A CRITICAL REVIEW OF CHANGE MANAGEMENT AND TECHNOLOGY ADOPTION FACTORS TO DRIVE ORGANISATIONAL PERFORMANCE: A STUDY OF THE ABU DHABI NATIONAL OIL COMPANY (ADNOC)

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Abstract

The study of technology-based change and innovation is receiving much attention from academics and practitioners as change/innovation plays a vital role in organisations' growth success and improved performance. Despite the potential benefits associated with new technologies, employees and organisations are generally reluctant to adopt them. In response to this issue, this study aims to enhance the general understanding concerning the factors that affect employees' adoption of technology in a Middle Eastern country (UAE), where the results can also be applied to other Arab countries in the region.

In spite of the recent progress in understanding how radio frequency identification (RFID) systems can substantially advance logistics and other services within the oil and gas sector, there is a significant gap in the literature concerning determinants of RFID application in managing various forms of operations. Hence, this study attempts to fill this gap by examining the key enablers and impediments of adopting RFID systems in the UAE oil and gas sector using the technology, organisation and environment framework (TOE). The purpose of this research is to refine and expand technology adoption theory for the oil and gas sector by testing the technology–organisation–environment framework in the Abu Dhabi National Oil Company (ADNOC) UAE. The research work identifies and ranks factors impacting employees' decision to implement RFID in ADNOC UAE.

A theoretical model was developed using a variety of TOE factors that may enable or impede RFID adoption in managing operations within the oil and gas sector. Then, the model was empirically tested by means of Structural Equation Modelling (SEM) based on survey data of 301 online questionnaire responses that were collected from managers, technicians, physicians and general employees working in ADNOC UAE. Results showed that Technology Competence, Top Management, Competitive Pressure, Firm's Size and Government Regulations showed significant and positive relationship with employees' intention to adopt RFID. However, perceived usefulness, perceived ease of use and perceived financial cost were found to have no significant effect on employees' willingness to adopt RFID.

The study contributes to the empirical research within the field of RFID and technology adoption in the UAE oil and gas sector. Furthermore, the findings of this study enable managers to make an informed decision about technology adoption within the oil and gas logistics setting.

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Declaration

I hereby declare that no portion of this work has been submitted in support of an application for any other degree or qualification at this or any other university or institution of learning. In addition, I hereby confirm that, this thesis is solely my work and all work of others cited in this thesis have been acknowledged.

Signed: *Ibrahim AlKhoori*

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List of Abbreviations

AGFI	Adjusted Goodness-of-Fit Index (Model appropriateness measure)
AMOS	Analysis of Moment Structures (Quantitative data analysis software)
AVE	Average variance extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index (Model appropriateness measure)
CM	Change Management
CR	Composite Reliability
DF	Degree of Freedom
ECO	Economy
EFA	Exploratory Factor Analysis
GFI	Goodness-of-Fit Index (Model appropriateness measure)
IS	Information Systems
IT	Information Technology
KMO	Kaiser-Meyer-Olkin (Sampling adequacy measure)
MI	Modification Indices (SEM measure)
OD	Organisational Development
PCA	Principal Component Analysis
QC	Quality of Communication
RMR	Root Mean Square Residual (Model appropriateness measure)
SEM	Structural Equation Modelling (Quantitative data analysis technique)
SMC	Squared Multiple Correlations (SEM measure)
SPSS	Statistical Package for Social Science software)
SR	Standardised Residuals (SEM measure)
SRW	Standardised Regression Weights (SEM measure)
TEC	Technical Infrastructure
TM	Top Management
VIF	Variance Inflation Factor

Chapter 1: Introduction

1.1 Introduction

This chapter begins by introducing the background to the topic under investigation, and proceeds to outline the research problem and scope of the study. It then highlights the general aim of the study, and presents a clear statement of the objectives and research questions. Next, the overview of the context and significance of the research is highlighted before ending with an overview of the structure of the thesis.

