. The first approach was developed by Leyton in 1995 is Active Benefits Management (ABM), which focuses on a continuous flow between benefits and business change. The second approach developed by Ward and Daniel from Cranfield University in 1996, is the Cranfield Process Model of Benefit Management. It describes a continuous process that flows from identifying and structuring potential benefits, planning for achievement, executing the plan, evaluating results, and identifying potential benefits. The third approach developed by Thorp in 1998, is the Benefit Realisation Approach. It is working on industry findings predictably. The fourth approach developed in 1998 by Remenyi and Sherwood-Smith, is Active Benefit Realisation (ABR) (Remenyi, D. and Sherwood-Smith, 1998). It is a continuous process for managing and evaluating IS development. The fifth approach developed by the Office of Government Commerce in the United Kingdom (OGC) in 2003 I the Benefits Management Framework. Fundamentally, it focuses on identifying potential benefits, planning, modelling, and tracking the results. The sixth approach developed by the Project Management Institute (PMI) in 2006, is the Benefit Management Approach for identifying, analysing, planning, realizing, and transiting benefits. The seventh approach came in 2009: APM developed the BM Lifecycle as a loop consisting of modelling, profiling, strategy, management plan, base lining, targeting, and the benefits realisation review. The eighth approach developed in

2009 by Barclay and Osei-Bryson, is the Multi-Objective Realisation Method (MORE) Framework evaluated the strategic contribution of the programme to its stakeholders by specific measurements. This framework is focused on four processes: identification, definition, analysis, and realisation. The ninth and final approach developed in 2010 by Bradley, is realizing benefits via change management through identify vision, objectives, benefits, needed changes, and required initiatives.

4.5.7.3 The proposed BR model of cloud-based ERP

As IT investment is associated with business objectives, the process should be ongoing, thus the proposed model is a loop. The model contains four steps: identify cloud-based ERP key drivers, plan cloud-based ERP benefits, assess benefits realisation, and establish the potential for further benefits as presented in Figure 4.9. the BR model explained in detail in chapter 6.

The use of this model starts in the post-implementation phase after a couple of months, or more beneficially, after one year. Most of the benefits need time to be achieved, such as organizational and strategic benefits.

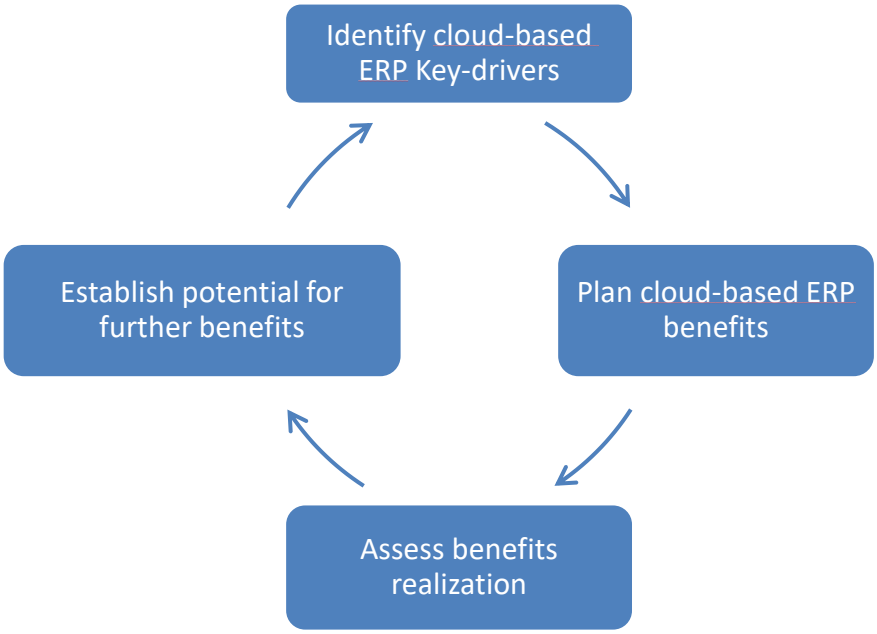


Figure 4.9: the proposed B.R. model of cloud-based ERP Implementation

4.6 Chapter Summary

This chapter describes the particulars of the processes undertaken for the data collection, analysis, and framework development. Section 4.1 is an introduction. Section 4.2 about the pilot study that supporting the literature for preparing to data collection. Section 4.3 address the data collection procedures; selecting organizations and interviewees, required procedures, and conducting interviews. Section 4.4 concerns data analysis procedures that explain: thematic analysis for collecting data, interview result, benefits categories, and maturity categories. Section 4.5 addressed framework development that included review of relevant models, framework of cloud-based ERP implementation, benefits dependency network framework, cloud-based ERP maturity model, change management, cloud-based ERP implementation, and benefits realization models.

5. CHAPTER FIVE: MATURITY ASSESSMENT MODEL

5.1 Introduction

This chapter details the first part of cloud-based ERP implementation framework, the Maturity Assessment Model, and fulfils the fifth objective of the research. Assessment is based upon outputs from the literature review chapter and the results of Chapter 4. The research on the cloud-ERP implementation and maturity assessment topic showed that the maturity approaches initially came from the field of quality management and were extended to the IT field to manage software development. Later, those approaches were applied to organizations' processes. Therefore, assessing an organization in the pre-implementation phase is essential to prepare both team and business for a cloud-based ERP project, as part of quality and improvement procedures.

An overview on the design of the model is provided and its key elements (the enablers) is explained in this chapter, which then highlights the validation of the developed tool with case studies. The assessment tool supports companies to assess their maturity level for cloud-based ERP implementation and identify areas of underperformance and make informed decisions on improvement.

The chapter has been structured in the next order: after the introduction in Section 5.1 the proposed maturity assessment model is described in Section 5.2. The methodology has been used to create the model and its components, illustrated in section 5.3. An overview on the model design and development with its major elements is presented in Section 5.4. A discussion on the formation of the Excel tool that was specially designed for this model is in Section 5.5. In section 5.6 an explanation of the case studies validation with a brief about the companies and the assessment application. In Section 5.7. about the discussion on the results of case studies maturity index. The chapter ceases with a summary in section 5.8 as illustrated in Figure 5.1.

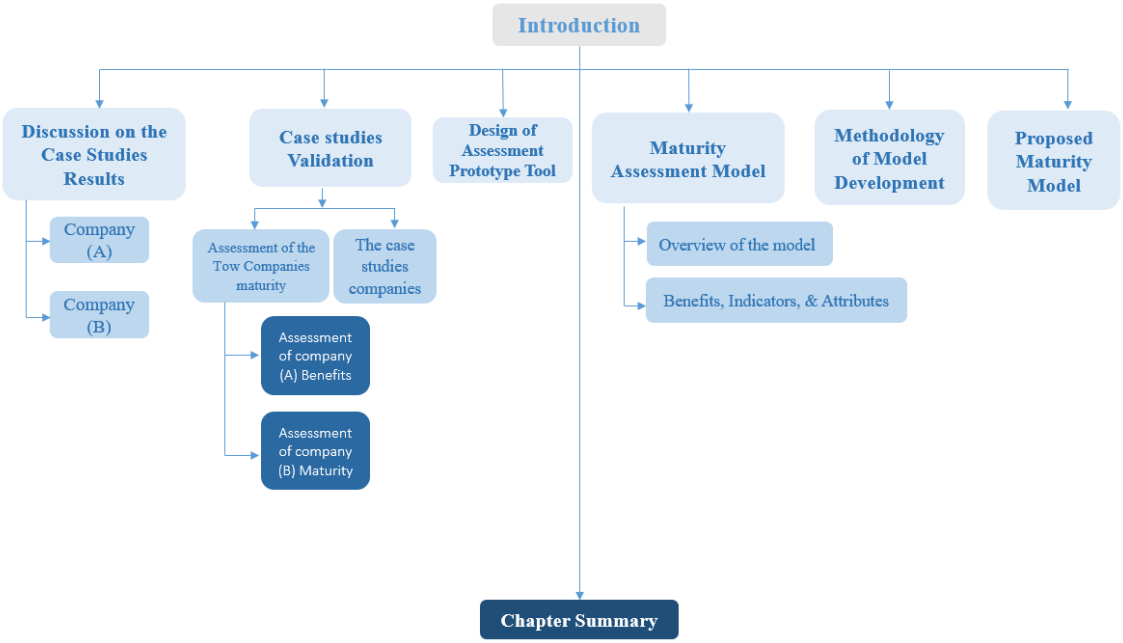


Figure 5.1: Outline of Chapter

5.2 Proposed Maturity Model

In Chapter 5, the developed framework was introduced after reviewing the literature and conducting a comparative analysis for available models and frameworks. Figure 5.2 shows the proposed model of this research built upon the results of data collection, through the challenges and critical success factors that could guarantee the maturity by enhancing the opportunity of success and mitigate the challenges in proactive procedures.

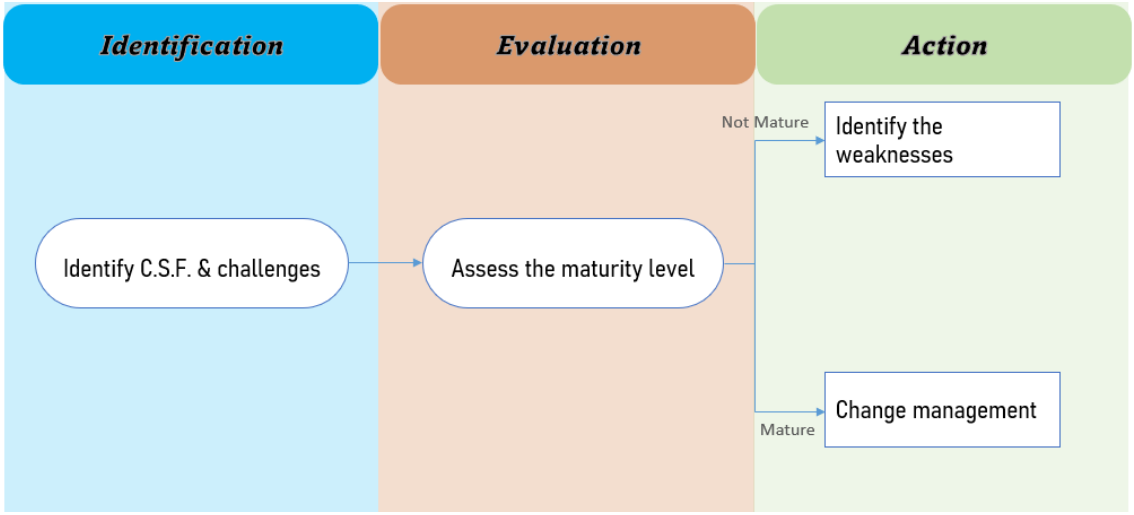


Figure 5.2: Maturity Model

The model consists of 3 phases:

Identification: during this phase, the factors that enhance the possibility of success of a cloud-based ERP project should be identified. To support this step, identifying the challenges will help eliminate any potential challenge. This step is crucial to restrict anything that may help or disrupt the success of the project as much as possible.

Evaluation: In this phase, the assessment of maturity index is used to discover the areas for improvement in organization necessary before starting the implementation. The index score is derived according to experts' judgements, who are members in the cloud-based ERP implementation project.

Action: this phase depends on the Evaluation phase; action required should be taken based on results. If the evaluation returns a full score (10) then change management should take place, otherwise there is need to make improvements depending upon what areas of weakness were identified in evaluation phase.

5.3 Methodology of the Model Development

To develop and validate the maturity assessment model, an iterative process was followed using theoretical and empirical approaches. The first step was studying the literature on maturity in IS/IT projects. The aim of the literature was to build knowledge about the

need for different choices in designing a tool for assessing maturity in information systems initiatives in different sectors. Reviewing the literature started with two main subjects: maturity assessment, and the link between BM and maturity models. The terms used in the review are: maturity, maturity model, assessment, maturity and IT, maturity and benefit management beside the swap between maturity and readiness.

After studying the literature review, a pilot survey was published, and then interviewed the academic researchers who has experience in cloud-based ERP projects and practitioner from different industries. Each interview tool from 45 to 60 minutes, there were four group meetings in three different companies. After the interviews, the model was built based on the collected data. Virtual meetings were then carried out with academics and the model, and its items were presented; how it is to be used to calculate maturity using fuzzy logic was also explained.

The second part of the research methodology, as illustrated in Figure 5.3, started with identifying suitable companies in which to apply the model. The validation was carried out in one UK company and one Saudi company due to the prevailing global pandemic. Both companies have had cloud-based ERP successfully implemented for more than one year; it was not possible find a company preparing implementation. For confidentiality, the data treated in strictest confidence where the names companies will be referred as Company A, and Company B, as mentioned in Chapter 4. Data collection from the case companies was used to calculate the maturity index for each company.

Five experts joined in the assessment process, three experts from Company A and two practitioners from Company B, as demonstrated in Table 5.1. The expert completed an Excel tool (see Section 5.5) separately with the researcher by identifying the relative importance (weight) of each enabler, criterion, and attribute. Then each expert evaluated the maturity of their company on each attribute by giving a score for each of the 51 attributes ranging from zero to 10; this will be discussed in more detail in Section 5.7.

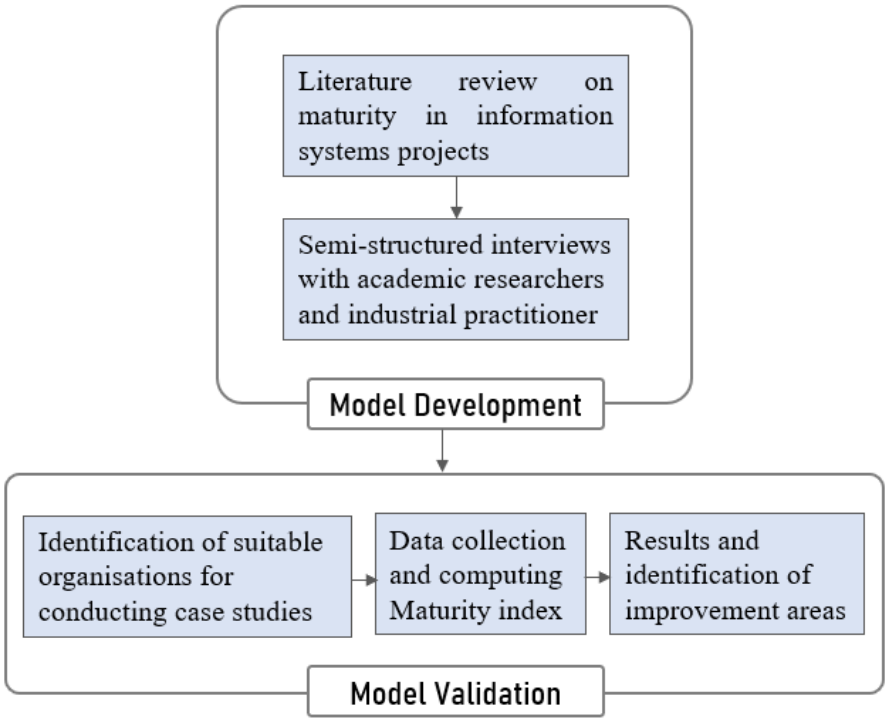


Figure 5.3: Model Development Methodology

Table 5.1: Experts Involved in the Assessment

Expert Number	Company	Role	Years of Experience
Expert 1	A	IT Director	15
Expert 2		SAP Team Lead	11
Expert 3		SAP SF Consultant	10
Expert 4	B	Implementation Manager	18
Expert 5		Workday Functional Consultant	10

5.4 Maturity Assessment Model

5.4.1 Overview of the model

The maturity assessment model includes three levels, as presented in Figure 5.4. It starts with level 1, that contains five enablers, next level2 includes 13 criteria, and finally the level 3 involves 51 attributes. The model formulated by using the five major enablers (CFSs) required for implementing cloud-based ERP in organizations. These enablers are

Leadership, Strategy, People, Technology, and Governance. These three elements, used in calculation the maturity level of organization is presented in Table 5.2. The next section will present a brief discussion of these five enablers.

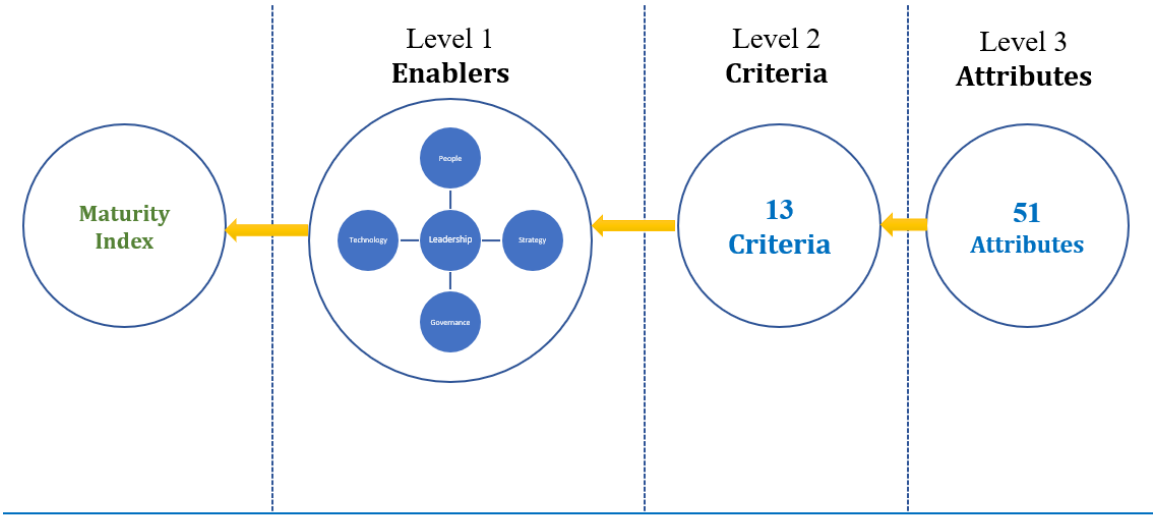


Figure 5.4: Maturity Summary of the Assessment Model

5.4.2 Enablers, Criteria, and Attributes

The concept of maturity and readiness of organization toward any change projects, is centred around the critical success factors of the project beside the challenges as well. Through the literature, pilot survey and interviews the author collected many factors that help to form the components of the assessment tool that illustrated in Table 5.2.

5.4.2.1 Leadership

The main factor that leads to successful cloud-based ERP implementation is top management support: it is fundamental to the success of complex projects. Cloud ERP projects encounter critical challenges, such as change management, customization, business process re-engineering, team resistance, and vendor's management; all need effective leadership involvement (Alharthi, Shehab and Al-ashaab, 2019). For cloud ERP projects and IT initiatives in general, leadership needs an approach that supports digital transformation. Cloud ERP is one such program initiative, and leadership should have a true understanding of cloud concepts and features in order to handle business expectations, governance, and compliance issues. This will encourage teamwork, commonality amongst workers (team spirit), and identify clear project goals that are

measurable. In addition, leadership and its management practices that involve effective steering committee objectives foster good accountability procedures. Moreover, a management culture that supports continuous improvement is conscious of cost reduction and aware of organizational culture.

5.4.2.2 Strategy

A Cloud ERP project, as with any project, needs a strategy to fulfil the goals and deliver the expected outputs. The strategy must include project preparation that consists of a clear plan; formation of the project team and assignment of their responsibilities; a cloud strategy that is separate to the project strategy and implementation strategy; identified deliverables and milestones; detailed budgets and financial value measures; and realistic release schedules. Business Blueprinting (the documentation of business processes), re-engineering of business processes, facilitation of compatibility between business expectation and cloud's standardization, and identification of the “As Is” state and the future “To Be” state, must also be part of the strategy. Additionally, an effective strategy to consider change management practices before the project start is needed. There should be a clear change vision, change leader/group, and effective change management plan.

5.4.2.3 People

Employees, who are motivated, empowered, have the knowledge and are ready to accept cloud-based ERP projects are one of the crucial factors for the effective cloud-based ERP implementation. The key people in cloud ERP implementation are cloud service providers, the user of ERP system, and the consultant. Cloud service providers (CSPs) need to have technological competence, diverse customer base that could support clients in their business, range of customisation, level of partnership, clear upgrade plan, available support levels. As cloud ERP’s user consider a success factor for implementation, they should have clear roles, job descriptions, training and knowledge transfer program, ability to use cloud-based ERP technology, strong participation in requirements development, clear and practical incentive program, awareness of purpose and vision, and readiness for change. Regarding consultants, they should have expertise on cloud, available expertise/ consultants, industry experience, and value creation practice.

5.4.2.4 Technology

Cloud ERP is an IT project that needs other technologies to be a success factor for implementation such as existence systems in terms of systems usability, systems compatibility, and systems integrality. As well as technical issues that related to reliability of internet and bandwidth, reliability of network between customer and CSP, and quality of data.

5.4.2.5 Governance

Where the data consider an important asset of any organization, as with cloud, the physical location of data, the authentications, access to data, all these issues need governance for providers and customers. Aleem and Sprott (2012) assert that governance appeared to be 62.3% of the concern. Furthermore, Momoh, Roy and Shehab (2010) considers governance of project is one of the complexities. Regarding governance, there is global compliance that enable the organization to be awareness of vendors' country regulations, awareness of customers' country regulations, and compatibility between SLA and Cloud-based ERP regulations. As well as storage and access that shows data storage location and awareness of legislation of data access.

Table 5.2: Maturity Assessment model Components

Enablers	Criteria	Attributes
Leadership	Leadership approach	Support digital transformation
		True understanding of cloud concept and its features
		Encourage excellent teamwork and team spirit
		Clear project goals and measurable
	Management Practice	Effective steering committee
		Focused Objectives
		Good accountability practice
	Management Culture	Support continuous improvement
		Conscious to cost reduction
		Aware of organization's culture
Strategy	Project Preparation	Clear plan of the project
		Assign project team and responsibilities
		Cloud strategy
		Identified deliverables and Milestones
		Well-thought off budgets and financial value
		Realistic Release Schedules

	Business Blueprinting	Existence of documentation of business processes
		Re-engineered business processes
		Compatibility between business expectation and cloud's standardization
		Identify the “As Is” state and the future “To Be” state
	Change management	Clear Change vision
		Change leader/group
		Effective change management plan
People	Cloud Service Providers	Technological Competence
		Diverse Customer Base
		Range of customisation
		Level of Partnership
		Clear Upgrade Plan
		Available Support Levels
	cloud ERP's users	Clear Roles and Job Descriptions
		Training & knowledge Transfer program
		Ability to use cloud-based ERP technology
		Strong Participation in Requirements Development
		Clear and Practical Incentive Program
		Awareness of Purpose & Vision
		Readiness for change
	Consultancy	Expertise on cloud
		Available expertise/ consultants
		Industry Experience
		Value Creation Practice
Technology	Existing systems	Systems usability
		Systems compatibility
		Systems integrality
	Technical issues	Reliability of Internet and bandwidth
		Reliability of network between customer and CSP
		Quality of data
Governance	Global compliance	Awareness of vendors’ countries’ regulations
		Awareness of customers’ countries’ regulations
		Compatibility between SLA and Cloud ERP regulations
	Storage and access	Data storage location is known
		Aware of legislation of data access

5.5 Design of Assessment Prototype Tool

After adopting the maturity assessment concept and create the model, it was worthwhile to tailor a prototype tool for assessors' usage. The researcher initially considered applications such as Microsoft Access, the option to build it with Apache, or develop an application. However, the limitation of time and the availability of the software requirement with the case study subjects stop the research from that, based on experts' suggestions.

The maturity assessment prototype tool was ultimately developed via MS Excel. The advantages of this software were availability (for the assessor); ease of use (for the user); accessibility, as it is popular amongst different business departments; and the ability to create statistical reports with graphical data during analysis phase etc. The usability and clarity of the tool was examined by academics and practitioners, and it developed also by researcher observations.

The design of the tool aimed to be practical and user-friendly, with clear illustrative information. The core of the assessment laid in three assessment steps: Enablers is step1, Criteria is step 2, and Attributes is step 3. for each element there is a drop-down list of options where experts can select their preferred answers for practical and easier use. The assessment cells linked with conditions, for example the total of Relative Importance (RI) of five enablers must be 100%, the same conditions applied on criteria and attributes. For data quality obtained from the answers, built in equations are used linking with visual conditions that allow cell colour change to support participant calculation process. The following figures will explain the assessment process visually.

The first sheet of the maturity is the introduction that explain to the participants the purpose and the confidentiality of the data with the researcher contact detail, as shown in Figure 5.5.

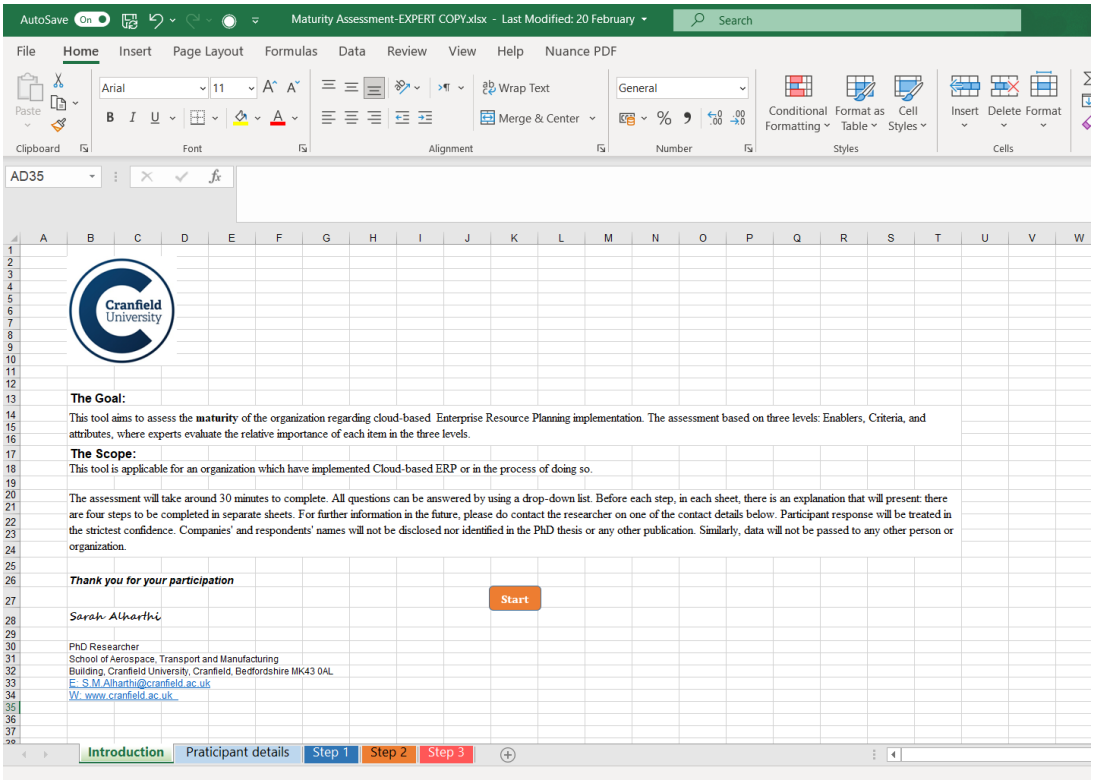


Figure 5.5: Screenshot of The Maturity Assessment Tool

In the next sheet, the participants input their details as presented in Figure 5.6. that for data quality and credibility of the research.

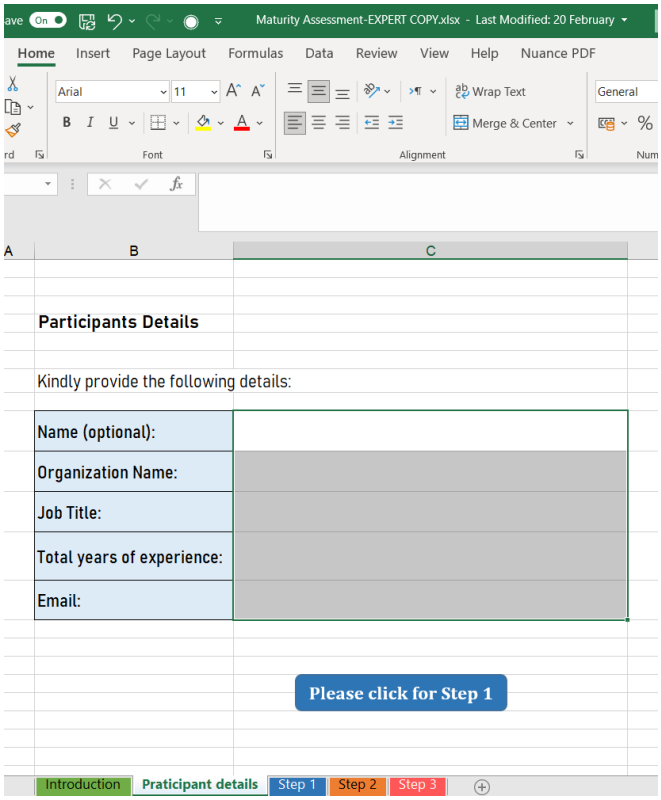


Figure 5.6: Participant details Sheet in The Maturity Assessment Tool

The next step, the participant required to assess each element within the sheets from his/her point of view. there is 100% should distributing among the enablers. showed in Figure 5.7.

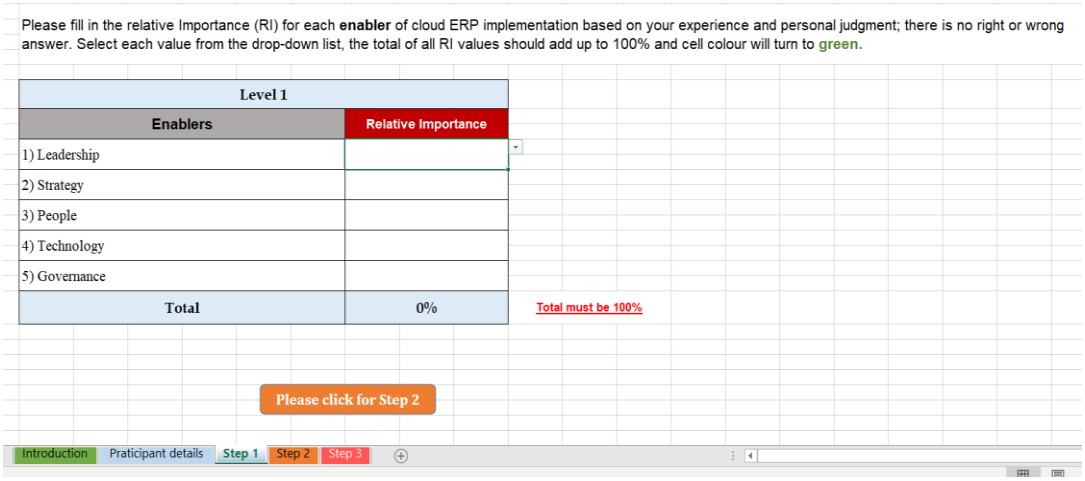
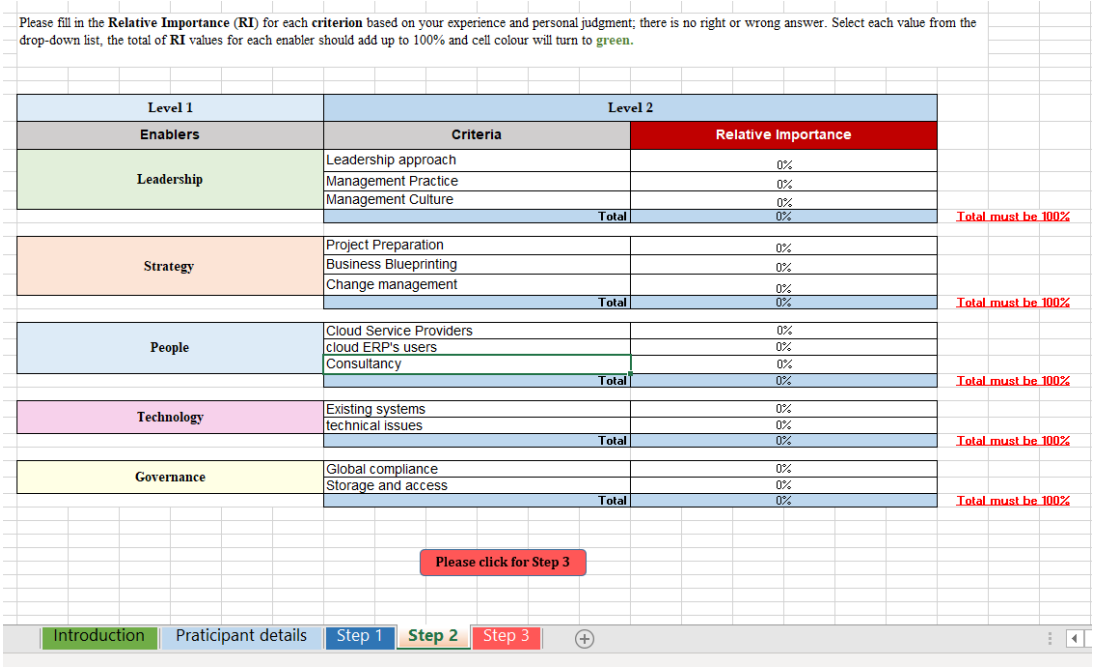


Figure 5.7: Relative importance ranking for enablers

In continuance, each enabler has a couple of criteria; the user assesses the criteria with RI as well (see Figure 5.8).



Please fill in the **Relative Importance** (**RI**) for each **criterion** based on your experience and personal judgment; there is no right or wrong answer. Select each value from the drop-down list, the total of **RI** values for each enabler should add up to 100% and cell colour will turn to green.

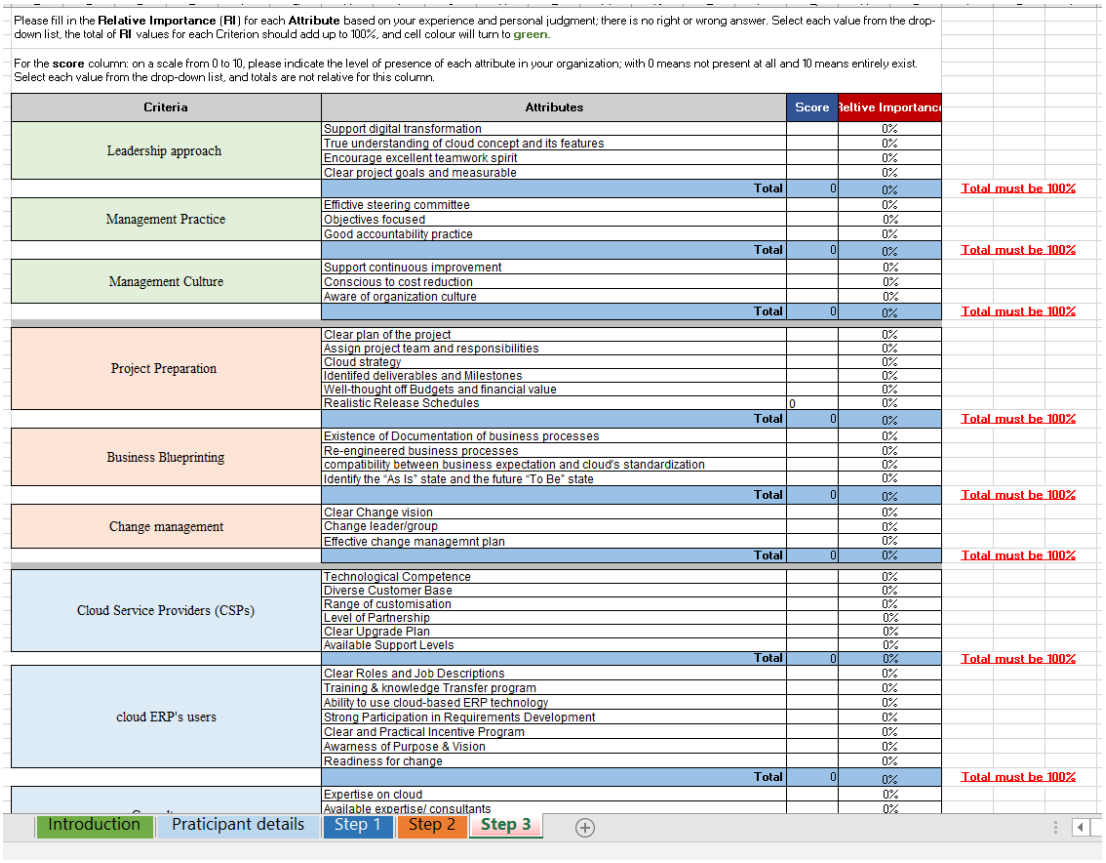
Level 1	Level 2		
Enablers	**Criteria**	**Relative Importance**	
Leadership	Leadership approach	0%	
	Management Practice	0%	
	Management Culture	0%	
	Total	0%	Total must be 100%
Strategy	Project Preparation	0%	
	Business Blueprinting	0%	
	Change management	0%	
	Total	0%	Total must be 100%
People	Cloud Service Providers	0%	
	cloud ERP's users	0%	
	Consultancy	0%	
	Total	0%	Total must be 100%
Technology	Existing systems	0%	
	technical issues	0%	
	Total	0%	Total must be 100%
Governance	Global compliance	0%	
	Storage and access	0%	
	Total	0%	Total must be 100%

Please click for Step 3

Introduction | Praticipant details | Step 1 | Step 2 | Step 3

Figure 5.8: Relative importance ranking for Level 2 (Criteria)

Figure 5.9 shows the last step in the assessment, The actual rating (Score) for each attribute. This captures the current levels of criterion's availability in the company. For the score the participants required to give a ranking from 0-10 beside the known RI. The assessment subsequently calculates the maturity index.



Please fill in the **Relative Importance** (RI) for each **Attribute** based on your experience and personal judgment; there is no right or wrong answer. Select each value from the drop-down list, the total of **RI** values for each Criterion should add up to 100%, and cell colour will turn to green.

For the **score** column: on a scale from 0 to 10, please indicate the level of presence of each attribute in your organization; with 0 means not present at all and 10 means entirely exist. Select each value from the drop-down list, and totals are not relative for this column.

Criteria	Attributes	Score	Reltive Importanc	
Leadership approach	Support digital transformation		0%	
	True understanding of cloud concept and its features		0%	
	Encourage excellent teamwork spirit		0%	
	Clear project goals and measurable		0%	
	Total	0	0%	Total must be 100%
Management Practice	Effictive steering committee		0%	
	Objectives focused		0%	
	Good accountability practice		0%	
	Total	0	0%	Total must be 100%
Management Culture	Support continuous improvement		0%	
	Conscious to cost reduction		0%	
	Aware of organization culture		0%	
	Total	0	0%	Total must be 100%
Project Preparation	Clear plan of the project		0%	
	Assign project team and responsibilities		0%	
	Cloud strategy		0%	
	Identifed deliverables and Milestones		0%	
	Well-thought off Budgets and financial value		0%	
	Realistic Release Schedules	0	0%	
	Total	0	0%	Total must be 100%
Business Blueprinting	Existence of Documentation of business processes		0%	
	Re-engineered business processes		0%	
	compatibility between business expectation and cloud's standardization		0%	
	Identify the "As Is" state and the future "To Be" state		0%	
	Total	0	0%	Total must be 100%
Change management	Clear Change vision		0%	
	Change leader/group		0%	
	Effective change managemnt plan		0%	
	Total	0	0%	Total must be 100%
Cloud Service Providers (CSPs)	Technological Competence		0%	
	Diverse Customer Base		0%	
	Range of customisation		0%	
	Level of Partnership		0%	
	Clear Upgrade Plan		0%	
	Available Support Levels		0%	
	Total	0	0%	Total must be 100%
cloud ERP's users	Clear Roles and Job Descriptions		0%	
	Training & knowledge Transfer program		0%	
	Ability to use cloud-based ERP technology		0%	
	Strong Participation in Requirements Development		0%	
	Clear and Practical Incentive Program		0%	
	Awarness of Purpose & Vision		0%	
	Readiness for change		0%	
	Total	0	0%	Total must be 100%
	Expertise on cloud		0%	
	Available expertise/ consultants		0%	

Introduction | Praticipant details | Step 1 | Step 2 | Step 3

Figure 5.9: The Score and Relative importance ranking for Level 3 (Attributes)

It is noteworthy explaining that the reference of the approach adopted in development of the tool is Vinodh and Chintha (2011) with required changes to fit the research purpose.

To calculate the maturity index (I) the following equation has been used:

$$\text{Maturity index } (\boldsymbol{I}) = \boldsymbol{W} \times \boldsymbol{R}$$

Where:

W: Overall weight

R: Overall assessment factor

I: Maturity index

To identify the maturity level of such an organization, intend to adopt cloud-based ERP, the five sets of fuzzy numbers are used to deal with the vagueness of subjective humans' judgment. The scores of maturity assessment as follows in Table 5.3:

Table 5.3: Score of Maturity Assessment

(8.1-10)	Stands for ' Mature '
(6.1-8)	Stands for 'Partial Mature'
(4.1-6)	Stands for 'moderately Mature’
(2.1- 4)	Stands for 'Poor Maturity'
(0-0.2)	Stands for 'Not Mature’

5.6 Case studies Validation

The validation has been conducted in two companies: one in Saudi Arabia and the second in UK. Both companies have applied a maturity assessment tool. Owing to data protection act, the companies’ name will not be disclosed and will be referred as Company A and Company B. The following presents a summary about each company.

5.6.1 The Case Study Companies

Company A: established in 1964, it considers one of the largest companies in the Middle East with over 2000 employees in 12 countries across four different industries (real estate, retail, wholesale, and manufacturing). The participants were three experts from the company, limited because of the COVID-19 situation and the difficulties running meetings with a larger number of experts. It is worth noting that the implementation of cloud-based ERP started 2019.

Company B A global science and chemicals company, and a leader in sustainable technologies. It has different activities in the context of pollution control system, refine gold and platinum, ...etc. with more than 400 employees. A related point to consider is that the company also started the implementation of cloud ERP in 2019.

Both companies have already implemented cloud-ERP for more than one year. Hence, the assessment was conducted retroactively.

5.6.2 Assessment of the Companies maturity

The assessment commenced by computing the taken information from experts, as shown in Table 5.4.

Table 5.4: Weights and Assessment Scores for the Tow Companies (Refer to Table 6.2 for Enablers, Criteria and Attributes)

Company A								Company B						
I_i	I_{ij}	E1	E2	E3	W_{ij}	W_i	W	I_i	I_{ij}	E1	E2	W_{ij}	W_i	W
I_1	I_{11}	1	1	1	0.4	0.4	0.2	I_1	I_{11}	10	8	0.35	0.225	0.25
		0.7	0.7	0.9	0.2					5	5	0.2		
		0.7	0.7	0.8	0.2					9	5	0.2		
		1	1	1	0.2					10	4	0.25		
	I_{12}	1	1	0.9	0.4	0.3			I_{12}	8	8	0.45	0.35	
		1	1	1	0.3					6	6	0.2		
		0.9	0.9	1	0.3					8	8	0.35		
	I_{13}	1	1	1	0.5	0.3			I_{13}	3	9	0.25	0.25	
		1	1	1	0.3					10	9	0.6		
		1	1	1	0.2					5	7	0.15		
I_2	I_{21}	1	1	1	0.3	0.2	0.2	I_2	I_{21}	9	8	0.2	0.175	0.175
		1	1	1	0.1					6	7	0.2		

		1	1	1	0.2					8	6	0.15		
		0.9	0.9	0.8	0.1					8	7	0.2		
		1	1	1	0.2					8	8	0.15		
		1	1	1	0.1					4	4	0.1		
	I_{22}	1	1	1	0.2	0.4			I_{22}	2	4	0.15	0.175	
		1	1	1	0.2					6	5	0.2		
		1	1	1	0.3					5	5	0.15		
		1	1	1	0.3					9	6	0.5		
	I_{23}	1	1	1	0.3	0.4			I_{23}	8	8	0.4	0.35	
		1	1	1	0.3					7	6	0.25		
		1	1	1	0.4					10	4	0.35		
I_3	I_{31}	0.9	0.9	0.9	0.2	0.3	0.2	I_3	I_{31}	8	7	0.35	0.125	0.125
		0.5	0.5	0.6	0.1					6	8	0.15		
		0.9	0.9	0.9	0.2					2	3	0.1		

		1	1	1	0.1					6	3	0.1		
		1	1	1	0.3					10	6	0.1		
		1	1	1	0.2					7	8	0.2		
	I_{32}	1	1	1	0.2	0.3			I_{32}	8	4	0.15	0.1	
		1	1	1	0.2					4	6	0.1		
		1	1	1	0.2					4	5	0.1		
		0.7	0.7	0.7	0.1					7	8	0.3		
		1	1	1	0.1					4	5	0.1		
		1	1	1	0.1					4	7	0.15		
		0.9	0.9	0.9	0.1					3	4	0.1		
	I_{33}	0.9	0.9	0.9	0.3	0.4			I_{33}	9	9	0.4	0.225	
		1	1	1	0.2					7	7	0.25		
		1	1	0.9	0.3					8	9	0.2		
		1	1	1	0.1					5	9	0.15		

I_4	I_{41}	0.8	0.8	0.9	0.4	0.5	0.3	I_4	I_{41}	5	7	0.15	0.3	0.3
		0.6	0.6	0.7	0.3					2	8	0.3		
		0.5	0.5	0.7	0.3					2	8	0.55		
	I_{42}	0.4	0.4	0.5	0.1	0.5			I_{42}	9	8	0.3	0.3	
		0.6	0.6	0.6	0.2					9	8	0.3		
		0.6	0.6	0.8	0.7					4	7	0.4		
I_5	I_{51}	1	1	1	0.6	0.6	0.1	I_5	I_{51}	7	8	0.3	0.3	0.4
		0.9	0.9	1	0.2					10	8	0.5		
		1	1	1	0.2					7	6	0.2		
	I_{52}	1	1	1	0.5	0.4			I_{52}	10	2	0.35	0.5	
		1	1	1	0.5					10	9	0.65		

5.6.2.1 Assessment of Company (A) Maturity

5.6.2.1.1 Step (1) Calculating the relative importance (weight)

The median has been used as an alternative of the mean in calculating the relative importance, the reason of using the median because of the small sample size. It is worth noting that the values entered for each relative importance enabler was in percentage values to make it easier for the expert judgement, then it was converted to a decimal for calculation purposes. For example, the relative importance given by the experts for the leadership enabler was 0.2, 0.2, and 0.2. By using the median, the relative importance (weight) for leadership was (0.2), Figure 5.10. presents the RI for all enablers.

Level 1				
Enablers	Expert 1	Expert 2	Expert 3	W
1) Leadership	0.2	0.2	0.2	0.2
2) Strategy	0.2	0.2	0.1	0.2
3) People	0.2	0.2	0.2	0.2
4) Technology	0.3	0.3	0.4	0.3
5) Governance	0.1	0.1	0.1	0.1

Figure 5.10: Weights of Company (A) Enablers

Shifting to level two, the RI for each criterion was also computed using the median. For example, the RI (weights) given by Company (A) experts for the leadership approach criterion were 0.4, 0.4, and 0.3, as revealed in Figure 5.11. Thus, the relative importance of the leadership approach criterion was calculated by median to be 0.4.