1.2 Background and Scope of the Study

The pace of innovation and technology adoption has increased significantly in recent years and is set to accelerate even further in a highly competitive environment, where organisations often have to fight to develop even faster to stay in existence in a new atmosphere of ‘hyper competition’ (Kuipers et al., 2013). However, whilst new technology adoption has increased in importance, technology adoption project failures are an unfortunate reality for many organisations, and radio frequency identification (RFID) projects are no exception.

RFID is an automated data-collection technology that enables equipment to read tags at a distance, without contact or direct line of sight (Lee and Jung, 2016; Want, 2004; Brown and Russell, 2007). Moreover, RFID is a new technology that dramatically changes the capabilities of the organisation to acquire a vast array of data about the location and properties of any entity that can be physically tagged and wirelessly scanned within certain technical limitations (Want, 2004; Angeles, 2005; Musa and Dabo, 2016). The RFID system consists of three basic components: a tag, a reader and back-office data-processing equipment. The tag contains unique identification information of the item to which it is attached; the reader emits and receives radio waves to read the information stored in the tag; and the data-processing equipment processes all the collected data (Wu et al., 2006; Lee and Jung, 2016). This equipment can be as simple as a personal computer or as complex as an entire networked enterprise management information system. In addition, RFID technology allows non-line-of-sight, non-contact and multiple-tag simultaneous-reading capabilities, which is more efficient than scanning barcodes for product tracking (Shi and Yan, 2016). The advanced real-time communication and unique identification properties of RFID technology enable it to contribute, in multiple ways, to improving large-scale industrial activities and processes. Therefore, RFID has attracted considerable attention as a technology that improves organisational performance; thus, numerous organisations are adopting RFID in order to reap the benefits of more efficient and automated business processes (Bhattacharya and Wamba, 2015; Shi and Yan, 2016).

In the past few years, RFID technology has led to much hope and optimism (Wu et al., 2006; Musa and Dabo, 2016). The mainstream press hails RFID as the avant-garde in technology and business. For example, CNN identified RFID as one of the top 10 emerging technologies to watch. However, despite promising benefits and huge investments, an estimated 55% to 75% of new information technology-based system implementations fail to meet their objectives (Shi and Yan, 2016). Given that RFID is one of the biggest IT investments large and mid-sized organisations make, it is critical to further explore why these projects fail, wasting billions of dollars annually. In practice, RFID technologies have been implemented widely in some developed countries through governmental and business projects, e.g., WalMart and DHL (Bhattacharya and Wamba, 2015; Wu et al., 2006). Despite the wide penetration and experience acquired, the types of changes implementing RFID systems requires have increasingly become unmanageable in organisations, leading to RFID implementation failures (Maguire et al., 2010). While the emerging literature of RFID adoption and use has demonstrated the high operational and strategic value of this technology (Ngai et al., 2014), the adoption and implementation challenges are still under-researched (Bhattacharya and Wamba, 2015; Lee and Jung, 2016). Thus, there is still more need to analyse the drivers of RFID adoption in different industrial contexts for a better understanding.

The unique characteristics offered by radio frequency identification (RFID) technology distinguish it from other technologies and so RFID warrants further investigation, specifically around its adoption (Bhattacharya and Wamba, 2015). While it is worthwhile to study applications of RFID particularly in the oil and gas industry, few studies have examined factors that influence RFID adoption and implementation in the oil and gas sector. Similarly, there are very few studies in the context of the Arab world. Although the RFID application is growing in the Arab world, related successful projects have been rare, with most still at the experimental stage. Furthermore, ERP implementation in developing countries is plagued with specific challenges like industrialisation, IT infrastructure and economic nuances, beyond those faced by the developed world (Xue et al., 2005; Bhattacharya and Wamba, 2015). To mitigate the risks of failure when such high investment costs are involved, understanding the factors that influence RFID systems' adoption is a significant process that requires attention. These factors must be controlled and continuously evaluated throughout the change process to avoid significant threats including budget overruns, missed timelines and breakdowns in business. In summary, the fact that the oil and gas sector of the Arab world is not adopting RFID technology as effectively as expected suggests that the area of RFID adoption demands more empirical research that could shed some light on the uncertainty associated with the adoption decision. This study is one such attempt.