Level 1	Level 2				
Enablers	**Criteria**	Expert 1	Expert 2	Expert 3	Wi
Leadership	Leadership approach	0.4	0.4	0.3	0.4
	Management Practice	0.3	0.3	0.3	0.3
	Management Culture	0.3	0.3	0.4	0.3
Strategy	Project Preparation	0.2	0.2	0.3	0.2
	Business Blueprinting	0.3	0.4	0.4	0.4
	Change management	0.5	0.4	0.3	0.4
People	Cloud Service Providers	0.3	0.3	0.3	0.3
	cloud ERP's users	0.3	0.3	0.2	0.3
	Consultancy	0.4	0.4	0.5	0.4
Technology	Existing systems	0.5	0.4	0.5	0.5
	technical issues	0.5	0.6	0.5	0.5
Governance	Global compliance	0.6	0.6	0.5	0.6
	Storage and access	0.4	0.4	0.5	0.4

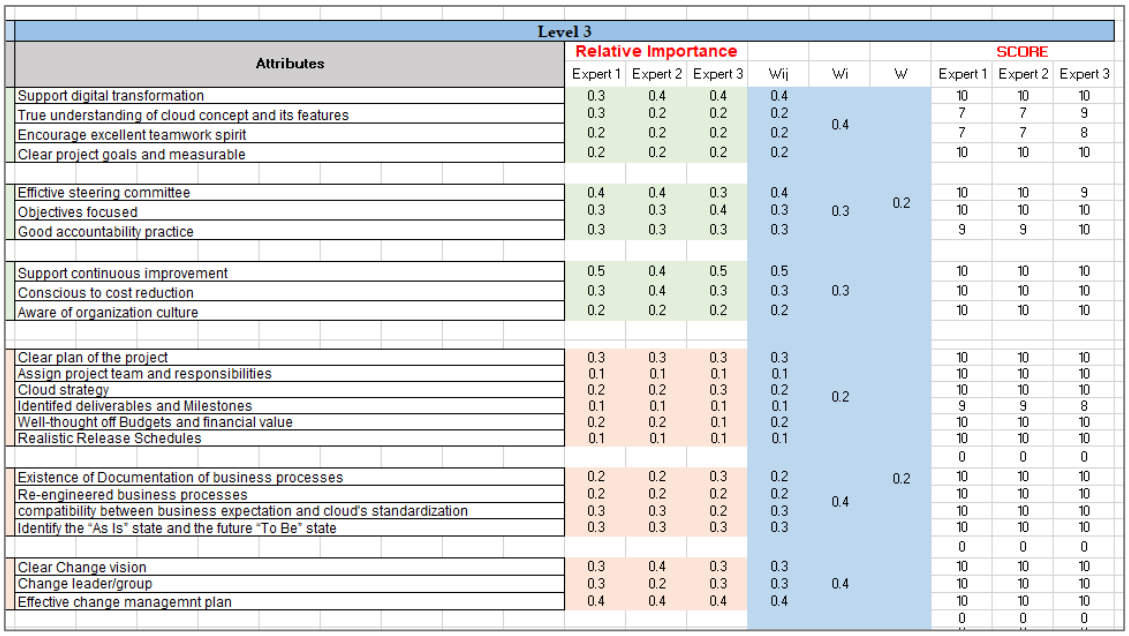
Figure 5.11: Weights of Company (A) Criteria

Applying the similar techniques, the RI (weight) for each attribute was assessed, as presented in Figure 5.12.

Level 1	Level 2	Level 3				
Enablers	**Criteria**	**Attributes**	**Relative Importance**			
			Expert 1	Expert 2	Expert 3	Wij
Leadership	Leadership approach	Support digital transformation	0.3	0.4	0.4	0.4
		True understanding of cloud concept and its features	0.3	0.2	0.2	0.2
		Encourage excellent teamwork spirit	0.2	0.2	0.2	0.2
		Clear project goals and measurable	0.2	0.2	0.2	0.2
		Total				
	Management Practice	Effictive steering committee	0.4	0.4	0.3	0.4
		Objectives focused	0.3	0.3	0.4	0.3
		Good accountability practice	0.3	0.3	0.3	0.3
		Total				
	Management Culture	Support continuous improvement	0.5	0.4	0.5	0.5
		Conscious to cost reduction	0.3	0.4	0.3	0.3
		Aware of organization culture	0.2	0.2	0.2	0.2
		Total				
Strategy	Project Preparation	Clear plan of the project	0.3	0.3	0.3	0.3
		Assign project team and responsibilities	0.1	0.1	0.1	0.1
		Cloud strategy	0.2	0.2	0.3	0.2
		Identifed deliverables and Milestones	0.1	0.1	0.1	0.1
		Well-thought off Budgets and financial value	0.2	0.2	0.1	0.2
		Realistic Release Schedules	0.1	0.1	0.1	0.1
		Total				
	Business Blueprinting	Existence of Documentation of business processes	0.2	0.2	0.3	0.2
		Re-engineered business processes	0.2	0.2	0.2	0.2
		compatibility between business expectation and cloud's standardization	0.3	0.3	0.2	0.3
		Identify the "As Is" state and the future "To Be" state	0.3	0.3	0.3	0.3
		Total				
	Change management	Clear Change vision	0.3	0.4	0.3	0.3
		Change leader/group	0.3	0.2	0.3	0.3
		Effective change managemnt plan	0.4	0.4	0.4	0.4
		Total				
	Cloud Service Providers (CSPs)	Technological Competence	0.2	0.2	0.2	0.2
		Diverse Customer Base	0.1	0.1	0.1	0.1
		Range of customisation	0.2	0.2	0.1	0.2
		Level of Partnership	0.1	0.1	0.1	0.1
		Clear Upgrade Plan	0.3	0.2	0.3	0.3
		Available Support Levels	0.1	0.2	0.2	0.2
		Total				

Figure 5.12: Weights of Company (A) Attributes

Lastly, Figure 5.13 shows the collected scores of each attribute which refer to the presence of the attributes in the company from participant evaluation.



Level 3										
Attributes	Relative Importance						SCORE			
	Expert 1	Expert 2	Expert 3	Wij	Wi	W	Expert 1	Expert 2	Expert 3	
Support digital transformation	0.3	0.4	0.4	0.4	0.4	0.2	10	10	10	
True understanding of cloud concept and its features	0.3	0.2	0.2	0.2			7	7	9	
Encourage excellent teamwork spirit	0.2	0.2	0.2	0.2			7	7	8	
Clear project goals and measurable	0.2	0.2	0.2	0.2			10	10	10	
Effictive steering committee	0.4	0.4	0.3	0.4	0.3		10	10	9	
Objectives focused	0.3	0.3	0.4	0.3			10	10	10	
Good accountability practice	0.3	0.3	0.3	0.3			9	9	10	
Support continuous improvement	0.5	0.4	0.5	0.5	0.3		10	10	10	
Conscious to cost reduction	0.3	0.4	0.3	0.3			10	10	10	
Aware of organization culture	0.2	0.2	0.2	0.2			10	10	10	
Clear plan of the project	0.3	0.3	0.3	0.3	0.2		10	10	10	
Assign project team and responsibilities	0.1	0.1	0.1	0.1			10	10	10	
Cloud strategy	0.2	0.2	0.3	0.2			10	10	10	
Identifed deliverables and Milestones	0.1	0.1	0.1	0.1			9	9	8	
Well-thought off Budgets and financial value	0.2	0.2	0.1	0.2			10	10	10	
Realistic Release Schedules	0.1	0.1	0.1	0.1			10	10	10	
							0	0	0	
Existence of Documentation of business processes	0.2	0.2	0.3	0.2	0.4		10	10	10	
Re-engineered business processes	0.2	0.2	0.2	0.2			10	10	10	
compatibility between business expectation and cloud's standardization	0.3	0.3	0.2	0.3			10	10	10	
Identify the "As Is" state and the future "To Be" state	0.3	0.3	0.3	0.3			10	10	10	
							0	0	0	
Clear Change vision	0.3	0.4	0.3	0.3	0.4		10	10	10	
Change leader/group	0.3	0.2	0.3	0.3			10	10	10	
Effective change managemnt plan	0.4	0.4	0.4	0.4			10	10	10	
							0	0	0	

Figure 5.13: Assessment Scores for Company (A)

The following Table 5.5 shows the calculated RI for the five enablers, its criteria, and the attributes, as well as the collected scores.

Table 5.5: Weights and Assessment Scores for Company (A)

Company A							
I_i	I_{ij}	E1	E2	E3	W_{ij}	W_i	W
I_1	I_{11}	10	10	10	4	0.4	0.2
		7	7	9	2		
		7	7	8	2		
		10	10	10	2		
	I_{12}	10	10	9	4	0.3	
		10	10	10	3		
		9	9	10	3		
	I_{13}	10	10	10	5	0.3	

		10	10	10	3		
		10	10	10	2		
I_2	I_{21}	10	10	10	3	0.2	0.2
		10	10	10	1		
		10	10	10	2		
		9	9	8	1		
		10	10	10	2		
		10	10	10	1		
	I_{22}	10	10	10	2	0.4	
		10	10	10	2		
		10	10	10	3		
		10	10	10	3		
	I_{23}	10	10	10	3	0.4	
		10	10	10	3		
		10	10	10	4		
I_3	I_{31}	9	9	9	2	0.3	0.2
		5	5	6	1		
		9	9	9	2		
		10	10	10	1		
		10	10	10	3		
		10	10	10	2		
	I_{32}	10	10	10	2		

		10	10	10	2	0.3	
		10	10	10	2		
		7	7	7	1		
		10	10	10	1		
		10	10	10	1		
		9	9	9	1		
	I_{33}	9	9	9	3	0.4	
		10	10	10	2		
		10	10	9	3		
		10	10	10	1		
I_4	I_{41}	8	8	9	4	0.5	0.3
		6	6	7	3		
		5	5	7	3		
	I_{42}	4	4	5	1	0.5	
		6	6	6	2		
		6	6	8	7		
I_5	I_{51}	10	10	10	6	0.6	0.1
		9	9	10	2		
		10	10	10	2		
	I_{52}	10	10	10	5	0.4	
		10	10	10	5		

5.6.2.1.2 Step (2) Calculating the Index of Criteria

To calculate the index for each criterion, the following equation was used:

$$\boldsymbol{Ii}\text{j}=\boldsymbol{Wi}\text{j} \times \boldsymbol{Ri}\text{j}$$

To illustrate it more, the RI (weights) of leadership approach criterion for company (A) is:

$$\text{W11= (0.4,0.2,0.2,0.2)}$$

Assessment scores pertaining to the leadership approach criterion is given by:

$$\text{R11} = \begin{bmatrix} 10 & 10 & 10 \\ 7 & 7 & 9 \\ 7 & 7 & 8 \\ 10 & 10 & 10 \end{bmatrix}$$

Index pertaining to the leadership approach criterion for company (A) is given by

$$\boldsymbol{I}_{11}=\boldsymbol{W}_{11} \times \boldsymbol{R}_{11}$$

$$\boldsymbol{I}_{11} = (8.8, 8.8, 9.4)$$

Following the same practices, the indices of all Maturity criteria have been calculated as presented in Table 5.6

Table 5.6: Indices of the Criteria for Company (A)

Iij	Expert 1	Expert 2	Expert 3
I_{11}	8.8	8.8	9.4
I_{12}	9.7	9.7	9.6
I_{13}	10	10	10
I_{21}	9.9	9.9	9.8
I_{22}	10	10	10

I_{23}	10	10	10
I_{31}	10.1	10.1	10.2
I_{32}	9.6	9.6	9.6
I_{33}	8.7	8.7	8.4
I_{41}	6.5	6.5	7.8
I_{42}	5.8	5.8	7.3
I_{51}	9.8	9.8	10
I_{52}	10	10	10

5.6.2.1.3 Step (3) Calculating the indices of the enablers

The enabler index calculated by the following equation:

$$\boldsymbol{I}_i=\boldsymbol{W}_i \times \boldsymbol{R}_i$$

For example, the calculation related to the leadership enabler for company (A) is given by: $\boldsymbol{I}_1=\boldsymbol{W}_1 \times \boldsymbol{R}_1$

Weight pertaining to the leadership enabler is given by:

$$\mathbf{W}_1= (0.2, 0.2, 0.2)$$

Assessment scores pertaining to the leadership enabler is given by:

$$\mathrm{R1} = \begin{bmatrix} 8.8 & 8.8 & 9.4 \\ 9.7 & 9.7 & 9.6 \\ 10 & 10 & 10 \end{bmatrix}$$

Index pertaining to the leadership for company (A) enabler is given by:

$$\boldsymbol{I}_1=\boldsymbol{W}_1 \times \boldsymbol{R}_1$$

$$\boldsymbol{I}_1 = (9.43, 9.43, 9.64)$$

In continues, all indices have been calculated for the reset of enablers for Company A, as shown in Table 5.7.

Table 5.7: Indices of the Enablers for Company (A)

Ii	Expert 1	Expert 2	Expert 3
I1	9.43	9.43	9.64
I2	9.98	9.98	9.96
I3	9.39	9.39	9.3
I4	6.15	6.15	7.55
I5	9.88	9.88	10

5.6.2.1.4 Step (4) Calculating Maturity Index for Company A

The Maturity Index calculated by the following equation:

$$\boldsymbol{I} = \boldsymbol{W} \times \boldsymbol{R}$$

The Maturity index for Company A has been computed as:

Overall weight **W** = (0.2, 0.2, 0.2, 0.3, 0.1)

Overall assessment vector $\mathbf{R} = \begin{bmatrix} 9.43 & 9.43 & 9.64 \\ 9.98 & 9.98 & 9.96 \\ 9.39 & 9.39 & 9.3 \\ 6.15 & 6.15 & 7.55 \\ 9.88 & 9.88 & 10 \end{bmatrix}$

Company A Maturity index has been calculated as:

$$\boldsymbol{I} = \boldsymbol{W} \times \boldsymbol{R}$$

$$\boldsymbol{I} = (8.593, 8.593, 9.045)$$

$$\boldsymbol{I} = 1/3\ (8.593 + 8.593 + 9.045)$$

$$I = 1/3\ (26.231)$$

$$I = 8.7$$

The Maturity index computed for company A is approximately 8.7

All the indices and weights calculated for Company A enablers and criteria are presented respectively in Figure 5.14. For Company A, the most important enabler is technology with a relative importance of 30% and an index of 6.15. While governance is the least important enabler with a relative importance of 10%, whereas it has the highest index of 9.88, the same as people, strategy, and leadership. An analysis of Company A's performance will be presented later in this chapter.

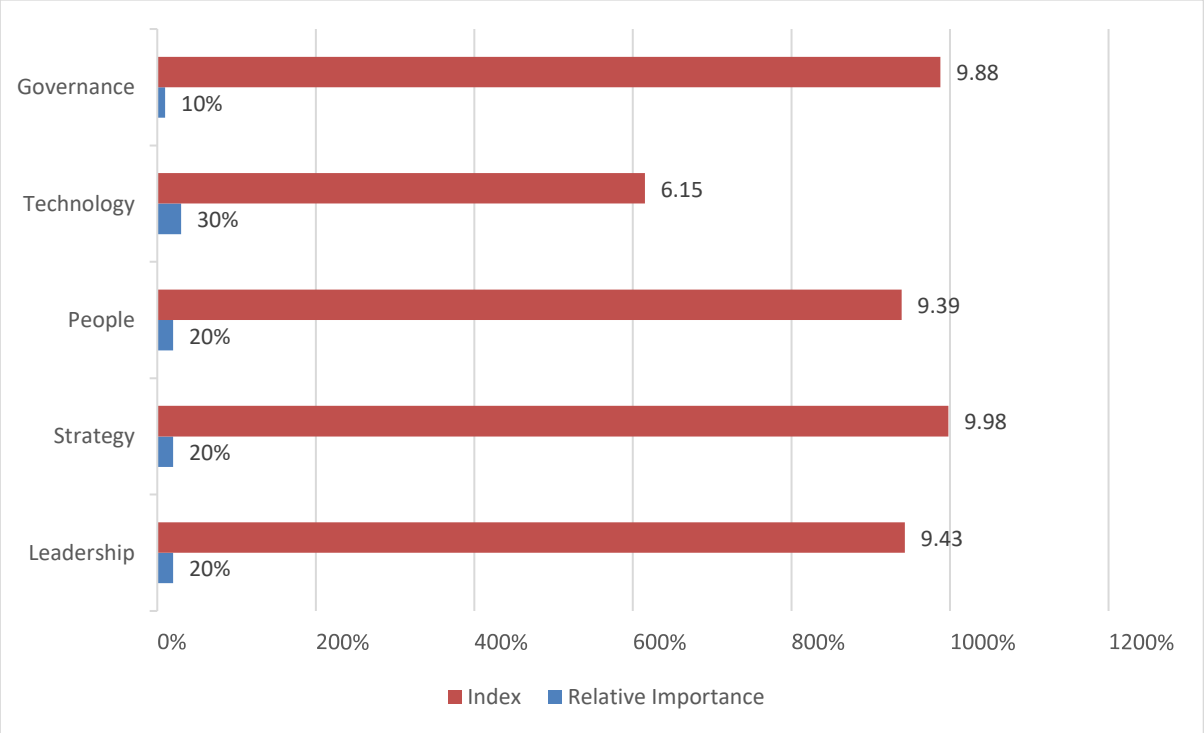


Figure 5.14: Relative Importance (weight) and Indices for Company (A) Enablers

5.6.2.2 Assessment of Company B Maturity

5.6.2.2.1 Step (1) Calculating the relative importance (weight)

As in the first case study, the same processes followed for the second case. It starts by getting the RI (weight (W)) for enablers, criteria, and attributes, then extract the median. Figure 5.15. presents the RI (weight) for the five enablers for company (B).

Level 1			
Enablers	**Expert 1**	**Expert 2**	**W**
1) Leadership	0.2	0.1	0.15
2) Strategy	0.1	0.2	0.15
3) People	0.3	0.4	0.35
4) Technology	0.3	0.2	0.25
5) Governance	0.1	0.1	0.1

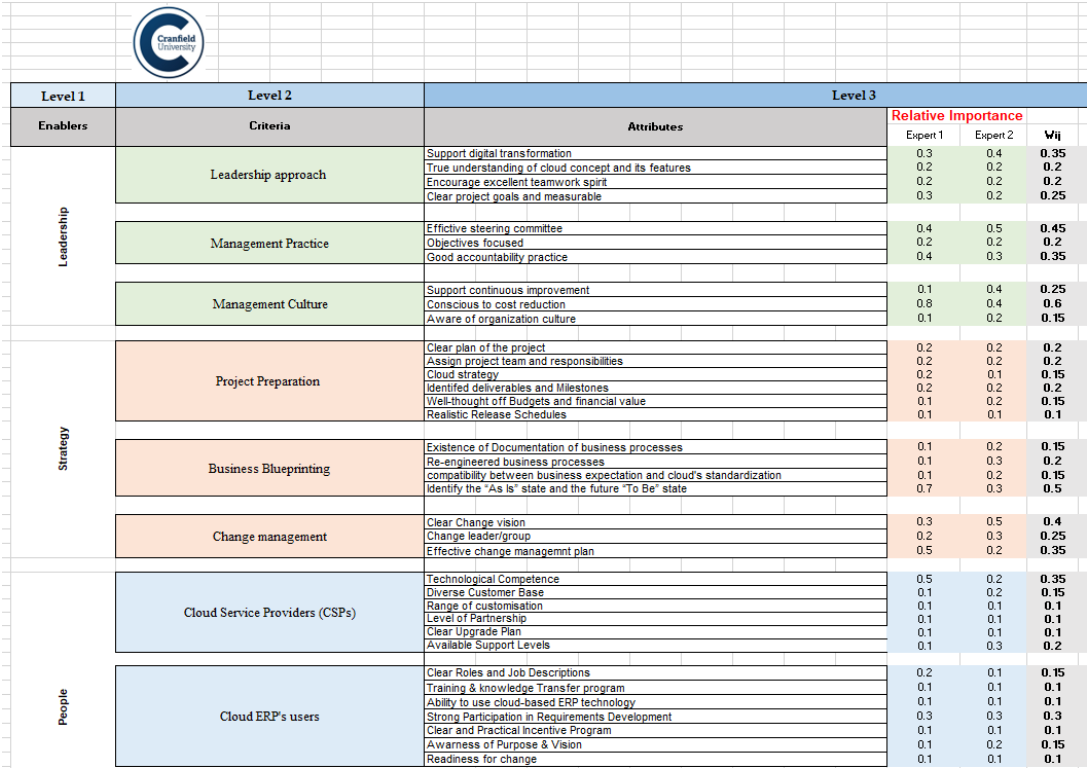
Figure 5.15: Weights of Company B Enablers

In the second level of the assessment, the RI for each criterion was calculated as illustrated in Figure 5.16.

Level 1	Level 2			
Enablers	**Criteria**	**Expert 1**	**Expert 2**	**Wi**
Leadership	Leadership approach	0.4	0.3	0.35
	Management Practice	0.4	0.4	0.4
	Management Culture	0.2	0.3	0.25
Strategy	Project Preparation	0.4	0.2	0.3
	Business Blueprinting	0.3	0.4	0.35
	Change management	0.3	0.4	0.35
People	Cloud Service Providers	0.4	0.2	0.3
	cloud ERP's users	0.3	0.7	0.5
	Consultancy	0.3	0.1	0.2
Technology	Existing systems	0.6	0.8	0.7
	technical issues	0.4	0.2	0.3
Governance	Global compliance	0.7	0.4	0.55
	Storage and access	0.3	0.6	0.45

Figure 5.16: Weights of Company B Criteria (Wi is the criterion weight)

The relative importance (weight) for each attribute was calculated as shown in Figure 5.17. Finally, all the assessment scores given by each expert were gathered, as presented in Figure 5.18.



Level 1	Level 2	Level 3			
Enablers	Criteria	Attributes	Relative Importance		
			Expert 1	Expert 2	Wij
Leadership	Leadership approach	Support digital transformation	0.3	0.4	**0.35**
		True understanding of cloud concept and its features	0.2	0.2	**0.2**
		Encourage excellent teamwork spirit	0.2	0.2	**0.2**
		Clear project goals and measurable	0.3	0.2	**0.25**
	Management Practice	Effictive steering committee	0.4	0.5	**0.45**
		Objectives focused	0.2	0.2	**0.2**
		Good accountability practice	0.4	0.3	**0.35**
	Management Culture	Support continuous improvement	0.1	0.4	**0.25**
		Conscious to cost reduction	0.8	0.4	**0.6**
		Aware of organization culture	0.1	0.2	**0.15**
Strategy	Project Preparation	Clear plan of the project	0.2	0.2	**0.2**
		Assign project team and responsibilities	0.2	0.2	**0.2**
		Cloud strategy	0.2	0.1	**0.15**
		Identifed deliverables and Milestones	0.2	0.2	**0.2**
		Well-thought off Budgets and financial value	0.1	0.2	**0.15**
		Realistic Release Schedules	0.1	0.1	**0.1**
	Business Blueprinting	Existence of Documentation of business processes	0.1	0.2	**0.15**
		Re-engineered business processes	0.1	0.3	**0.2**
		compatibility between business expectation and cloud's standardization	0.1	0.2	**0.15**
		Identify the "As Is" state and the future "To Be" state	0.7	0.3	**0.5**
	Change management	Clear Change vision	0.3	0.5	**0.4**
		Change leader/group	0.2	0.3	**0.25**
		Effective change managemnt plan	0.5	0.2	**0.35**
People	Cloud Service Providers (CSPs)	Technological Competence	0.5	0.2	**0.35**
		Diverse Customer Base	0.1	0.2	**0.15**
		Range of customisation	0.1	0.1	**0.1**
		Level of Partnership	0.1	0.1	**0.1**
		Clear Upgrade Plan	0.1	0.1	**0.1**
		Available Support Levels	0.1	0.3	**0.2**
	Cloud ERP's users	Clear Roles and Job Descriptions	0.2	0.1	**0.15**
		Training & knowledge Transfer program	0.1	0.1	**0.1**
		Ability to use cloud-based ERP technology	0.1	0.1	**0.1**
		Strong Participation in Requirements Development	0.3	0.3	**0.3**
		Clear and Practical Incentive Program	0.1	0.1	**0.1**
		Awarness of Purpose & Vision	0.1	0.2	**0.15**
		Readiness for change	0.1	0.1	**0.1**

Figure 5.17: Weights of Company B Criteria (Wij is the criterion weight)

Level 3							
Attributes	Relative Importance					SCORE	
	Expert 1	Expert 2	Wij	Wi	W	Expert 1	Expert 2
Support digital transformation	0.3	0.4	**0.35**			10	8
True understanding of cloud concept and its features	0.2	0.2	**0.2**	**0.35**		5	5
Encourage excellent teamwork spirit	0.2	0.2	**0.2**			9	5
Clear project goals and measurable	0.3	0.2	**0.25**			10	4
Effictive steering committee	0.4	0.5	**0.45**		**0.15**	8	8
Objectives focused	0.2	0.2	**0.2**	**0.4**		6	6
Good accountability practice	0.4	0.3	**0.35**			8	8
Support continuous improvement	0.1	0.4	**0.25**			3	9
Conscious to cost reduction	0.8	0.4	**0.6**	**0.25**		10	9
Aware of organization culture	0.1	0.2	**0.15**			5	7
Clear plan of the project	0.2	0.2	**0.2**			9	8
Assign project team and responsibilities	0.2	0.2	**0.2**			6	7
Cloud strategy	0.2	0.1	**0.15**	**0.3**		8	6
Identifed deliverables and Milestones	0.2	0.2	**0.2**			8	7
Well-thought off Budgets and financial value	0.1	0.2	**0.15**			8	8
Realistic Release Schedules	0.1	0.1	**0.1**			4	4
Existence of Documentation of business processes	0.1	0.2	**0.15**		**0.15**	2	4
Re-engineered business processes	0.1	0.3	**0.2**	**0.35**		6	5
compatibility between business expectation and cloud's standardization	0.1	0.2	**0.15**			5	5
Identify the "As Is" state and the future "To Be" state	0.7	0.3	**0.5**			9	6
Clear Change vision	0.3	0.5	**0.4**			8	8
Change leader/group	0.2	0.3	**0.25**	**0.35**		7	6
Effective change managemnt plan	0.5	0.2	**0.35**			10	4
Technological Competence	0.5	0.2	**0.35**			8	7
Diverse Customer Base	0.1	0.2	**0.15**			6	8
Range of customisation	0.1	0.1	**0.1**	**0.3**		2	3
Level of Partnership	0.1	0.1	**0.1**			6	3
Clear Upgrade Plan	0.1	0.1	**0.1**			10	6
Available Support Levels	0.1	0.3	**0.2**			7	8
Clear Roles and Job Descriptions	0.2	0.1	**0.15**			8	4
Training & knowledge Transfer program	0.1	0.1	**0.1**			4	6
Ability to use cloud-based ERP technology	0.1	0.1	**0.1**		**0.35**	4	5
Strong Participation in Requirements Development	0.3	0.3	**0.3**	**0.5**		7	8
Clear and Practical Incentive Program	0.1	0.1	**0.1**			4	5
Awarness of Purpose & Vision	0.1	0.2	**0.15**			4	7
Readiness for change	0.1	0.1	**0.1**			3	4
Expertise on cloud	0.5	0.3	**0.4**			9	9
Available expertise/ consultants	0.3	0.2	**0.25**	**0.2**		7	7
Industry Experience	0.1	0.3	**0.2**			8	9
Value Creation Practice	0.1	0.2	**0.15**			5	9

Figure 5.18: Assessment Scores for Company B

Table 5.8 shows a summary of the relative importance (weights) computed for the enablers, criteria, and attributes and all the assessment scores of each attribute collected from Company B experts.

Table 5.8: Weights and Assessment Scores for Company (B)

Company B						
I_i	I_{ij}	E1	E2	W_{ij}	W_i	W
I_1	I_{11}	10	8	0.35	0.225	0.25
		5	5	0.2		
		9	5	0.2		

		10	4	0.25		
	I_{12}	8	8	0.45	0.35	
		6	6	0.2		
		8	8	0.35		
	I_{13}	3	9	0.25	0.25	
		10	9	0.6		
		5	7	0.15		
I_2	I_{21}	9	8	0.2	0.175	0.175
		6	7	0.2		
		8	6	0.15		
		8	7	0.2		
		8	8	0.15		
		4	4	0.1		
	I_{22}	2	4	0.15	0.175	
		6	5	0.2		
		5	5	0.15		
		9	6	0.5		
	I_{23}	8	8	0.4	0.35	
		7	6	0.25		
		10	4	0.35		
I_3	I_{31}	8	7	0.35	0.125	0.125
		6	8	0.15		

		2	3	0.1		
		6	3	0.1		
		10	6	0.1		
		7	8	0.2		
	I_{32}	8	4	0.15	0.1	
		4	6	0.1		
		4	5	0.1		
		7	8	0.3		
		4	5	0.1		
		4	7	0.15		
		3	4	0.1		
	I_{33}	9	9	0.4	0.225	
		7	7	0.25		
		8	9	0.2		
		5	9	0.15		
I_4	I_{41}	5	7	0.15	0.3	0.3
		2	8	0.3		
		2	8	0.55		
	I_{42}	9	8	0.3	0.3	
		9	8	0.3		
		4	7	0.4		
I_5	I_{51}	7	8	0.3	0.3	0.4

		10	8	0.5		
		7	6	0.2		
	I_{52}	10	2	0.35	0.5	
		10	9	0.65		

5.6.2.2.2 Step (2) Calculating the index of criterion

The index of each criterion assessed by the following equation:

$$\mathbf{I_{ij} = W_{ij} \times R_{ij}}$$

To explain the calculation of the criterion index; "Leadership approach" criterion will be the example as follows:

Weights pertaining to Leadership approach criterion W_{11}= (0.35, 0.2, 0.2, 0.25), where 11 refers to the number of attributes and number of experts, subsequently which is the weight of attribute number one of first expert.

The scores of Leadership approach is given by:

$$R11 = \begin{bmatrix} 10 & 8 \\ 5 & 5 \\ 9 & 5 \\ 10 & 4 \end{bmatrix}$$

The Index of Leadership approach criterion is given by

$$I_{11}=W_{11}\times R_{11}$$

$$I_{11}= (0.88, 0.58)$$

Using the same procedures, the indices of all criteria have been computed, as appeared in Table 5.9

Table 5.9: Expert's assessment score and weights for Company B

Iij	Expert 1	Expert 2	Wi

I_{11}	0.88	0.58	0.225
I_{12}	0.76	0.76	0.35
I_{13}	0.75	0.87	0.25
I_{21}	0.74	0.69	0.175
I_{22}	0.675	0.535	0.175
I_{23}	0.845	0.61	0.35
I_{31}	0.69	0.645	0.125
I_{32}	0.54	0.605	0.1
I_{33}	0.77	0.85	0.225
I_{41}	0.245	0.785	0.3
I_{42}	0.7	0.76	0.3
I_{51}	0.85	0.76	0.3
I_{52}	1	0.655	0.5

5.6.2.2.3 Step (3) Calculating the indices of enabler

The enabler index pertaining to each is calculated using the following equation:

$$\boldsymbol{I_i}=\boldsymbol{W_i} \times \boldsymbol{R_i}$$

The calculation -for example- of the leadership enabler for Company B is given by:

$$\boldsymbol{I}_1=\boldsymbol{W}_1 \times \boldsymbol{R}_1$$

Weight (RI) of leadership enabler is given by:

$$\boldsymbol{W}_1 = (0.35, 0.4, 0.25)$$

The scores of leadership enabler is given by:

$$R11 = \begin{bmatrix} 10 & 8 \\ 5 & 5 \\ 9 & 5 \\ 10 & 4 \end{bmatrix}$$

Index pertaining to the Leadership criterion is given by:

$$I_1 = (7.9, 7.2)$$

On the same principle, the following indices have been processed for all enablers of Company B, as seen in Table 5.10

Table 5.10: Calculated Indices of all Enablers for Company B

Ii	Expert 1	Expert 2
I1	7.995	7.245
I2	7.54	6.0775
I3	6.31	6.66
I4	3.815	7.775
I5	9.175	7.1275

5.6.2.2.4 Step (4) Computing Maturity Index for Company B

The Maturity index computed using the following equation:

$$I = W x R$$

Overall weight **W**=(0.15, 0.15, 0.35, 0.25, 0.1)

Overall assessment vector $R = \begin{bmatrix} 7.9 & 7.2 \\ 7.5 & 6 \\ 6.3 & 6.6 \\ 3.8 & 7.7 \\ 9.17 & 7.1 \end{bmatrix}$

Company B Maturity index has been calculated as:

$$I = W \times R$$

$$I = (6.41, 6.98)$$

$$I = ½ (6.41 + 6.98)$$

$$I = 6.7$$

Company B's Maturity index is roughly 6.7

Figure 5.19. shows the indices and (RI) weights that belonging to Company (B), where the most important enabler is people, with a relative importance of 35% and an index of 6.48. While governance is the least important enabler with a relative importance of 10%, though it has the highest index of 8.1. An analysis of Company B's performance will be presented later in this chapter.

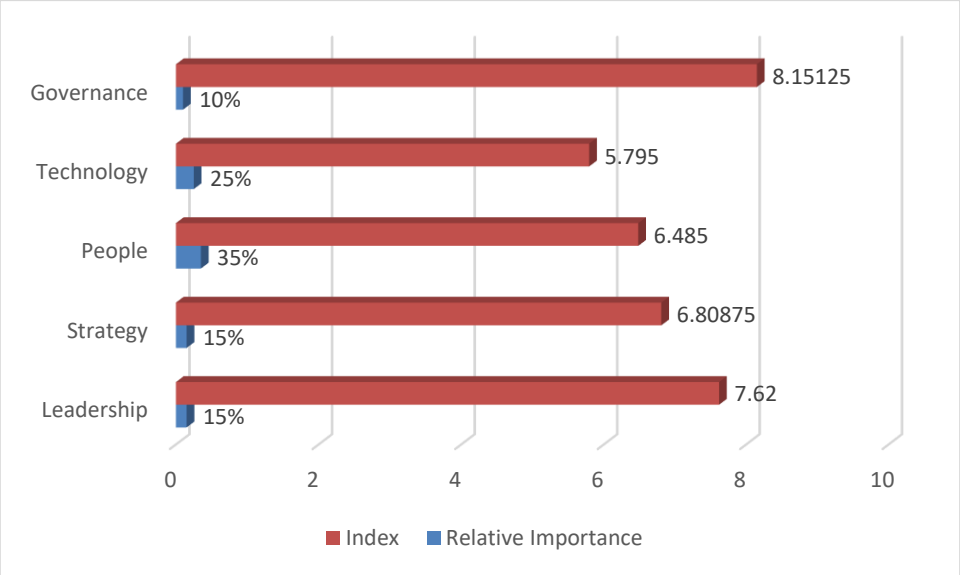


Figure 5.19: Relative Importance (weight) and Indices for Company B Enablers

According to the results produced from the assessment tool, the Maturity Index for the cloud-based ERP implementation process in Company A is 6.6. according to fuzzy set the company is "Partial Mature".

5.7 Discussion on the Case Studies Results

According to the results of the two companies (A and B), the Maturity Indices are shown in Table 5.11.

Table 5.11: Maturity Index for the Two Companies

Company	Maturity Index
Company A	8.7
Company B	6.6

The indices for both Companies A and B showed the maturity level where Company A is more mature than Company B. Figure 5.20 shows the level of each company on the maturity score.

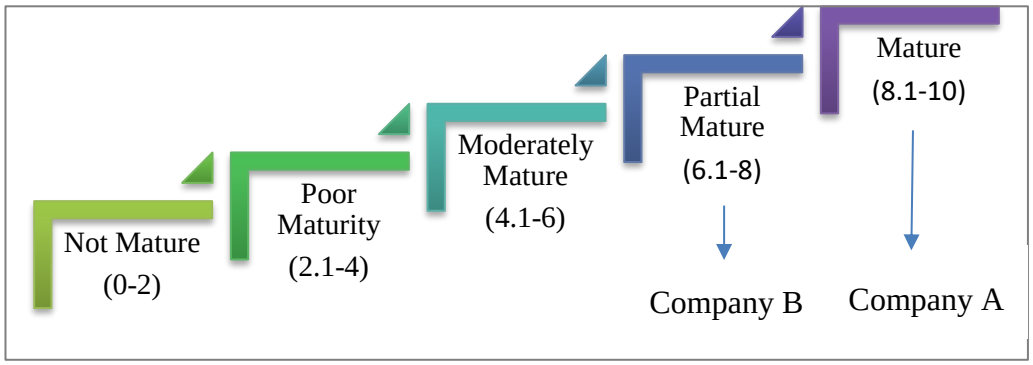


Figure 5.20: Maturity Score

5.7.1 Company A

The Maturity Index of Company A is 8.7, the index in Company A is just about to be completely mature, with the difference just 1.3. As presented in Table 5.12, Company A needs some improvements in terms of technology, specifically with systems integrity, reliability of internet and bandwidth, reliability of network between customer and CSP and quality of data. Where based on the assessment, technology consider an essential for

cloud ERP initiative. Where people enabler need focus on the consultancy, which is Value creation practice, available expertise/consultants, Expertise on cloud and Industry Experience respectively. Leadership also needs some focusing regarding leadership approach whence True understanding of cloud concept and its features and encourage excellent teamwork spirit. While governance where it is the less important enabler based on the assessment, and the improvement here should be on Awareness of customers' country regulations and Compatibility between SLA and Cloud ERP regulations. Strategy, which come after technology as an important enabler, need focus on project preparation criterion in general, specifically with assign project team and responsibilities, realistic release Schedules, identified deliverables and Milestones, Well-thought off Budgets and financial value, cloud strategy, and clear plan of the project respectively.

Table 5.12: Comparison Between the Two Companies

Enablers	Company A		Company B	
	Index	Weight	Index	Weight
1) Leadership	9.43	20%	7.6	15%
2) Strategy	9.98	20%	6.8	15%
3) People	9.39	20%	6.4	35%
4) Technology	6.15	30%	5.7	25%
5) Governance	9.88	10%	8.1	10%
Leadership				
Leadership approach	8.8	40%	7.3	35%
Management Practice	9.7	30%	7.6	40%
Management Culture	10	30%	8.1	25%
Strategy				
Project Preparation	9.9	20%	7.15	30%

Business Blueprinting	10	40%	6.05	35%
Change management	10	40%	7.2	35%
People				
Cloud Service Providers	10.1	30%	6.6	30%
Cloud ERP's users	9.6	30%	5.7	50%
Consultancy	8.7	40%	8.1	20%
Technology				
Existing systems	6.5	50%	5.1	70%
Technical issues	5.8	50%	7.3	30%
Governance				
Global compliance	9.8	60%	8	55%
Storage and access	10	40%	8	45%

5.7.2 Company B

In contrast to Company A, the Maturity Index of Company B is 6.6. On the maturity score, this is considered as being “Partial Mature”, which comes before the high level of maturity, “Mature”. At this level, and particularly with a value of 6.6, it is clear that the company needs improvements in various aspects. According to Table 11, Company B needs to concentrate on the Technology enabler (Index = 5.7) with regard to existing systems, particularly systems usability and systems compatibility, as well as data quality in the technical issues criterion. While people that is the second lower enabler (Index=6.4) and highest weight (35%), could do well through users that get index (5.7) as it has the highest weight (50%) so the improvement could be in readiness for change, clear and practical incentive program, Ability to use cloud-based ERP technology, then training and knowledge transfer program. Also cloud service providers has index (6.6) so it can be improved through range of customisation, and level of partnership. in the same context

of improvements, strategy enabler has index (6.8) should focus on business blueprinting (index=6) and highest weight (35%), specifically on existence of documentation of business processes. Regarding leadership enabler (index= 7.6) should concentrate on leadership approach (index 7.3) through improving management practice that has the highest weight (40%) and index (7.6). Finally, a simple improvement with governance enabler that has the highest index (8.1) and the lowest weight (10%) through data storage and access specially data storage location is known.

5.8 Chapter Summary

The Chapter presents the development of the maturity assessment model. The purpose of the model to assess the degree of maturity in organization intending to implement cloud-based ERP, as well as finding areas for further improvement.

In this chapter, after the Introduction (Section 5.1), Section 5.2 gives a background about maturity assessment; the purpose and the concept of the Maturity Assessment Model is also explained. Additionally, the technique of fuzzy logic was introduced. Furthermore, in this section, the proposed model of this research is presented with its three phases. In Section 5.3, the methodology used to develop the model and the methodology of validating the model with case studies to reveal the organization's maturity level was detailed. In Section 5.4, an overview on the model's design and development, with its major elements, is presented. The five enablers are explained with its criteria and attributes. Section 5.5 details the process of the designed tool that was devised to be practical and user-friendly, with clear illustrative information; included is a discussion on the formation of the Excel tool that was specially designed for this model.

In Section 5.6, there is an explanation of the technique of multi-grade fuzzy logic with the Maturity Assessment Model. In Section 5.7, the application and validation of the model and its tool used in the case studies conducted are described. The section presented a brief explanation about the case studies and the assessment process on each one individually. Section 5.8 comprises a discussion of the results of the case studies after establishing the Maturity Index of the companies. There is also a detailed explanation of potential areas of improvements for each company. The chapter concludes with the Summary, Section 5.9.

6. CHAPTER SIX: DEVELOPMENT of BENEFITS ASSESSMENT MODEL

6.1 Introduction

An important part of the framework for this research is the benefits realization model that starts earlier before the implementation cloud ERP and continue to post implementation. This chapter discusses the benefits realization model. Firstly, the chapter explains detail of the model and explains its component (the Benefits). Then, clarify the mean for model validation using a designed tool with two case studies. The assessment helps companies evaluate their realization level for cloud-based ERP benefits and identify the potential benefits in future for more investment objectives.

This chapter has been structured as follows: Section 6.1 is the introduction to the chapter. Section 6.2 presents proposed benefits assessment model. Section 6.3 highlights the methodology that has been used to create the model and its components. Section 6.4 presents an overview on the model design and development with its major elements explained in detail. In section 6.5, an overview on the model design with its major elements is presented; this is alongside the five benefits that should be realized from cloud-based ERP project, explained with its indicators and attributes. Section 6.6 describes the application of the model and the validation through case studies. Section 6.7 constitutes a discussion of the results of the case studies' maturity index. Section 6.8 the Spearman test adopted to find a relationship between BR and maturity model. The chapter concludes with a summary in Section 6.9, as shown in Figure 6.1.

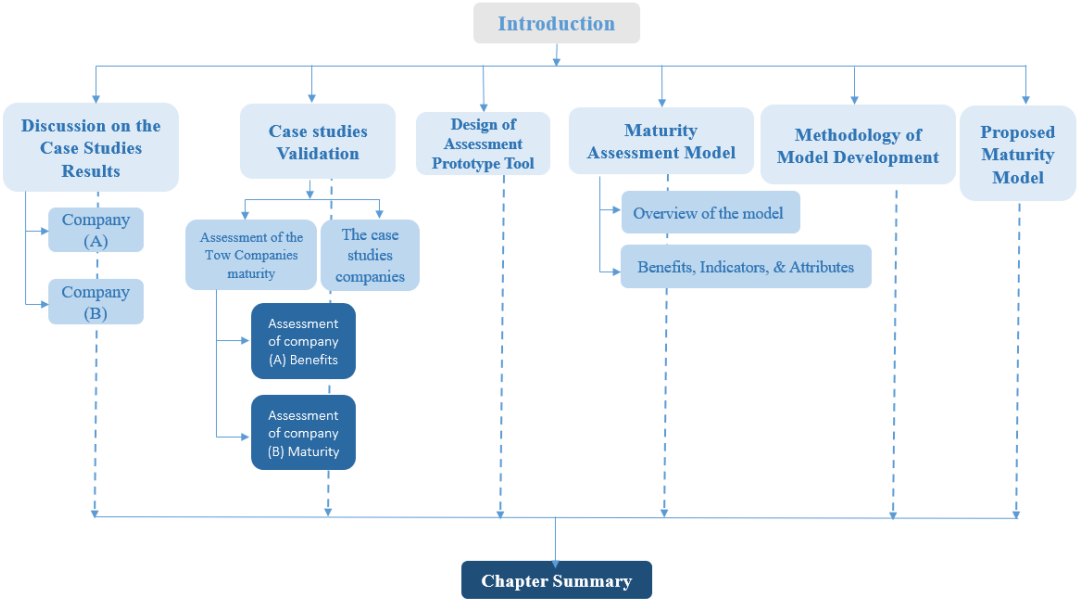


Figure 6.1: Outline of Chapter 6

6.2 The proposed Benefits Assessment Model

As IT investment is associated with business objectives, the process should be ongoing, thus the proposed model is a loop. The model contains four steps:

Step1: Identify cloud-based ERP benefits

In this step, identify the accurate benefits that possible to realize via advantage, key-drivers, and benefits of cloud-based ERP through workshops with stakeholders, or customer insight or benefits mapping. Inaccurate identification could affect the realization process.

Step 2: Plan cloud-based ERP benefits

The planning step includes validating benefits that can be realistic and appropriate. Validate with the recipient or owner of the benefits that what happened during the validation sessions with experts. This step is supposed to determine the roles and authentications,

Step 3: Assess benefits realisation

After refining the benefits, an assessment tool is tailored to help the organisation assess the realisation of its benefits. The assessment tool contains the expected benefits, the indicators of these benefits, and the attributes of each indicator. The

researcher chooses fuzzy logic technique to calculate the benefit index at the end. This step can return to step two if the benefits need refinement.

Step 4: Establish the potential for further benefits

After assessing the benefits of realisation and acting to accomplish the realisation result, this step allows the addition of potential benefits to the benefits realisation journey, which can lead to more business objectives.

The use of this model starts the pre-implementation & post-implementation phase after a couple of months, or more beneficially, after one year. Where step 1 & 2 should start before implementation but step 3 & 4 after implementation. Most of the benefits need time to be achieved, such as organizational and strategic benefits.

6.3 Methodology of the Model Development

After adopting a success definition which is the benefits realization of cloud-based ERP as IT has no values with no change of the way, we use it. The literature was studied deeply from different aspects: ERP over cloud through (challenges, CSFs, key drivers), cloud-based ERP and benefits realisation management, cloud-based ERP, and maturity as it is a crucial requirement of realising benefits.

The methodology of this chapter is split into two parts. The first part is Model development: the focus here is on critical drivers of cloud-based ERP, which represents the business benefits at the end. To clarify, key drivers are the reasons beyond adopting the technology; they are differentiated from one organisation to another; concentrating on one more than another depends on the industries and their size.

Interviews were conducted with industry experts to support the data from the literature and pilot survey. The results that involved the components and elements of the assessment tool were presented to experts in academia and industry. Then the best-fit companies were chosen for conducting the case studies. Data was collected and the index of benefits realisation was computed. The results were then analysed to identify areas for improvement.

The second part of the research methodology is illustrated in Figure 6.2. Model validation commenced with identifying suitable companies in which to utilize the model. The

validation was executed in one company in the UK and one in Saudi Arabia. Both these companies had implemented cloud-based ERP successfully over one year previously, which is known as “stabilizing period”; this is the time period that Badewi et al. (2018) illustrated is appropriate to realize benefits. for confidentiality, the companies’ names will be hidden, just referred to as Company A and Company B, as mentioned in Chapter 5. The collection of data was started from the case study companies to calculate the Benefits Realization (BR) index for each company.

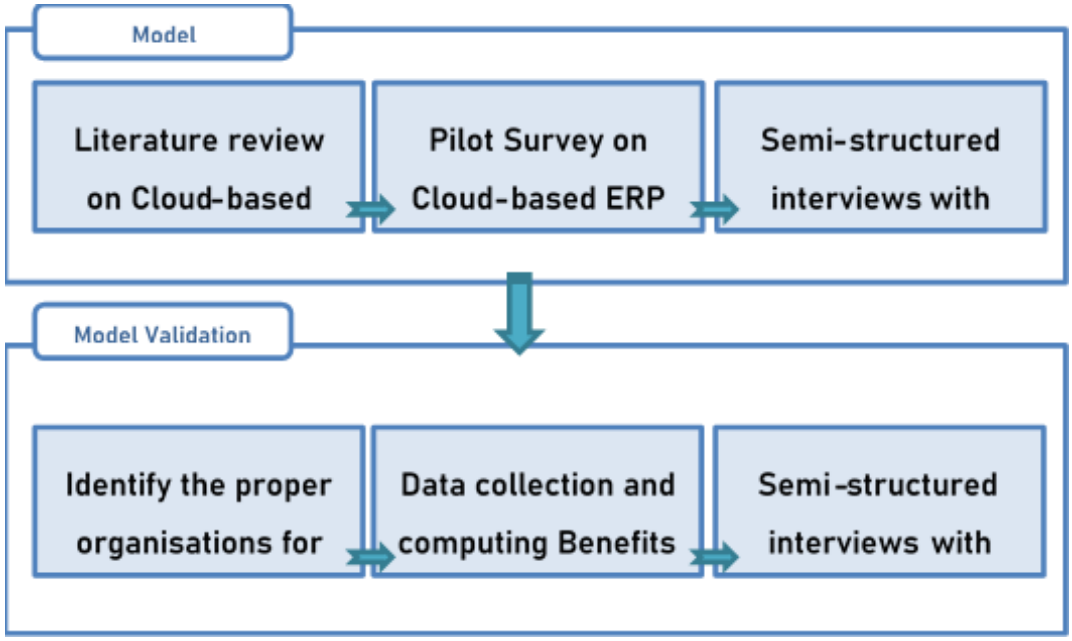


Figure 6.2: Methodology of Benefits Realization model development

6.4 BR Assessment model

6.4.1 Overview of the model

The Benefits Realization assessment model has three levels, as given Figure 6.3 The first level consists of five benefits, the second level contains 10 indicators, and finally the third level involves 39 attributes. The rationale behind the formulation of the model is that it presents the five benefits required for implementing cloud-based ERP in organizations. These benefits are Operational, Managerial, Strategic, Technology, and Organizational; these were extracted from a study by Shang & Seddon (2000). The benefits, indicators and attributes used in computing the benefits realization level of organization are presented in Table 6.1 in the next section. This section provides a brief discussion of these five benefits.

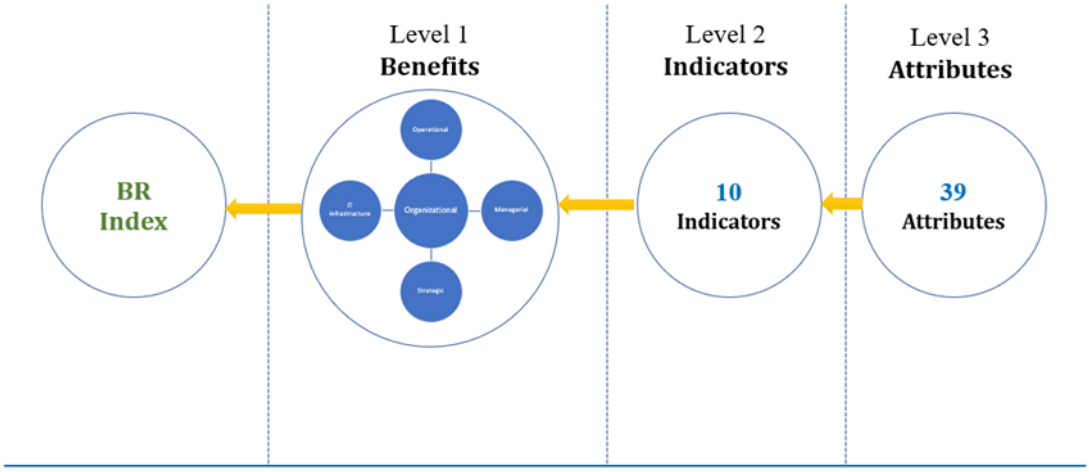


Figure 6.3: Benefits Summary of Assessment Model

6.4.2 Benefits, Indicators, and Attributes

The benefits from any projects are identifying by couples of indicators that indicate to each benefit individually. These indicators also have attributes, they collected through the literature, pilot survey and interviews. The key drivers of cloud-based ERP were the target of the questions to form the components of the assessment tool.

6.4.2.1 Operational

Information technology is a good way in decrease costs and increase ROI (Shang & Seddon, 2000). It is proved by evidence that investment in IS/IT to simplify and automate the business processes, provides business with hard & soft saving benefits. The hard saving is related to cash, provided by reduce spending on compute storage, networking, and security, avoidance of hardware and software purchases (capital expenses), reduction in operational costs, back up and DR/DC, short-term running cost of business less than long-term operating cost (comparing with traditional ERP), and reduction in IT labour cost. While soft saving is related to the features that do not fit to any of the categories, such as re-use of services and applications, faster implementations and time to value, increased systems' user productivity, and improved customer satisfaction.

6.4.2.2 Managerial

Cloud-based ERPs are information systems providing information managers with relevant business information to help in resources management in terms of availability of resources. the hardware resources and more storage devices are accessible, increase the variety of resources, and help to secure the environment. Furthermore, they help

information managers to improve performance and decision-making regarding via improved planning and facilitating innovation.

6.4.2.3 Strategic

To achieve a competitive advantage for business there are three strategies, as Millar and Porter (1985) asserted: these strategies are cost leadership, differentiation and focus. Thus, according to the data collected in Chapter 4, the strategic benefits have two indicators. The first is business efficiency, to support business growth and alliance, and to enable business processes to change quickly around new and emerging opportunities and thereby generate product differentiation. The second indicator is external benefits for business, which build cost leadership, improve collaboration, and facilitate shared services.

6.4.2.4 Technology

The technology benefit is focusing more on the characteristic of cloud technology that differentiates cloud-based ERP from traditional ERP. The first indicator to technology benefits is top-end IT capability. This is related to the use of sophisticated hardware and software, access to highly qualified IT personnel, and instant updates to keep up with advanced technologies. The other indicator is cloud value added in terms of using security standards for encryption and decryption, access to ERP system from different platforms (Availability), easy accessed on-campus or off-campus, measured services (Pay as you use model) and rapid elasticity.

6.4.2.5 Organizational

These core benefits ultimately lead to investment objectives and need time to be realized. Organizational benefit has two indicators: the first indicator is support organizational changes that has couples of attributes: changing work patterns, fit between the organization and IT/IS, increased global reach, and facilitate organizational learning. The second indicator associated to support organizational integration in terms of employee empowerment, perceived integration benefits (system quality, information quality, process quality), and built common visions.

Table 6.1: Benefits Realization Assessment model Components

Benefits	Indicators	Attributes
Level 1	**Level 2**	**Level 3**
Operational	Hard Saving	Reduce spending on computer storage, networking, and security
		Avoidance of hardware and software purchases (capital expenses)
		Reduction in operational costs, back up and DR/DC
		Short-term running cost of business < long-term operating cost (compared with traditional ERP)
		Reduction in IT labour cost
	Soft Saving	Reuse of services and applications
		Faster implementations and time to value
		Increased the system's user productivity
		Improved customer satisfaction
Managerial	Resources Management	Availability of the resources
		Easier access to hardware resources and more storage devices
		Varieties of resources
		Over secure environment
		Improved decision making
		Improved planning

	Improve performance and decision making	Facilitate innovation
		Performance improvement
Strategic	Business efficiency	Support business growth
		Support business alliance
		Ability to change business processes quickly around new and emerging opportunities
		Generate product differentiation
	External benefits for business	Build cost leadership
		Improved collaboration
		Facilitate shared services
Technology	Top-end IT capabilities	Use of sophisticated hardware and software
		Access to highly qualified IT personnel
		Instant update to keep up with the advanced technologies
	Cloud value added	Using security standards for encryption and decryption
		Access to ERP system from different platforms (Availability)
		Easy accessed on-campus or off-campus
		Measured services (pay-as-you-use model)
		Rapid elasticity

Organizational	support organizational changes	Changing work patterns
		Fit between the organization and IT/IS
		Increased global reach
		Facilitate organizational learning
	support organizational integration	Employee empowerment
		Perceived integration benefits (system quality, information quality, process quality)
		Built common visions

6.5 Design of Assessment Prototype Tool

In the same principle of chapter 5 section (5.5), the tool was designed to be practical and user-friendly, with clear illustrative information.

The first sheet of the BR assessment model provides a brief background with the aim of the BR assessment model, whilst ensuring confidentiality of information provided and details of the researcher, as shown in Figure 6.4.

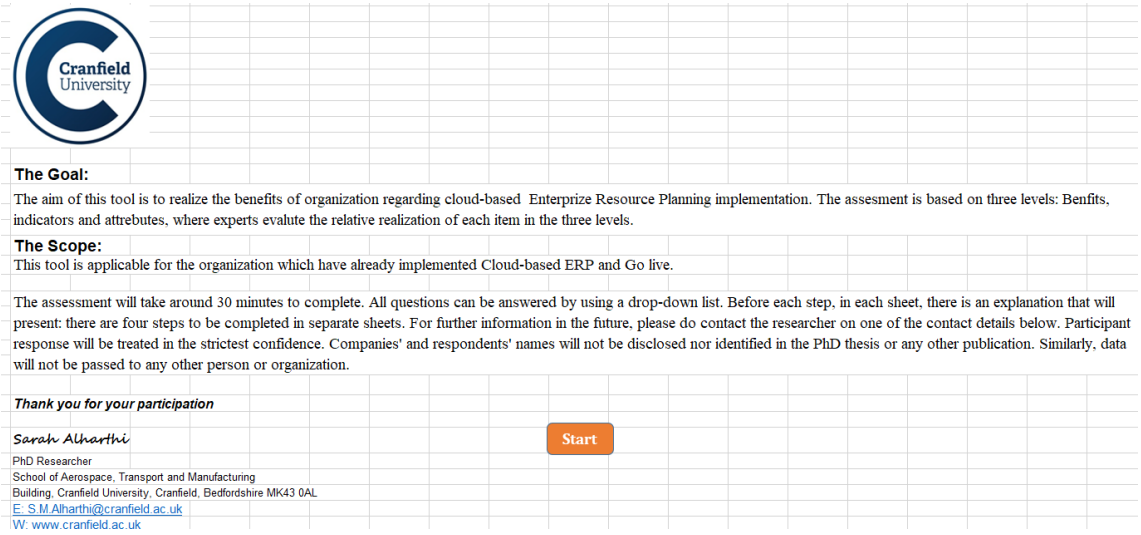


Figure 6.4: Screenshot of The Benefits Realization Assessment Tool

In the next sheet, the participants filled their details for the quality of data and credibility of the research, as shown in Figure 6.5.

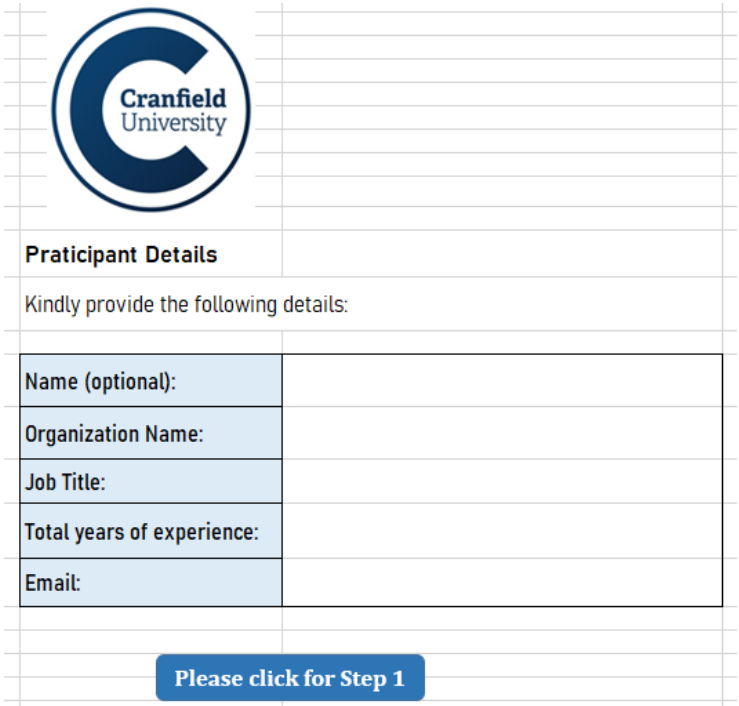


Figure 6.5: Participant details Sheet in The Benefits Realization Assessment Tool

The next sheet is Step 1, starts by evaluating each benefit based on personal judgement, experts need to provide a relative ranking, as showed in Figure 6.6. And so on with the indicators in Figure 6.7.

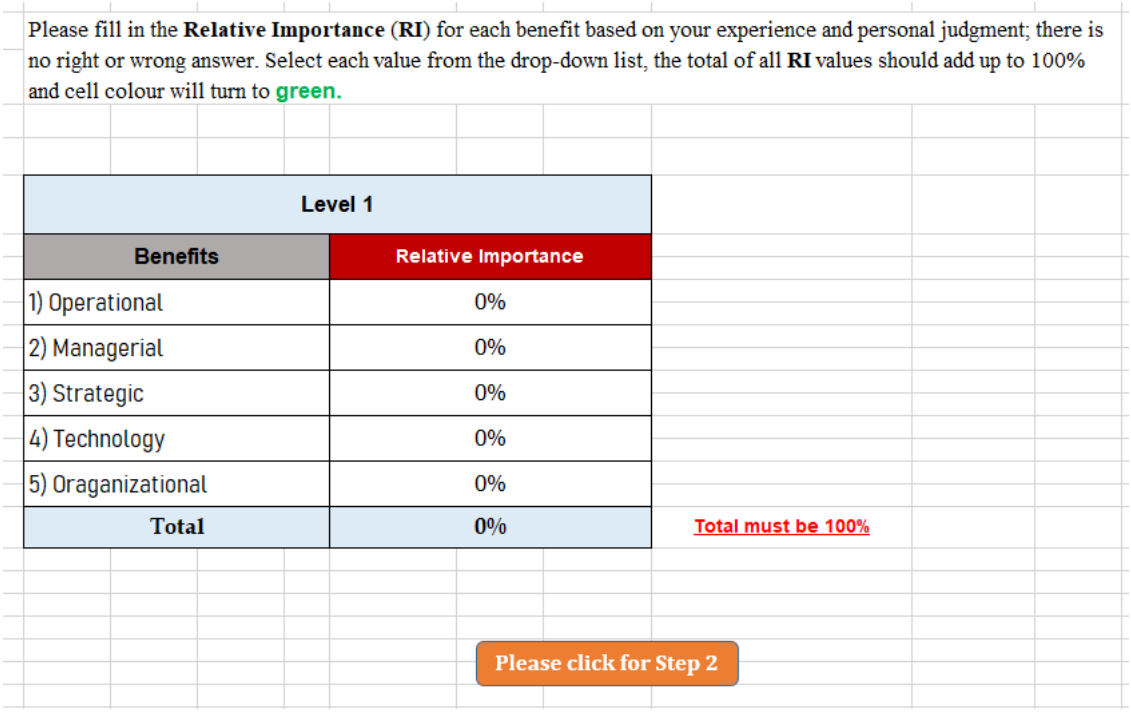


Figure 6.6: STEP 1 the Relative importance ranking for Benefits

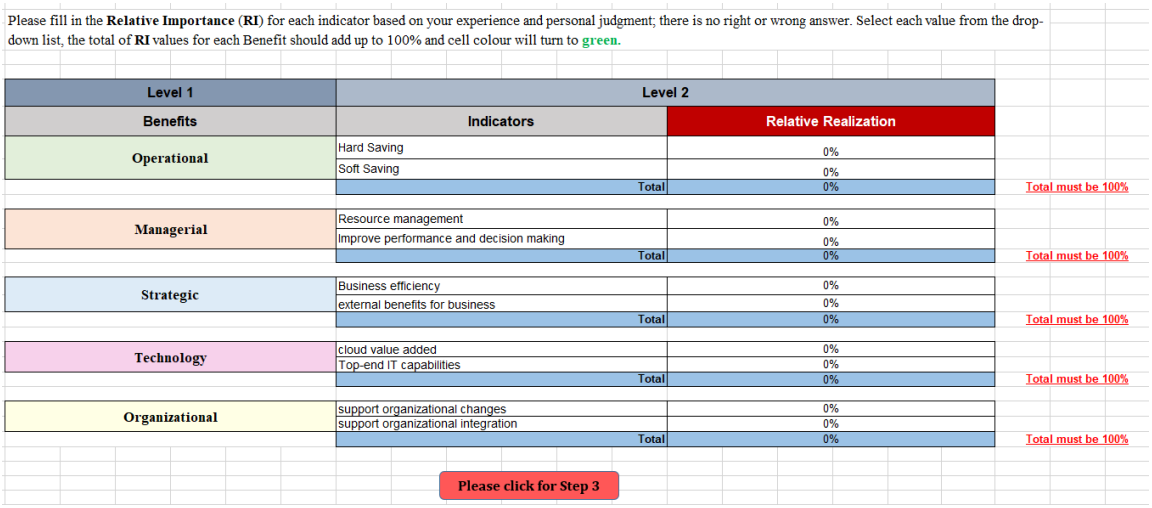
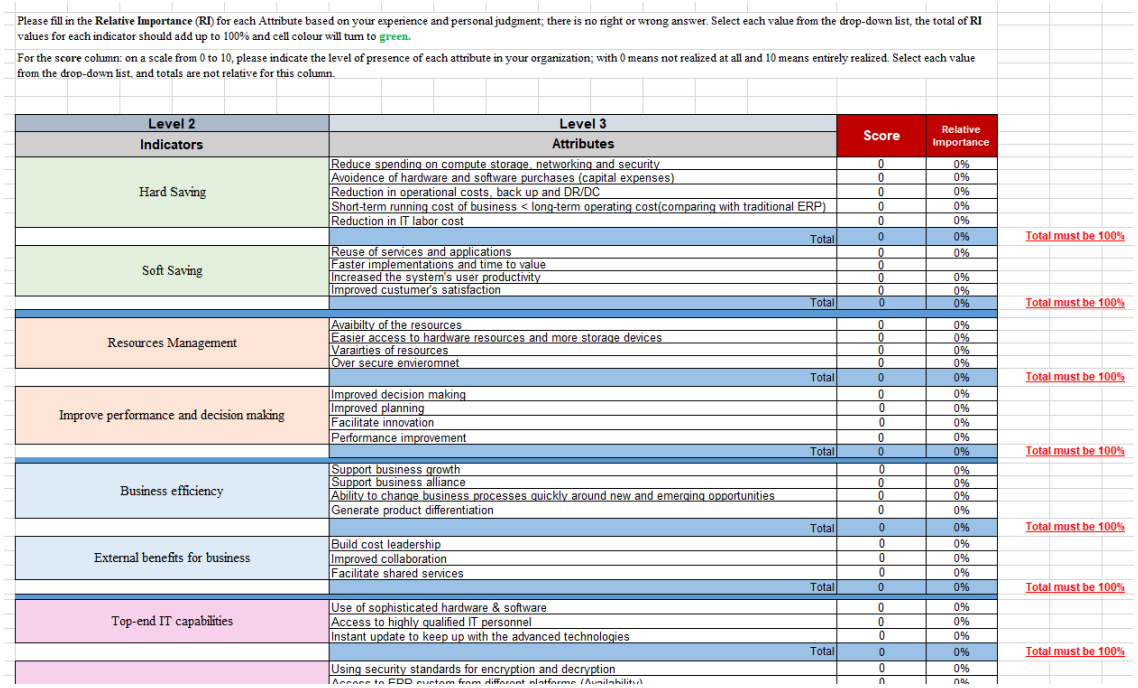


Figure 6.7: Relative importance ranking for Level 2 (Indicators)

The user then is required to continue to Level 3; at this stage, a relative ranking for each attribute (that corresponds to the previously assessed indicators) is required; this has been described in Figure 6.8.



Please fill in the **Relative Importance (RI)** for each Attribute based on your experience and personal judgment; there is no right or wrong answer. Select each value from the drop-down list, the total of **RI** values for each indicator should add up to 100% and cell colour will turn to **green**.

For the **score** column: on a scale from 0 to 10, please indicate the level of presence of each attribute in your organization; with 0 means not realized at all and 10 means entirely realized. Select each value from the drop-down list, and totals are not relative for this column.

Level 2 Indicators	Level 3 Attributes	Score	Relative Importance	
Hard Saving	Reduce spending on compute storage, networking and security	0	0%	
	Avoidence of hardware and software purchases (capital expenses)	0	0%	
	Reduction in operational costs, back up and DR/DC	0	0%	
	Short-term running cost of business < long-term operating cost(comparing with traditional ERP)	0	0%	
	Reduction in IT labor cost	0	0%	
	Total	0	0%	Total must be 100%
Soft Saving	Reuse of services and applications	0	0%	
	Faster implementations and time to value	0		
	Increased the system's user productivity	0	0%	
	Improved custumer's satisfaction	0	0%	
	Total	0	0%	Total must be 100%
Resources Management	Avaibilty of the resources	0	0%	
	Easier access to hardware resources and more storage devices	0	0%	
	Varairties of resources	0	0%	
	Over secure enviromnet	0	0%	
	Total	0	0%	Total must be 100%
Improve performance and decision making	Improved decision making	0	0%	
	Improved planning	0	0%	
	Facilitate innovation	0	0%	
	Performance improvement	0	0%	
	Total	0	0%	Total must be 100%
Business efficiency	Support business growth	0	0%	
	Support business alliance	0	0%	
	Ability to change business processes quickly around new and emerging opportunities	0	0%	
	Generate product differentiation	0	0%	
	Total	0	0%	Total must be 100%
External benefits for business	Build cost leadership	0	0%	
	Improved collaboration	0	0%	
	Facilitate shared services	0	0%	
	Total	0	0%	Total must be 100%
Top-end IT capabilities	Use of sophisticated hardware & software	0	0%	
	Access to highly qualified IT personnel	0	0%	
	Instant update to keep up with the advanced technologies	0	0%	
	Total	0	0%	Total must be 100%
	Using security standards for encryption and decryption	0	0%	
	Access to ERP system from different platforms (Availability)	0	0%	

Figure 6.8: The Score and Relative importance ranking for Level 3 for BR Assessment (Attributes)

The BR index (I) is calculated by multiplying the overall assessment factor (R) and the overall weight (W). The BR index of an organisation (A) is denoted by I. The formula for the BR index is given by the following equation:

$$\text{BR index } (\boldsymbol{I}) = \boldsymbol{W} \times \boldsymbol{R}$$

Where:

W: Overall weight

R: Overall assessment factor

To interpret the expert judgment as they consider vagueness of subjective humans judgment, five sets of fuzzy numbers are used to represent the scores of BR assessment as follows in Table 6.2:

Table 6.2: The BR Assessment Score

(8.1-1)	Stands for 'Realised'
(6.1-8)	Stands for 'Partially realised'
(4.1-6)	Stands for 'moderately realised'

(2.1- 4)	Stands for 'Poor realisation'
(0-2)	Stands for 'Not Realised'

6.6 The Case studies Validation

6.6.1 Assessment of Company A's Benefits Realization

In chapter 5, the company previously introduced, and this section will be on the same context of the process of the assessment of maturity assessment.

6.6.1.1 Step (1) Calculating the relative importance (weight)

The process starts with calculating the relative importance (weight (W)) for each benefit, indicator, and attribute; the median of experts' value for each element is then computed. The actual assessment figures presented by each expert and the relative importance weights for all benefits, indicators, and attributes are presented in Table 6.3 . By estimating the median for each benefit, the relative importance of each benefit was computed. For example, the relative importance given by the experts for the operational benefits was 0.2, 0.3 and 0.2. The RI (weight) for operational benefits was 0.2. The RI (weight) for all benefits is presented in Figure 6.9.

Level 1				
Benefits	Expert 1	Expert 2	Expert 3	W
1) Operational	0.2	0.3	0.2	0.2
2) Managerial	0	0.1	0.1	0.1
3) Strategic	0.2	0.1	0.1	0.1
4) Technology	0.3	0.3	0.3	0.3
5) Oraganizational	0.3	0.2	0.3	0.3

Figure 6.9: Weights of Company A Benefits

In level 2, the RI for each indicator was calculated. For example, the weights given for the hard saving indicator were 0.6, 0.6 and 0.7 which is W_i, as shown in Figure 6.10.

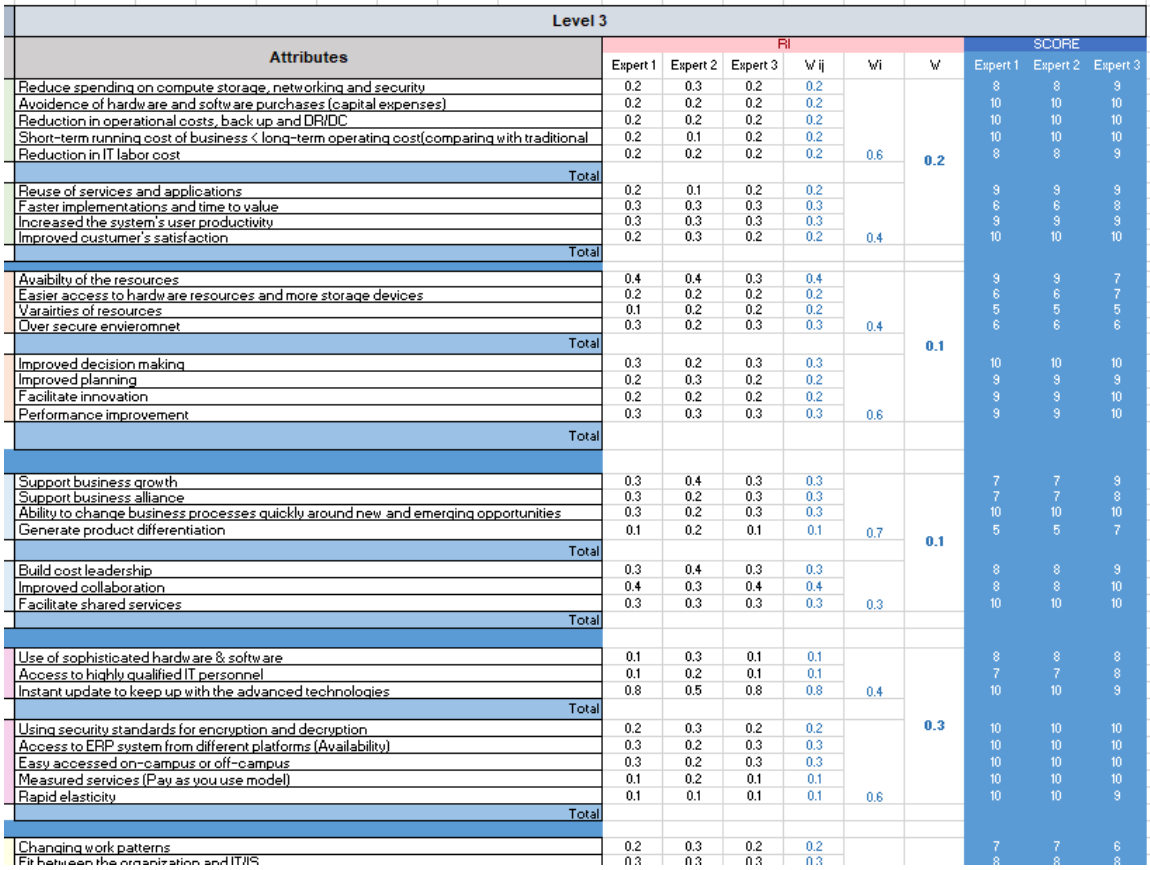
Level 1	Level 2				
Benefits	**Indicators**	Expert 1	Expert 2	Expert 3	Wi
Operational	Hard Saving	0.6	0.6	0.7	0.6
	Soft Saving	0.4	0.4	0.3	0.4
	Total				
Managerial	Resource management	0.3	0.4	0.4	0.4
	Improve performance and decision making	0.7	0.6	0.6	0.6
	Total				
Strategic	Business efficiency	0.7	0.6	0.7	0.7
	external benefits for business	0.3	0.4	0.3	0.3
	Total				
Technology	cloud value added	0.6	0.7	0.5	0.6
	Top-end IT capabilities	0.4	0.3	0.5	0.4
	Total				
Organizational	support organizational changes	0.5	0.3	0.5	0.5
	support organizational integration	0.5	0.7	0.5	0.5

Figure 6.10: Weights of Company A Indicators (Wi is the indicator weight)

Continuing the same process with attributes, the RI (weight) for each attribute shown in Figure 6.11. Finally, all the assessment scores presented in Figure 6.12.

Level 1	Level 2	Level 3				
Benefits	**Indicators**	**Attributes**	RI			
			Expert 1	Expert 2	Expert 3	W ij
Operational	Hard Saving	Reduce spending on compute storage, networking and security	0.2	0.3	0.2	0.2
		Avoidence of hardware and softw are purchases (capital expenses)	0.2	0.2	0.2	0.2
		Reduction in operational costs, back up and DR/DC	0.2	0.2	0.2	0.2
		Short-term running cost of business < long-term operating cost(comparing with traditional	0.2	0.1	0.2	0.2
		Reduction in IT labor cost	0.2	0.2	0.2	0.2
		Total				
	Soft Saving	Reuse of services and applications	0.2	0.1	0.2	0.2
		Faster implementations and time to value	0.3	0.3	0.3	0.3
		Increased the system's user productivity	0.3	0.3	0.3	0.3
		Improved custumer's satisfaction	0.2	0.3	0.2	0.2
		Total				
Managerial	Resources Management	Avaibilty of the resources	0.4	0.4	0.3	0.4
		Easier access to hardw are resources and more storage devices	0.2	0.2	0.2	0.2
		Varairties of resources	0.1	0.2	0.2	0.2
		Over secure envieromnet	0.3	0.2	0.3	0.3
		Total				
	Improve performance and decision making	Improved decision making	0.3	0.2	0.3	0.3
		Improved planning	0.2	0.3	0.2	0.2
		Facilitate innovation	0.2	0.2	0.2	0.2
		Performance improvement	0.3	0.3	0.3	0.3
		Total				
Strategic	Business efficiency	Support business growth	0.3	0.4	0.3	0.3
		Support business alliance	0.3	0.2	0.3	0.3
		Ability to change business processes quickly around new and emerging opportunities	0.3	0.2	0.3	0.3
		Generate product differentiation	0.1	0.2	0.1	0.1
		Total				
	External benefits for business	Build cost leadership	0.3	0.4	0.3	0.3
		Improved collaboration	0.4	0.3	0.4	0.4
		Facilitate shared services	0.3	0.3	0.3	0.3

Figure 6.11: Weights of Company A Attributes (Wij is the attributes weight)



Level 3									
Attributes	RI						SCORE		
	Expert 1	Expert 2	Expert 3	W ij	Wi	W	Expert 1	Expert 2	Expert 3
Reduce spending on compute storage, networking and security	0.2	0.3	0.2	0.2			8	8	9
Avoidence of hardw are and softw are purchases (capital expenses)	0.2	0.2	0.2	0.2			10	10	10
Reduction in operational costs, back up and DR/DC	0.2	0.2	0.2	0.2			10	10	10
Short-term running cost of business < long-term operating cost(comparing with traditional	0.2	0.1	0.2	0.2			10	10	10
Reduction in IT labor cost	0.2	0.2	0.2	0.2	0.6	0.2	8	8	9
Total									
Reuse of services and applications	0.2	0.1	0.2	0.2			9	9	9
Faster implementations and time to value	0.3	0.3	0.3	0.3			6	6	8
Increased the system's user productivity	0.3	0.3	0.3	0.3			9	9	9
Improved custumer's satisfaction	0.2	0.3	0.2	0.2	0.4		10	10	10
Total									
Availbilty of the resources	0.4	0.4	0.3	0.4			9	9	7
Easier access to hardw are resources and more storage devices	0.2	0.2	0.2	0.2			6	6	7
Varairties of resources	0.1	0.2	0.2	0.2			5	5	5
Over secure envieromnet	0.3	0.2	0.3	0.3	0.4		6	6	6
Total						0.1			
Improved decision making	0.3	0.2	0.3	0.3			10	10	10
Improved planning	0.2	0.3	0.2	0.2			9	9	9
Facilitate innovation	0.2	0.2	0.2	0.2			9	9	10
Performance improvement	0.3	0.3	0.3	0.3	0.6		9	9	10
Total									
Support business growth	0.3	0.4	0.3	0.3			7	7	9
Support business alliance	0.3	0.2	0.3	0.3			7	7	8
Ability to change business processes quickly around new and emerging opportunities	0.3	0.2	0.3	0.3			10	10	10
Generate product differentiation	0.1	0.2	0.1	0.1	0.7		5	5	7
Total						0.1			
Build cost leadership	0.3	0.4	0.3	0.3			8	8	9
Improved collaboration	0.4	0.3	0.4	0.4			8	8	10
Facilitate shared services	0.3	0.3	0.3	0.3	0.3		10	10	10
Total									
Use of sophisticated hardw are & softw are	0.1	0.3	0.1	0.1			8	8	8
Access to highly qualified IT personnel	0.1	0.2	0.1	0.1			7	7	8
Instant update to keep up with the advanced technologies	0.8	0.5	0.8	0.8	0.4		10	10	9
Total									
Using security standards for encryption and decryption	0.2	0.3	0.2	0.2		0.3	10	10	10
Access to ERP system from different platforms (Availability)	0.3	0.2	0.3	0.3			10	10	10
Easy accessed on-campus or off-campus	0.3	0.2	0.3	0.3			10	10	10
Measured services (Pay as you use model)	0.1	0.2	0.1	0.1			10	10	10
Rapid elasticity	0.1	0.1	0.1	0.1	0.6		10	10	9
Total									
Changing work patterns	0.2	0.3	0.2	0.2			7	7	6
Fit between the organization and IT/IS	0.3	0.3	0.3	0.3			8	8	8

Figure 6.12: B.R. Assessment Scores for Company A

In Table 6.3 the summary of the relative importance (weights) and scores of each benefit, indicator, and attribute collected from Company A's experts.

Table 6.3: Summary of the RI for the Benefits, Indicators, and Attributes for Company A

Company A							
I_i	I_{ij}	E1	E2	E3	W_{ij}	W_i	W
I_1	I_{11}	0.2	0.3	0.2	0.2	0.6	0.2
		0.2	0.2	0.2	0.2		
		0.2	0.2	0.2	0.2		
		0.2	0.1	0.2	0.2		
		0.2	0.2	0.2	0.2		

	I_{12}	0.2	0.1	0.2	0.2	0.4	
		0.3	0.3	0.3	0.3		
		0.3	0.3	0.3	0.3		
		0.2	0.3	0.2	0.2		
I_2	I_{21}	0.4	0.4	0.3	0.4	0.4	0.1
		0.2	0.2	0.2	0.2		
		0.1	0.2	0.2	0.2		
		0.3	0.2	0.3	0.3		
	I_{22}	0.3	0.2	0.3	0.3	0.6	
		0.2	0.3	0.2	0.2		
		0.2	0.2	0.2	0.2		
		0.3	0.3	0.3	0.3		
I_3	I_{31}	0.3	0.4	0.3	0.3	0.7	0.1
		0.3	0.2	0.3	0.3		
		0.3	0.2	0.3	0.3		
		0.1	0.2	0.1	0.1		
	I_{32}	0.3	0.4	0.3	0.3	0.3	
		0.4	0.3	0.4	0.4		
		0.3	0.3	0.3	0.3		
I_4	I_{41}	0.1	0.3	0.1	0.1	0.4	0.3
		0.1	0.2	0.1	0.1		
		0.8	0.5	0.8	0.8		

	I_{42}	0.2	0.3	0.2	0.2	0.6	
		0.3	0.2	0.3	0.3		
		0.3	0.2	0.3	0.3		
		0.1	0.2	0.1	0.1		
		0.1	0.1	0.1	0.1		
I_5	I_{51}	0.2	0.3	0.2	0.2	0.5	0.3
		0.3	0.3	0.3	0.3		
		0.2	0.2	0.2	0.2		
		0.3	0.2	0.3	0.3		
	I_{52}	0.4	0.4	0.4	0.4	0.5	
		0.5	0.4	0.5	0.5		
		0.1	0.2	0.1	0.1		

6.6.1.2 Step (2) Calculating the index of Indicator

The index of each indicator computed using the following equation:

$$\mathbf{I_{ij} = W_{ij} \times R_{ij}}$$

To calculate the index of each indicator; an example for this step is given by the calculation of the index for the "Hard Saving" indicator, which is as follows:

The weights of hard saving indicator W_{11}= (0.2, 0.2, 0.2, 0.2, 0.2), where 11 refers to the number of attributes and number of experts, subsequently which is the weight of attribute number one of the first expert.

Assessment scores relating to the hard saving indicator is given by:

$$R11 = \begin{bmatrix} 8 & 8 & 9 \\ 10 & 10 & 10 \\ 10 & 10 & 10 \\ 10 & 10 & 10 \\ 8 & 8 & 9 \end{bmatrix}$$

Index pertaining to the hard saving indicator is given by

$$I_{11}=W_{11}\times R_{11}$$

$$I_{11}= (9.2, 9.2, 9.6)$$

Using the same techniques, the indices of the remaining benefits indicators have been computed, as presented in Table 6.4

Table 6.4: Expert's assessment score and weights for Company A

I_{ij}	Expert 1	Expert 2	Expert 3	Wi
I_{11}	9.2	9.2	9.6	0.6
I_{12}	8.3	8.3	8.9	0.4
I_{21}	7.6	7.6	7	0.4
I_{22}	9.3	9.3	9.8	0.6
I_{31}	7.7	7.7	8.8	0.7
I_{32}	8.6	8.6	9.7	0.3
I_{41}	9.5	9.5	8.8	0.4
I_{42}	10	10	9.9	0.6
I_{51}	8.1	8.1	8.4	0.5
I_{52}	9.8	9.8	10	0.5

6.6.1.3 Step (3) Calculating the indices of Benefits

The index pertaining to each benefit is calculated with the following equation:

$$\boldsymbol{I_i}=\boldsymbol{W_i} \times \boldsymbol{R_i}$$

Operational benefits will be used as an example for the next processes:

$$\boldsymbol{I}_1=\boldsymbol{W}_1 \times \boldsymbol{R}_1$$

Operational benefits weight is given by:

$$\boldsymbol{W}_1 = (0.6, 0.4)$$

Operational benefits scores are given by:

$$\mathrm{R1} = \begin{bmatrix} 9.2 & 9.2 & 9.6 \\ 8.3 & 8.3 & 8.9 \end{bmatrix}$$

Index pertaining to the Operational benefits is given by:

$$\mathrm{I}_1 = (8.84, 8.84, 9.32)$$

On the same principle, the following indices have been calculated for remaining benefits for Company A, as seen in Table 6.5.

Table 6.5: Calculated Indices of all Benefits for Company A

Ii	Expert 1	Expert 2	Expert 3
I_1	8.84	8.84	9.32
I_2	8.62	8.62	8.68
I_3	7.97	7.97	9.07
I_4	9.8	9.8	9.46
I_5	8.95	8.95	9.2

6.6.1.4 Step (4) Calculating Benefits Realization Index for Company B

The Benefits Realization (BR) index for Company A was computed using the following equation:

$$I = W x R$$

Overall weight **W**=(0.2, 0.1, 0.1, 0.3, 0.3)

$$\text{Overall assessment vector } R = \begin{bmatrix} 8.84 & 8.84 & 9.32 \\ 8.62 & 8.62 & 8.68 \\ 7.97 & 7.97 & 9.07 \\ 9.8 & 9.8 & 9.46 \\ 8.95 & 8.95 & 9.2 \end{bmatrix}$$

Company B benefits realization index has been calculated as:

$$I = W x R$$

$$I = (9.05, 9.052, 9.23)$$

$$I = 1/3\ (9.05 + 9.052 + 9.23)$$

$$I = 9.113667$$

The BR index computed for Company A is approximately 9.11

All the indices and weights calculated for Company B's benefits are presented in Table 5. For Company B, the most realized benefits are technology benefits, where the index is 7.36 and the relative importance is 20%. Organizational benefit has the second highest index, which is 7.22, but the lowest weight is 10%. The most important benefit is operational benefits, with a relative importance of 40% and an index of 7.04. Strategic and managerial benefits are quite similar with their results and values: both have same weight of 15%, where managerial has BR index 6.76 strategic. An analysis of Company B's performance will be presented in Section 6.7 in this chapter.

6.6.2 Assessment of Company B Benefits Realization

The company previously introduced in Chapter five and the process of the assessment is similar to the previous section (6.6.1).

6.6.2.1 Step (1) Calculating the relative importance (weight)

On the same calculation processes of company, A, Figure 6.13. presents the relative importance of the benefits.

Level 1			
Benefits	**EXPERT 1**	**EXPERT 2**	**W**
1) Operational	0.3	0.5	0.4
2) Managerial	0.1	0.2	0.15
3) Strategic	0.2	0.1	0.15
4) Technology	0.3	0.1	0.2
5) Oraganizational	0.1	0.1	0.1

Figure 6.13: Weights of Company B Benefits

The relative importance for each indicator was calculated, as shown in Figure 6.14. while Figure 6.16 presents the relative importance (weight) for each attribute. Figure 6.16 shows the assessment scores of company B.

Level 1	Level 2			
Benefits	**Indicators**	EXPERT 1	EXPERT 2	Wi
Operational	Hard Saving	0.4	0.5	0.45
	Soft Saving	0.6	0.5	0.55
	Total			
Managerial	Resource management	0.3	0.4	0.35
	Improve performance and decision making	0.7	0.6	0.65
	Total			
Strategic	Business efficiency	0.7	0.7	0.7
	external benefits for business	0.3	0.3	0.3
	Total			
Technology	cloud value added	0.6	0.6	0.6
	Top-end IT capabilities	0.4	0.4	0.4
	Total			
Organizational	support organizational changes	0.6	0.5	0.55
	support organizational integration	0.4	0.5	0.45

Figure 6.14: Weights of Company B Indicators (Wi is the indicator weight)

Level 1	Level 2	Level 3			
Benefits	Indicators	Attributes	PI		
			Expert 1	Expert 2	W ij
Operational	Hard Saving	Reduce spending on compute storage, networking and security	0.4	0.3	0.35
		Avoidence of hardware and software purchases (capital expenses)	0.3	0.2	0.25
		Reduction in operational costs, back up and DR/DC	0.1	0.3	0.2
		Short-term running cost of business < long-term operating cost(comparing with traditional ERP)	0.1	0.1	0.1
		Reduction in IT labor cost	0.1	0.1	0.1
		Total			
	Soft Saving	Reuse of services and applications	0.1	0.2	0.15
		Faster implementations and time to value	0.6	0.2	0.4
		Increased the system's user productivity	0.2	0.2	0.2
		Improved custumer's satisfaction	0.1	0.4	0.25
		Total			
Managerial	Resources Management	Avaibilty of the resources	0.4	0.2	0.3
		Easier access to hardware resources and more storage devices	0.1	0.2	0.15
		Varairties of resources	0.1	0.3	0.2
		Over secure envieromnet	0.4	0.3	0.35
		Total			
	Improve performance and decision making	Improved decision making	0.3	0.3	0.3
		Improved planning	0.2	0.2	0.2
		Facilitate innovation	0.2	0.2	0.2
		Performance improvement	0.3	0.3	0.3
		Total			
Strategic	Business efficiency	Support business growth	0.3	0.1	0.2
		Support business alliance	0.3	0.2	0.25
		Ability to change business processes quickly around new and emerging opportunities	0.2	0.3	0.25
		Generate product differentiation	0.2	0.4	0.3
		Total			
	External benefits for business	Build cost leadership	0.2	0.2	0.2
		Improved collaboration	0.3	0.4	0.35
		Facilitate shared services	0.5	0.4	0.45
		Total			
Technology	Top-end IT capabilities	Use of sophisticated hardware & software	0.1	0.2	0.15
		Access to highly qualified IT personnel	0.6	0.2	0.4
		Instant update to keep up with the advanced technologies	0.3	0.6	0.45
		Total			
	Cloud value added	Using security standards for encryption and decryption	0.5	0.2	0.35
		Access to ERP system from different platforms (Availability)	0.2	0.3	0.25
		Easy accessed on-campus or off-campus	0.1	0.2	0.15
		Measured services (Pay as you use model)	0.1	0.1	0.1
		Rapid elasticity	0.1	0.2	0.15

Figure 6.15: Weights of Company B Attributes (W_{ij} is the attributes weight)

Level 1	Level 2	Level 3						SCORE	
Benefits	Indicators	Attributes	PI						
			Expert 1	Expert 2	W ij	Wi	W	Expert 1	Expert 2
Operational	Hard Saving	Reduce spending on compute storage, networking and security	0.4	0.3	0.35			8	8
		Avoidence of hardware and software purchases (capital expenses)	0.3	0.2	0.25			8	5
		Reduction in operational costs, back up and DR/DC	0.1	0.3	0.2			8	8
		Short-term running cost of business < long-term operating cost(comparing with traditional ERP)	0.1	0.1	0.1			7	6
		Reduction in IT labor cost	0.1	0.1	0.1	0.45	0.4	6	6
		Total							
	Soft Saving	Reuse of services and applications	0.1	0.2	0.15			3	5
		Faster implementations and time to value	0.6	0.2	0.4			8	6
		Increased the system's user productivity	0.2	0.2	0.2			7	5
		Improved custumer's satisfaction	0.1	0.4	0.25	0.55		8	9
		Total							
Managerial	Resources Management	Avaibilty of the resources	0.4	0.2	0.3			8	4
		Easier access to hardware resources and more storage devices	0.1	0.2	0.15			3	5
		Varairties of resources	0.1	0.3	0.2			3	8
		Over secure envieromnet	0.4	0.3	0.35	0.35		8	8
		Total					0.15		
	Improve performance and decision making	Improved decision making	0.3	0.3	0.3			9	6
		Improved planning	0.2	0.2	0.2			7	5
		Facilitate innovation	0.2	0.2	0.2			7	6
		Performance improvement	0.3	0.3	0.3	0.65		9	7
		Total							
Strategic	Business efficiency	Support business growth	0.3	0.1	0.2			8	4
		Support business alliance	0.3	0.2	0.25			8	5
		Ability to change business processes quickly around new and emerging opportunities	0.2	0.3	0.25			4	7
		Generate product differentiation	0.2	0.4	0.3	0.7		4	6
		Total					0.15		
	External benefits for business	Build cost leadership	0.2	0.2	0.2			7	4
		Improved collaboration	0.3	0.4	0.35			7	7
		Facilitate shared services	0.5	0.4	0.45	0.3		8	8
		Total							
Technology	Top-end IT capabilities	Use of sophisticated hardware & software	0.1	0.2	0.15			4	6
		Access to highly qualified IT personnel	0.6	0.2	0.4			8	6
		Instant update to keep up with the advanced technologies	0.3	0.6	0.45	0.6		8	9
		Total							
	Cloud value added	Using security standards for encryption and decryption	0.5	0.2	0.35		0.2	10	6
		Access to ERP system from different platforms (Availability)	0.2	0.3	0.25			8	8
		Easy accessed on-campus or off-campus	0.1	0.2	0.15			8	6
		Measured services (Pay as you use model)	0.1	0.1	0.1			4	5
		Rapid elasticity	0.1	0.2	0.15	0.4		5	8

Figure 6.16: B.R. Assessment Scores for Company B

Table 6.6, presents the relative importance (weights) calculated for the benefits, indicator, and attributes and all the assessment scores of each attribute collected from Company B's experts.

Table 6.6: Summary of the RI for the Benefits, Indicators, and Attributes for Company B

Company B						
I_i	I_{ij}	E1	E2	W_{ij}	W_i	W
I_1	I_{11}	0.4	0.3	0.35	0.45	0.4
		0.3	0.2	0.25		
		0.1	0.3	0.2		
		0.1	0.1	0.1		
		0.1	0.1	0.1		
	I_{12}	0.1	0.2	0.15	0.55	
		0.6	0.2	0.4		
		0.2	0.2	0.2		
		0.1	0.4	0.25		
I_2	I_{21}	0.4	0.2	0.3	0.35	0.15
		0.1	0.2	0.15		
		0.1	0.3	0.2		
		0.4	0.3	0.35		
	I_{22}	0.3	0.3	0.3	0.65	
		0.2	0.2	0.2		
		0.2	0.2	0.2		
		0.3	0.3	0.3		
I_3	I_{31}	0.3	0.1	0.2	0.7	0.15
		0.3	0.2	0.25		

		0.2	0.3	0.25		
		0.2	0.4	0.3		
	I_{32}	0.2	0.2	0.2	0.3	
		0.3	0.4	0.35		
		0.5	0.4	0.45		
I_4	I_{41}	0.1	0.2	0.15	0.6	0.2
		0.6	0.2	0.4		
		0.3	0.6	0.45		
	I_{42}	0.5	0.2	0.35	0.4	
		0.2	0.3	0.25		
		0.1	0.2	0.15		
		0.1	0.1	0.1		
		0.1	0.2	0.15		
I_5	I_{51}	0.3	0.1	0.2	0.55	0.1
		0.2	0.3	0.25		
		0.2	0.3	0.25		
		0.3	0.3	0.3		
	I_{52}	0.2	0.3	0.25	0.45	
		0.6	0.3	0.45		
		0.2	0.4	0.3		

6.6.2.2 Step (2) Calculating the index of Indicator

The index pertaining to each indicator will be calculated using the following equation:

$$\mathbf{I_{ij} = W_{ij} \times R_{ij}}$$

To get the index of each indicator - an example for this step is given by the calculation of the index for the "Hard Saving" indicator, which is as follows:

Weights pertaining to hard saving indicator W11= (0.35, 0.25, 0.2, 0.1, 0.1), where 11 refers to the number of attributes and number of experts, subsequently which is the weight of attribute number one of the first expert.

Assessment scores pertaining to the hard saving indicator is given by:

$$R11 = \begin{bmatrix} 8 & 8 \\ 8 & 5 \\ 8 & 8 \\ 7 & 6 \\ 6 & 6 \end{bmatrix}$$

Index of the hard saving indicator is given by

$$I_{11}=W_{11}\times R_{11}$$

$$I_{11}= (7.7, 7.0)$$

The indices of all benefits indicators have been computed, as illustrated in Table 6.7

Table 6.7: Expert's assessment score and weights for Company B

Iij	Expert 1	Expert 2	Wi
I_{11}	7.7	7	0.45
I_{12}	6.8	6.8	0.55
I_{21}	5.5	6.6	0.35
I_{22}	8.2	6.1	0.65
I_{31}	5.2	5.9	0.7

I_{32}	7.4	6.8	0.3
I_{41}	7.2	7.8	0.6
I_{42}	7.4	6.9	0.4
I_{51}	8	6.8	0.55
I_{52}	6.6	7.4	0.45

6.6.2.3 Step (3) Calculating the indices of Benefits

The index pertaining to each benefit is calculated using the following equation:

$$\boldsymbol{I_i}=\boldsymbol{W_i} \times \boldsymbol{R_i}$$

For example, the calculation related to the Operational benefits for Company B is given by:

$$\boldsymbol{I}_1=\boldsymbol{W}_1 \times \boldsymbol{R}_1$$

Weight pertaining to the Operational benefits is given by:

$$\boldsymbol{W}_1 = (0.45, 0.55)$$

Assessment scores pertaining to the Operational benefits is given by:

$$\mathrm{R1} = \begin{bmatrix} 7.7 & 7 \\ 6.8 & 6.8 \end{bmatrix}$$

Index pertaining to the Operational benefits is given by:

$$I_1 = (7.20, 6.89)$$

The indices have been calculated in the same principle for the remaining benefits of Company B, as seen in Table 6.8.

Table 6.8: Calculated Indices of all Benefits for Company B

Ii	Expert 1	Expert 2

I1	7.205	6.89
I2	7.255	6.275
I3	5.86	6.17
I4	7.28	7.44
I5	7.37	7.07

6.6.2.4 Step (4) Calculating Benefits Realization Index for Company B

The Benefits Realization (BR) index for Company B was computed using the following equation:

$$I = W x R$$

Overall weight **W**=(0.4, 0.15, 0.15, 0.2, 0.1)

Overall assessment vector $R = \begin{bmatrix} 7.2 & 6.89 \\ 7.25 & 6.27 \\ 5.86 & 6.17 \\ 7.28 & 7.44 \\ 7.37 & 7.07 \end{bmatrix}$

Company B's benefits realization index has been calculated as:

$$I = W x R$$

$$I = (7.04, 6.8)$$

$$I = ½ (7.04 + 6.8)$$

$$I = 6.93$$

The BR index computed for Company B is approximately 6.93

For Company B, Figure 6.17 shows the most realized benefits are technology benefits where the index is 7.36 and the relative importance is 20%. Organizational benefit has

the second highest index, which is 7.22, but the lowest weight of 10%. The most important benefit is operational benefits, with a RI of 40% and an index of 7.04. Strategic and managerial benefits are quite similar with their results and values, both have same weight 15%, where managerial has a BR index 6.76 strategic. An analysis of Company B's performance will be presented in section 6.7 in this chapter.

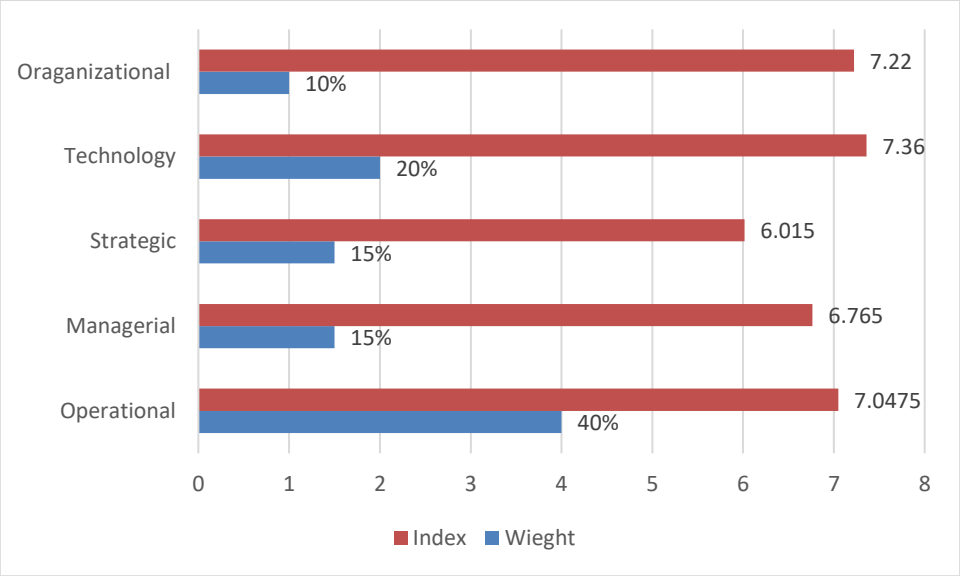


Figure 6.17: Indices and Weights for each Benefit of Company B

6.7 Discussion on the Case Studies Results

According to the result of the assessment of two companies (A and B), it was found that their BR Indices are 9.11 and 6.93, as shown in Table 6.9.

Table 6.9: Benefits Index for the Two Companies

Company	BR Index
Company A	9.11
Company B	6.93

The indices for both Companies A and B showed the benefits realization level where Company A is more realized of the benefits than Company B. Figure 6.18 shows the level of each company on the BR score.

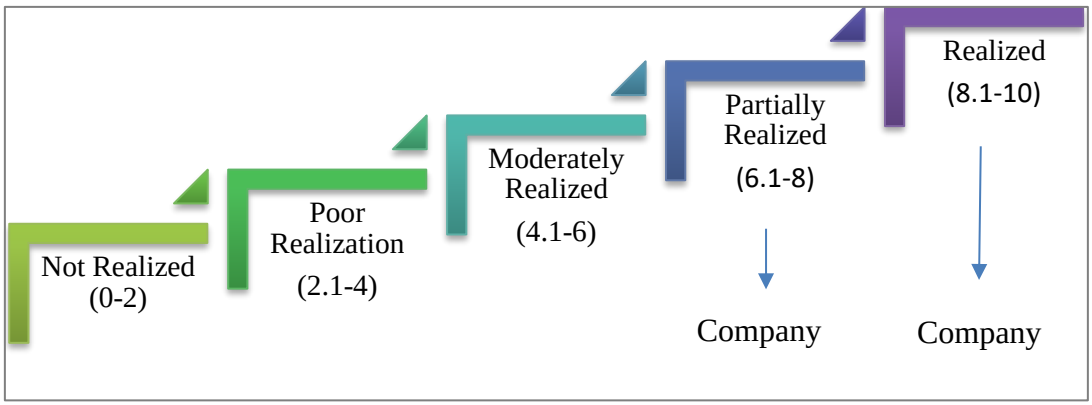


Figure 6.18: Benefits Realization Score

Table 6.10: Comparison Between the Two Companies

Benefits	Company A		Company B	
	Index	Weight	Index	Weight
1) Operational	8.84	20%	7.0475	40%
2) Managerial	8.62	10%	6.765	15%
3) Strategic	7.97	10%	6.015	15%
4) Technology	9.8	30%	7.36	20%
5) Organizational	8.95	30%	7.22	10%
Operational				
Hard Saving	9.2	70%	7.35	45%
Soft Saving	8.3	30%	6.8	55%
Managerial				
Resource management	7.6	40%	6.05	35%
Improve performance & decision making	9.3	60%	7.15	65%
Strategic				
Business efficiency	7.7	70%	5.55	70%
External benefits for business	8.6	30%	7.1	30%
Technology				
Top-end IT capabilities	9.5	40%	7.5	60%

Cloud value added	10	60%	7.15	40%
Organizational				
Support organizational changes	8.1	50%	7.4	55%
Support organizational integration	9.8	50%	7	45%

6.7.1 Company A

The B.R. index of Company A is 9.11, which shows that the benefits about to be completely realized with difference (0.89) to reach the score. A more detailed explanation is from Table 9 that shows regarding benefits, the technology benefit is the most important benefit where the weight (relative importance) is 30%. While the highest index, which is the most realized benefits is technology benefits with score 9.8. Organizational benefit is the second realized benefit with an index of 8.95. On the other hand, the lowest realized benefit is the strategic one with an index value of 7.97, as well as and lowest relative importance of 10%. Operational benefit realized with an index value of 8.84 and relative importance of 20%. Lastly managerial also had the lowest relative importance value of 10% and an index of 8.62.

6.7.2 Company B

The B.R. index of Company B is 6.93; the benefit is partially realized with difference (3.07) to hit the score. As shown in Figure 6.19, the most important benefit is the operational benefits with weight of 40%, and it considers one of the highest regarding realized benefits, with an index value of 7.047. The second most important benefit is the technology benefits with weight of 20%; it is also the most realized benefit among the five benefits with an index value of 7.36. The least important benefit is the organizational benefit at 10%; however, it is the second realized benefit after the technology benefit, with an index of 7.22. The least realized benefit is the strategic one with an index value of 6.01 and weight of 15%. Managerial benefit has a weight of 15% and index of 6.76.

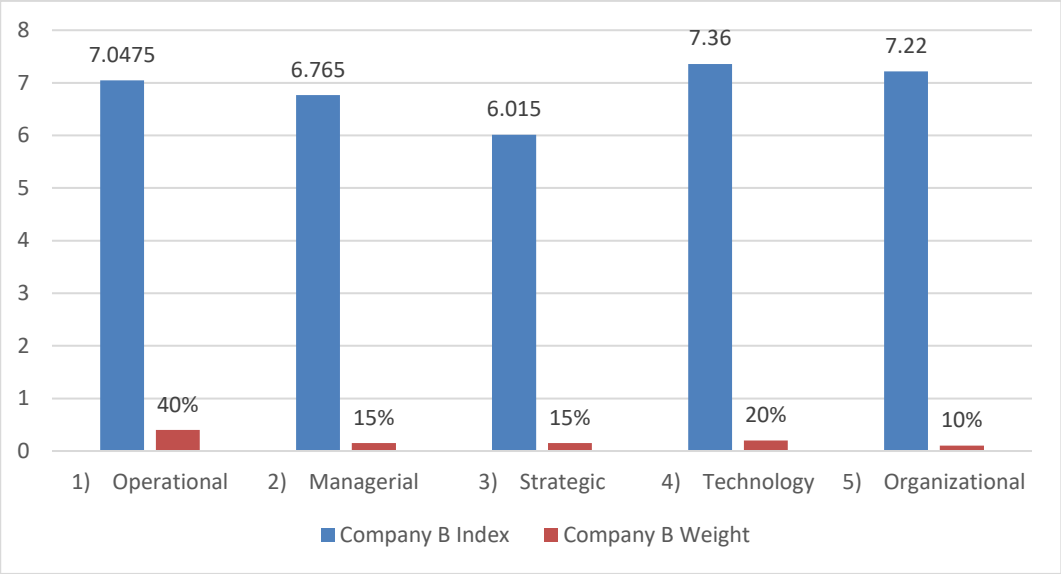


Figure 6.19: The Indices and Weights for the Five Benefits of Cloud ERP in Company B

To illustrate it clearly, the following figures explain each benefit separately. As shown in Figure 6.20, the indicators of operational benefits, which are hard saving and soft saving, have very close values. Soft saving is more important (55%) than hard saving (45%); however, hard saving (7.35) realized more than soft saving (6.8).

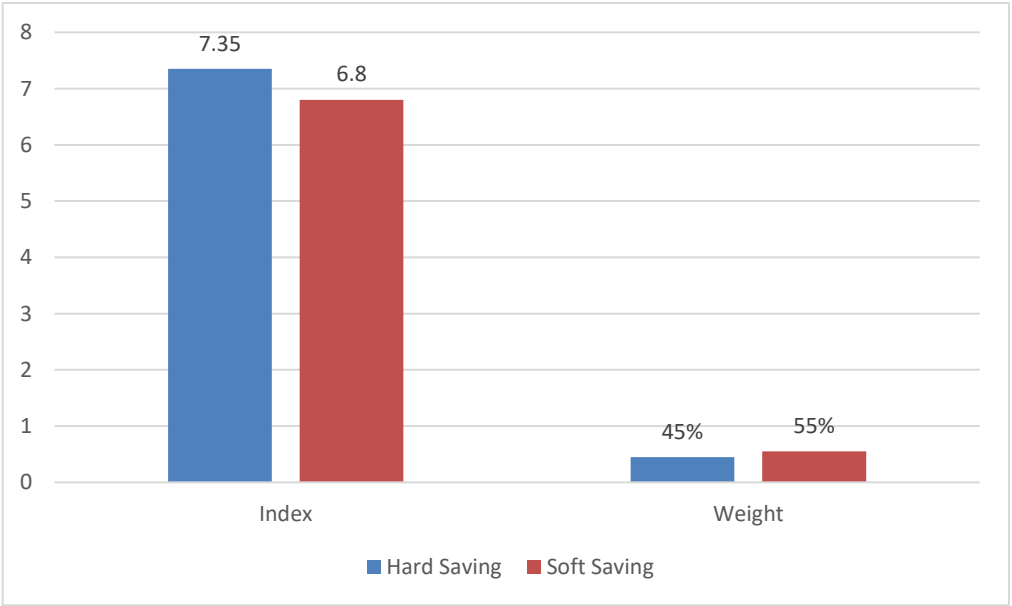


Figure 6.20: The Operational Benefits for Company B

Managerial benefits have two indicators, resource management and improve performance and decision-making, which have values that are far apart. Figure 6.21 shows that improve performance and decision-making is a more important indicator for managerial

benefits, with weight 65%, while resource management has a lesser weight of 35%. Regarding realizing level, improve performance and decision-making, realized with index of 7.15, whereas resource management has an index of 6.05.

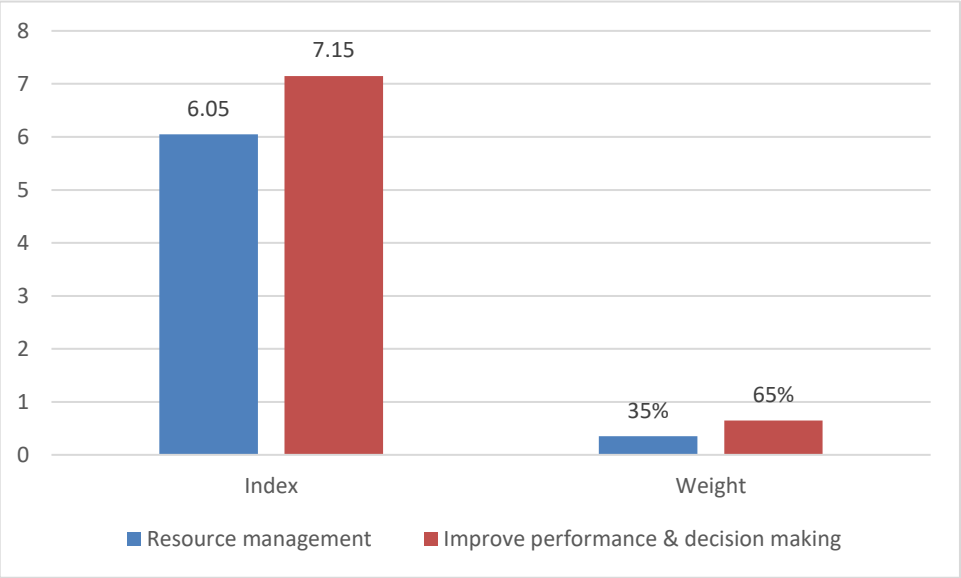


Figure 6.21: The Managerial Benefits for Company B

In terms of strategic benefits, which is the lowest benefit regarding the B.R. index and the relative importance there is a contrast here among the indicators where business efficiency is much more important (70%) than external benefits for business (30%). The index that reflects the realization of the benefits external benefits for business has the highest value of 7.1, whereas business efficiency is 5.55 as shown in Figure 6.22.

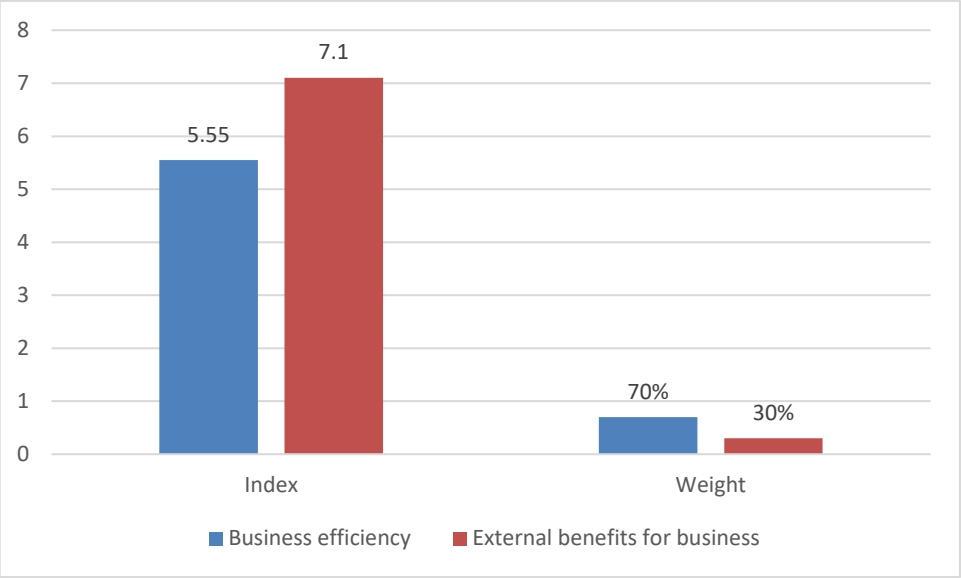


Figure 6.22: The Strategic Benefits for Company B

The technology benefit is the second most important benefit and has the highest value of benefits realization. Top-end IT capabilities is more important (60%) than cloud value added (40%). As well as the index of B.R., for top-end IT capabilities is higher (7.5) than cloud value added (7.1), as shown in Figure 6.23.

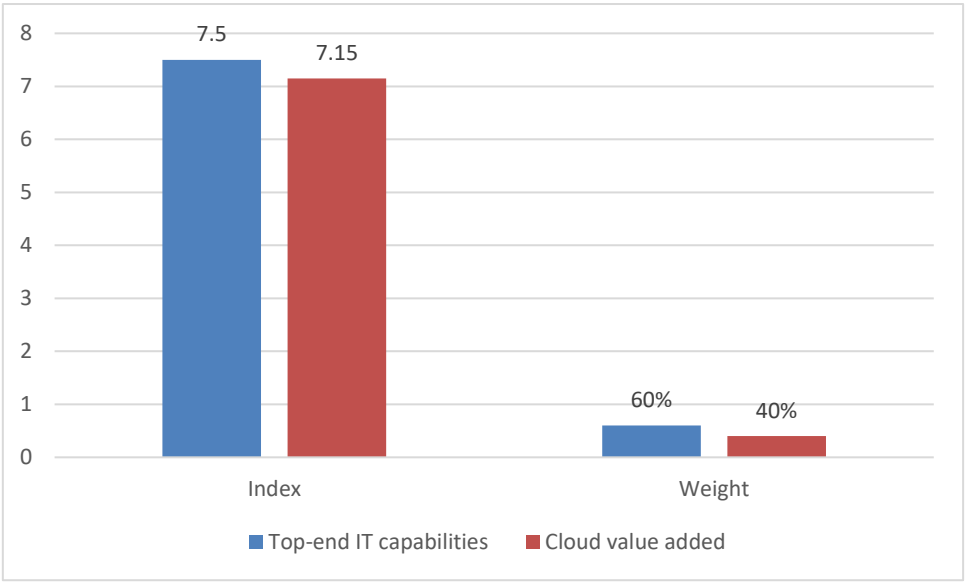


Figure 6.23: The Technology Benefits for Company B

The final benefit is organizational. The weight of the two indicators is close; support organizational changes are more important with a R.I. of 55% and support organizational integration of 45%. The realized benefit was support organizational changes with an index value of 7.4, whereas support organizational integration has an index value of 7.

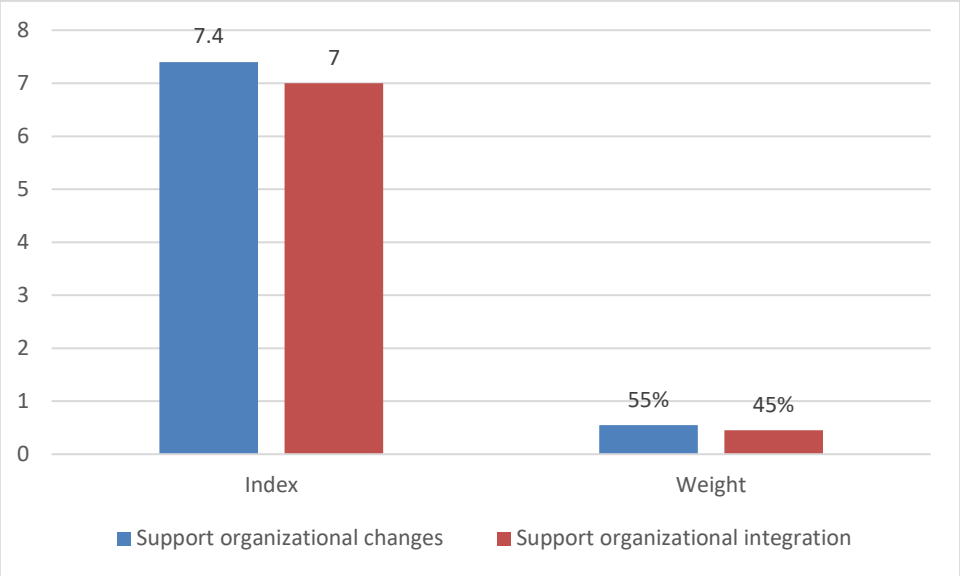


Figure 6.24: The Organizational Benefits for Company B

6.8 Spearman Rank Correlation Coefficient

In chapter 5, the maturity indices are calculated, and this chapter computed the BR indices as well for both case studies. So, to examine the association between the maturity and benefits realization, Spearman rank correlation coefficient has been used. The Spearman correlation coefficient is usually adopted to find the strength and direction of ordinal variables. The values of Spearman correlation coefficient, *r*s, takes values between from +1 to -1. When *r*s = +1 that refer to perfect association rank, a *r*s = zero then there is no association among ranks where a *r*s = -1 indicates a perfect negative association of ranks. If the value of *r*s close to zero, the association between the ranks is weak.

$$r_s = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

R_x= the rank of x

R_y = the rank of y

$d = R_x - R_y$

$n = 2$

$$r_s = 1 - \frac{(6)(0)}{2(16-1)} = 1 - \frac{0}{2*15} = 1$$

r_s= +1

Table 6.11: The values of Spearman Rank Correlation Coeffient of maturity and benefits realization

Company	BR Index x	Maturity Index y	R_x	R_y	d	d^2
Company A	9.11	8.7	1	1	0	0
Company B	6.93	6.6	2	2	0	0

The value of r_s that calculated from Spearman rank correlation coefficient is +1 which reveals about a perfect association of ranks, means the BR index will increase with the increasing of maturity index. To explain it more, the maturity of organization affects the benefits realization.

6.9 Chapter Summary

This chapter presents the benefits realization (B.R.) assessment model development then the validation process via case studies. The B.R. assessment model can be used to assess the degree of benefits realization in organizations intending to implement cloud-based ERP, as well as identifying the indicators to these benefits and their attributes. This enables them to be realized and traced in the long term in order to meet the investment objectives and facilitate further improvement.

This chapter was structured in the following order: after the introduction (Section 6.1), Section 6.2 highlighted the background to benefits assessment; the purpose and the concept of the benefits assessment model are also explained. Beside the benefits models discussed in the literature, the proposed benefits realization model has been presented. Along with the proposed benefits realization model, it was explained that the process should be ongoing, thus the proposed model is a loop. The four steps of the model were illustrated: *identify* cloud ERP key drivers; *plan* cloud ERP benefits; *assess* benefits realisation; and *establish* the potential for further benefits. In Section 6.3, the methodology used to develop the model, then the methodology of validating the model. Section 6.4 provided an overview of the model design and development, with its major elements presented. Furthermore, the five benefits that should be realized from a cloud-

based ERP project are detailed with its indicators and attributes. Section 6.5 explains the usability of the designed tool, with clear illustrative information. It included a discussion on the formation of the Excel tool that specially designed for this model. In Section 6.6, the application and validation of the model and its tool at the case studies conducted are described. The section presented a brief explanation of the case studies and the assessment process employed for each one. Following the B.R. Index for the case study companies, Section 6.7 provided a detailed discussion on the results by explaining the most realized ones and the benefits that need be tracked in. Section 6.8, examine the relation between the maturity and the benefits realization via Spearman rank correlation coefficient by using BR indices in this chapter and maturity indices in chapter 5. The chapter concludes with a summary in section 6.9.

7. CHAPTER SEVEN: DISCUSSION AND CONCLUSIONS

7.1 Introduction

This chapter provides a summary of the research findings and further discusses their implications to the relevant fields. Additionally, the conclusions drawn from this thesis are presented.

The structure of the chapter as follow: Section 7.1, is a summary and an additional discussion of the key research findings described in this thesis is presented, taking each area of the thesis in turn. Section 7.2 discusses the quality and the generalisability of the research findings. Section 7.3 emphasises the main contributions of this research. Section 7.4 reports the objectives fulfilment by the research findings. Section 7.5 debates the research limitations that faced the researcher. Section 7.6 illustrate the conclusions in detail. Finally, in Section 7.7, highlight the future research directions.

7.2 Discussion of Key Research Findings

7.2.1 Literature Review

The literature review investigated three crucial research areas including cloud-based ERP implementation, maturity of organization, and benefits realization management. Furthermore, the aim of the literature review chapter was to give a critical review of the academic literature, to find gaps among researchs that add value and contribute to the knowledge.

To understand what business and the IT industry gain from cloud, it is necessary to address the pre-cloud era. The literature attempts to explain the significant role of cloud technology in business, management, and the IT industry. Investing in e-products and e-services can involve high expenditure, complexity of reaching market, and substantial maintenance and operation costs.

On the other hand, the cloud era (from the late 1990s onwards) relates to everything concerned with the internet. The literature chapter presents different definitions of cloud in academia and business. The characteristic of cloud is presented in detail with the cloud models: the deployment models which are public cloud, private cloud, community cloud,

and hybrid cloud. Beside service models: Software as a Service (SaaS), platforms as a Service (PaaS) and Infrastructure as a Service (IaaS).

Furthermore, the literature review illustrates the value that cloud technology adds to business and cloud-based services. There followed an introduction to cloud-ERP through traditional ERP. The technology of cloud-ERP in developing and developed countries was described in order to understand the as-is state.

The literature review covered the core subject areas of the research: benefits realization management and its approaches, in addition to the benefits management and IT investment; and the link between maturity and benefits management. To conclude, the research gap was presented at the end of the chapter and the aim and objectives were set up to fill this gap.

7.2.2 Research Methodology

As explained in Chapter 3, the research methodology implemented to fill the research gap by answering the research question and achieving the objectives.

The research methodology begins by summarising the research overview, consisting of the research paradigms, research approaches, and research strategy. Three research paradigms were outlined, and their characteristics noted. The possible research approaches (qualitative, quantitative and mixed-method), used to capture knowledge, are summarised. The qualitative research methodology was adopted which generally has bias from the researcher and the participants, thus, affecting the validity and reliability of results. The author took several actions to improve these weaknesses. These actions involved: (1) using different methods during data collection phase. (2) select the case studies and experts that meet the research needs. (3) conducting interviews with different industries, sectors, experts, and companies. (4) collect feedback from participants and set the findings. The validation conducted on two large organisations from different fields and countries.

Finally, the chosen research methodology was described, comprising the four stages that expressed the nature of the steps in the research: “Understanding context and current practices”, “Data Collection and Analysis”, “Framework Development” and “Validation”.

7.2.3 Cloud-based ERP Implementation Framework

The proposed framework considers a roadmap for the cloud-based ERP implementation with efficient and effective end by realizing projects benefits. The framework begins with the maturity model that start by identifying the organization status regarding maturity by assessing the existence of CSFs that support the implementation and free of challenges. The index of the model allows to track the weakness area for any improvement process. This part of maturity determines the as-is status of organization. The sequence of framework that start with maturity model, change management models, cloud-based ERP implementation, and the benefits realization model. This sequence is proposed for better outcome where the second part (change management) is required based on the result of interviews and during the collecting data meetings. As well as the third part is crucial phase that represent the life cycle of cloud-based ERP process depend on the vendors' process. The fourth part which is the proposed benefits realization model considers a contribution for this research with the maturity model. Benefits realization model start by identifying the expected benefits which occurred during the interviews by asking about the key-drivers, next plan to execute these benefits by determine the roles and authentications, then assess the realization of benefits by using the assessment tool that tailored in Ms excel to calculate an index of BR that shows how many benefits did the organization realized and how many left. Last step in benefits realization model is to Establish the potential for further benefits according to the result of BR index.

7.2.4 Maturity Assessment Model

The maturity assessment model was designed for evaluation purpose, beside determine the degree of maturity in organization intending to implement cloud-based ERP. The chapter highlighted the background around maturity assessment; the purpose and the concept of the maturity assessment model were explained; the technique of fuzzy logic was also introduced. Furthermore, the proposed model of this research was presented with its three phases, along with the methodology of model development, and the methodology of validating the model with case studies to the point of an organization achieving the necessary maturity level. The chapter also presents an overview of the model design and development with its major elements. The five enablers are explained with their criteria and attributes. The design of the tool, designed to be practical and user-friendly, with

clear illustrative information is shown. The chapter includes a discussion on the formation of the Excel tool that was specially designed for this model.

Also considered was the technique of multi-grade fuzzy logic with the maturity assessment model. Beside the multi-grade fuzzy logic approach, the scores of maturity assessment been expressed via five sets of fuzzy numbers. There is an explanation about validating of the model, as well as a description of the case studies and the assessment process employed for each one. After attaining companies' Maturity Indexes, there is a detailed discussion of the results, explaining the improvement areas for each company.

7.2.5 Benefits Realization Assessment Model

This chapter presents the methodology of validating and developing the BR assessment model. The BR tool is tailored support organization in evaluation process of benefits realization for cloud-based ERP implementation, as well as identifying the indicators of these benefits, and the attributes necessary to realize and track them in long term in order to meet the investment objectives and instigate any further improvement deemed necessary.

Also in this chapter was the background to benefits assessment and an explanation of the purpose and the concept of the proposed benefits assessment model. Following the benefits models discussed in the literature, the proposed benefits realization model was presented. The explanation of the proposed benefits realization model details how the process should be ongoing, thus the proposed model is a loop. The four steps of the model are Identify cloud ERP key drivers; Plan cloud ERP benefits; Assess benefits realisation; and establish the potential for further benefits.

The model development and validation methodology are described through the case studies to discover the level of and organization's benefits realization. An overview of the model design and development with its major elements is presented. The five benefits that should be realized from cloud-ERP project are explained, with indicators and attributes. The design of the tool sought to be practical and user-friendly, with clear illustrative information.

A discussion was made around the formation of the Excel tool specially designed for this model. Furthermore, an explanation of the technique of multi-grade fuzzy logic with the

benefits assessment model was given. In addition, the scores of BR assessment that consist of five sets of fuzzy numbers, been described. The section also presents a brief description of the case studies and the assessment process carried out on each one individually. After realizing the B.R. Index, the results achieved was discussed.

7.3 Generalisability and Quality of Findings

Throughout the research, the author endeavoured to follow methodical and systematic way during the process of collecting data, analysing the result and all the research processes.

the research considers the methods of data collections as it was a formal strategy, where described in Chapter 3. The formal strategy of this research applied by conducting a semi-structured interview, studying case studies, and collecting relevant documents. The time available for the researcher was the critical limitation due to the global Coronavirus pandemic, in terms of the available case studies.

Consequently, all the possible processes to choose the available cases with reasonable number of participants were taken as much as possible.

Data was collected from six firms that operate across different industries and different size, as well as from four consultants. The first company acted as a customer and provider of cloud-based ERP, it implemented the system as SaaS and IaaS by SAP. The second company is considered as a non-profit and judicial type. It was a customer of first company. The third company was a customer as well for first one and using the cloud service as SaaS. The fourth company is an international enterprise for e-services and products, it was a well-known company as cloud providers.

The generalisability of the research findings was achieved by examining different industries. Thus, the framework applicable is able to be used and examined via other industries. The proposed maturity and benefits realization assessment models were validated via five experts working in two different companies: one in a developed country and one in developing country. In addition, the participants in the validation phase for the two assessment tools, have not objected on the usability of the tool against the size or sectors of their companies

7.4 Key Research Contributions

The contribution in the cloud-based ERP implementation framework was the integration of benefits realization management with maturity approach, assessment means, with suggestion of change management practice and a life cycle of cloud-based ERP implementation. The novelty here represented in introducing the maturity assessment model within the concept of the benefits realization model. Furthermore, the integration starts in pre-implementation and continue to the post-implementation phase for more control and more realization.

This research has been successful in contributing to knowledge in several areas:

- Uniformity in the realization of CSFs and their challenges.
- Create a maturity assessment model and tool that enhanced by CSFs, to obtain the current state
- Uniformity in the understanding of key-drivers of cloud ERP implementation.
- The development of a benefits realization assessment model and its tool which can be used by organisations to realize and track the benefits from the innovation in order to achieve investment objectives.
- Development of a novel framework that ensures successful and optimal cloud-based ERP implementation by integrated of BRM and maturity model.
- Examine the relationship between maturity and BR that shows a strong impact of maturity on realizing benefits.
- Understanding the important role of change management, prior to implementation. Finally, tracking of the benefits that identified earlier.

7.5 Fulfilment of Research Aim and Objectives

the aim of the research is to develop a framework for developing countries organizations that able them to implement cloud-based ERP successfully through BRM methodology. The aim needs to set a few objectives to be achieved

There are seven research objectives, the first one was to understand the current state of cloud-based ERP implementation according to the literature review. The plan to capture information in support of the literature was via survey, consisting of different aspects of

cloud-based ERP implementation: to distinguish the opportunities for any improvement. This is documented in Chapter 2.

The second, third and fourth objectives were investigating the challenges, the critical success factors, the key drivers of cloud ERP implementation and were illuminated in interviews with academics and industrial practitioners. The findings revealed factors, challenges, and key-drivers that play an important role during cloud-based ERP journey. These finding can be employed in improving the implementation process.

The fifth objective was designing a maturity assessment tool to identify the maturity level of an organization before the implementation of cloud ERP. Through the CSFs and challenges gathered previously, they can be used proactively to support an organization by improving its maturity level regarding cloud-based ERP.

The sixth objective was design of a benefits realization assessment tool to track and realize the key-drivers that encourage an organization to adopt cloud-based ERP. These benefits ultimately lead to the investment objectives.

The seventh and final one based on the findings and through BRM approach, the framework developed, beside further modules, that involved maturity assessment as a mean of improving the weaknesses area before starting the implementation to ensure an integral framework, were developed.

7.6 Research Limitations

The focus of the research is directed towards companies in developing countries that implemented cloud-based ERP in their organizations. The work concentrated on the implementation phase that commences after a company has taken the decision of cloud-based ERP adoption.

The research limitations are restricted on the methodology, the proposed cloud-based ERP framework, the classification of challenges and CSFs, and maturity and benefits realization assessment models. The limitation of the framework is represented in its scope in developing countries. as well as its exclusive of any interest about cost, effort, time, or firms size. In terms of the methodology and qualitative research, the semi-structured interviews technique is exposed to bias. To avoid the bias as much as possible, the

validation has been done through experts from different fields, including academia and industry. A further limitation in the vein of models, (either the maturity or benefits realization) they are exclusive of any financial parameters; however, this aspect is essential in industry consideration. But the research believes the cost is vast topic need individual study.

7.7 Conclusions

To review, the research has accomplished the aim and objectives of developing a framework of cloud-based ERP implementation in developing countries.

The most important conclusions are summarized on that wise:

1. To maintain and prove the rationales of change, benefits realization management is required.
2. Benefits realization management is not only a road map for the project; this journey should end up achieving business objectives.
3. Maturity approaches pave the way to project success and achieving business benefits, which it is all about improvements.
4. There is a robust association between maturity and benefits realization, as when maturity is achieved the benefits could be more realized, according to the case studies maturity index and BR index shows that when the maturity index is ' Mature', the BR index is 'Realised'; on the other hand, when maturity index is 'Partial Mature', the BR index follows the same level, which is 'Partially realised'.
5. The implementation phase is critical in terms of cost and effort, so for success, attention should be paid in the pre-implementation phase by adopting maturity approaches. In addition, ERP on cloud has major partner within the project who is CSPs that add more responsibility on the on organization in selection, planning, and implementation phases.
6. Most of the CSFs and the challenges that face cloud-based ERP are related to change management; thus, consideration of a change management model is necessary as an ERP system affects most of an organization’s processes.

7.8 Future Research Direction

Studying of literature review revealed some lack studies, The following details promise areas of research for future work that would be beneficial.

Regarding cloud characteristics and ERP systems, the research studied them regardless of the organization's size; most studies focus on SMEs, so large organizations need further attention in terms of data sensitivity. A large organization has two options to go with cloud deployment models, private or public; how can they maintain the feature of the cloud for small entities that belong to the large organization. The service models of the cloud (SaaS, PaaS, and IaaS) are possible models for an ERP system and should be considered when studying cloud-based ERP in the future. Popular opinion around cloud-based ERP is for SaaS only, while it could be via other service models. As well as finding a classification of the benefits of cloud-based ERP based on the deployment or services models.

As to the cost of cloud-based ERP, one of the significant issues faced by the organization in the industry when conducting cloud-based ERP projects is related to exceeding cost and time limits that count failure of these projects. Consequently, precise, and early planning with a proper budget of activities related to the adoption and accomplishment of cloud-based ERP projects are essential for its success. Indeed, access to reliable and accurate cost estimates is a crucial factor to achieve several benefits that will enable the success of cloud-based ERP projects. A potential solution to the cloud-based ERP high failure rates is developing a whole lifecycle cost model (WLC) for cloud-based ERP projects.

Concerning benefits realization of cloud ERP, the projects' benefits should lead to investment objectives. Thus, the expiry of each business benefit end with the change of that objectives? Especially for the long-term benefits which usually related to organizational and strategic benefits. Classifying the benefits between short and long benefits and studying them from a timeline perspective that explains the expected time of realizing them and is it failed who exceed that time? And the relation between that and investment objectives change. The association between benefits realization and maturity needs to be examined via quantitative methodology to prove the relationship with sizeable

potential case studies. In terms of benefits, the long-term ones usually related to organizational and strategic benefits are more concerned with the customer instead of providers. Where CPSs focus on operational, managerial, and technology in the marketing context. Thus, there is a need to study the benefits from the CPSs perspective and customer perspective separately.

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APPENDICES

Appendix (1): Pilot Survey

Dear Participant,

This survey is being conducted as part of a PhD research project titled **(Development of a framework for cloud-based ERP implementation)** at Cranfield University, and seeks to investigate the challenges facing organizations in implementing cloud based ERP solutions, the key-drivers that engages organizations when implementing cloud based ERP and the factors that facilitate the processes of implementation.

The survey is targeting specific participants who are working for, or representing cloud service providers (CSPs), ERP vendors, consultants and/or customers and end-users whom represent organizations that need to transfer their ERP system to a cloud based solution.

The results of the survey will be available for all participants. Your response really does count. However, as much as I value your responses to the survey, it is important to note that the participation is voluntary. The survey will take approximately 15 minutes to complete, as well as all responses will be considered as confidential and anonymous to protect the respondent identity in any published data.

For any enquiries or questions about the study, please contact the researcher, Sarah Alharthi by the e-mail given below.

Thank you for your participation.

Sarah Mohammed Alharthi

E-mail: s.m.alharthi@cranfield.ac.uk

1- Which of the following levels does your position fall into?

Please select all applicable.

- ☐ Cloud service providers (CSPs)
- ☐ ERP vendors
- ☐ Consultant
- ☐ Client (organization, enterprise … etc.)
- ☐ User of cloud ERP system

2- What is your organisation category?

- ☐ Public sector
- ☐ Private sector
- ☐ Non-profit organisation
- ☐ Other (Please indicate)

3- What is the size of your company in terms of staff strength?

- 1 - 50
- 50 - 100
- 100 - 250
- 250 - 500
- > 1000
- Other

4- Where is your organisation located in?

5- What is your role/title in the implementation of cloud-based ERP?

6- How long have you been working on the implementation of cloud-based ERP?

- Less than 1 year
- 1 – 5 years
- 6 – 10 years
- More than 10 years

7- Following is a list of **key-drivers** of cloud-based ERP **implementation**. For each one Please indicate your opinion on its effect on successful Cloud-based ERP implementation.

	5 High Effect	4	3	2	1 No Effect
1- Scalability	○	○	○	○	○
2- Flexibility	○	○	○	○	○
3- Cost reduction	○	○	○	○	○
4- Accessibility	○	○	○	○	○
5- Using advanced technology	○	○	○	○	○
6- Lower upfront cost	○	○	○	○	○
7- Lower total cost of ownership	○	○	○	○	○
8- Rapid implementations	○	○	○	○	○
9- Rapid updates and upgrades	○	○	○	○	○
10- Improved collaboration	○	○	○	○	○
11- Other (Please indicate)	○	○	○	○	○

8- Following is a list of **challenges** that might you face in cloud-based ERP **implementations**. For each one Please indicate your opinion on its complexity on implementing Cloud-based ERP successfully.

	5 Extremely complex	4	3	2	1 Not complex
1- Security concerns	○	○	○	○	○
2- Excessive Customization	○	○	○	○	○
3- High level of standardization in cloud	○	○	○	○	○
4- Hidden Costs	○	○	○	○	○
5- Low Performance	○	○	○	○	○
6- Compliance and Physical Location	○	○	○	○	○
7- Poorly defined (SLAs)	○	○	○	○	○
8- IT Department resistance change	○	○	○	○	○
9- IT Losing competences	○	○	○	○	○
10- Vendor Lock-in	○	○	○	○	○
11- Reengineering business process	○	○	○	○	○
12- Shortage of competent consultants	○	○	○	○	○
13- Other (Please indicate)	○	○	○	○	○

9- In which **stages** of cloud ERP **implementations** you might face each **challenges**?

The stages are:

	Stage 1	Stage 2	Stage 3	Stage 4	I don't know
1- Security concerns	☐	☐	☐	☐	☐
2- Excessive Customization	☐	☐	☐	☐	☐
3- High level of standardization in cloud	☐	☐	☐	☐	☐
4- Hidden Costs	☐	☐	☐	☐	☐
5- Low Performance	☐	☐	☐	☐	☐
6- Compliance and Physical Location	☐	☐	☐	☐	☐
7- Poorly defined (SLAs)	☐	☐	☐	☐	☐
8- IT Department resistance change	☐	☐	☐	☐	☐
9- IT Losing competences	☐	☐	☐	☐	☐
10- Vendor Lock-in	☐	☐	☐	☐	☐
11- Reengineering business process	☐	☐	☐	☐	☐
12- Shortage of competent consultants	☐	☐	☐	☐	☐
13- Other (Please indicate)	☐	☐	☐	☐	☐

10- Following is a list of **factors** that **assist** organizations in implementing Cloud-based ERP successfully. For each one, Please indicate your opinion on its effect on implementing Cloud-based ERP successfully.

	5 very important	4	3	2	1 not important
1- Changeability of management	○	○	○	○	○
2-Limited customization	○	○	○	○	○
3- Realizing of ERP Business Implications	○	○	○	○	○
4-Data quality	○	○	○	○	○
5- Top management support	○	○	○	○	○
6- Competent consultants	○	○	○	○	○
7- Skilled employee	○	○	○	○	○
8- Great implementation team	○	○	○	○	○
9-Extensive education and training	○	○	○	○	○
10- implementing standardized software packages	○	○	○	○	○
11- Alignment of IT with business	○	○	○	○	○
12- Clear understanding of strategic goals	○	○	○	○	○
13-Excellent Project management	○	○	○	○	○
14-Clarity of Potential cost	○	○	○	○	○
15- Readiness of organization	○	○	○	○	○
16- ERP vendor support	○	○	○	○	○
17- Other (Please indicate)	○	○	○	○	○

11- In which stages of cloud ERP implementation; each one of these **factors** **assist** in implementing cloud-based ERP effectively.

The stages are:

	Stage 1	Stage 2	Stage 3	Stage 4	I don't know
1- Changeability of management	☐	☐	☐	☐	☐
2- Limited customization	☐	☐	☐	☐	☐
3- Realizing of ERP Business Implications	☐	☐	☐	☐	☐
4- Data quality	☐	☐	☐	☐	☐
5- Top management support	☐	☐	☐	☐	☐
6- Competent consultants	☐	☐	☐	☐	☐
7- Skilled employee	☐	☐	☐	☐	☐
8- Great implementation team	☐	☐	☐	☐	☐
9- Extensive education and training	☐	☐	☐	☐	☐
10- implementing standardized software packages	☐	☐	☐	☐	☐
11- Alignment of IT with business	☐	☐	☐	☐	☐
12- Clear understanding of strategic goals	☐	☐	☐	☐	☐
13- Excellent Project management	☐	☐	☐	☐	☐
14- Clarity of Potential cost	☐	☐	☐	☐	☐
15- Readiness of organization	☐	☐	☐	☐	☐
16- ERP vendor support	☐	☐	☐	☐	☐
17- Other (Please indicate)	☐	☐	☐	☐	☐

Appendix (2): Interview Questions

1) Could you please give a brief description of your current work and IT projects you are involved in?

2) Could you please shed some lights on your work experience and roles in regard to Cloud ERP implementation projects?

3) What were the key-drivers in migrating ERP to cloud?

4) What were the main challenges of Cloud-based ERP implementations?

5) In your perception, what are the three most critical success factors of Cloud-based ERP implementation?

6) Did your company conduct any kind of assessment before/ after cloud-based ERP implementation?

7) Do you have any other comments, please?