1.3 Research Context and Rationale of the Study

While there has been a wide acceptance and penetration of RFID system implementations in developed countries such as the US, UK and Canada, less developed countries have lagged behind with this technology trend. The acceptance and implementation of RFID systems is largely dependent on people's intention to adopt change because the workforce is at the heart of the change process. However, change is not simply an exercise in convincing the various stakeholders to get on board; it is an exercise in negotiation and compromise. Most of the research work regarding the understanding of change processes has focused on macro-level factors (Cunningham, 2006), which include organisational and environmental variables. Due to the high failure rates of change projects (Weiner, 2009), researchers need to shift their focus from the macro-level to micro-level individual factors affecting the change process (Hameed et al., 2017; Devos et al., 2007). Therefore, there is a need to study factors that may affect employees' attitude towards change at the micro-organisational level.

Although various attempts have been made to investigate effective ways of implementing technology successfully, there remains insufficient consensus or unequivocal understanding of the mechanisms by which technology can most effectively be integrated into organisations (Karlsson et al., 2010). Moreover, there is a lack of clarity over what factors influence the integration process, and how these are related. Thus, there is a need to understand the applicability of such integration mechanisms in different contexts and circumstances.

Use of RFID has been well established for retail industry applications for tracking the goods at different points in the supply chain, but the possible uses of RFID in the oil and gas industry has not been greatly publicised. Although the applications of RFID can be limitless, a few applications relevant to the oil and gas industry are summarised in the following figure.

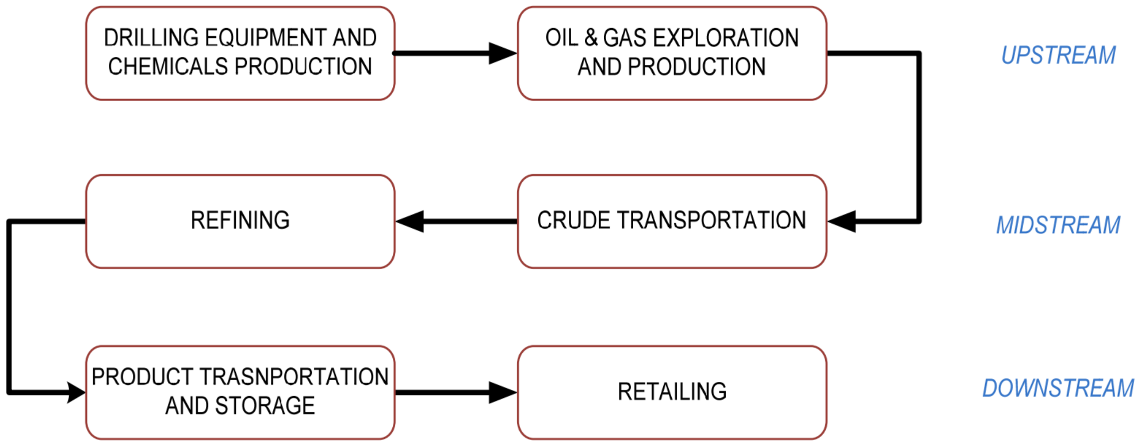

Figure 1. 1 Key Features of the Oil and Gas Sector

Source: Adopted from Gaukler et al. (2009) and Felemban and Sheikh (2013).

According to Gaukler et al. (2009), the manufacturing process of pipes provides ample opportunities for RFID implementation. Pipes and other drilling equipment are often pre-ordered and stored at the oil rigs. The authors further explain that tags can be embedded into these pipes during manufacturing to prevent rework during later stages. To do this, a small section of pipe can be cut to place the tag. Alternatively, tags can be attached to the outside of pipes using adhesives or plastic collars. Tagging a drill pipe, casing or collar can be beneficial not only to the manufacturer, but also to every member of the supply chain who uses the pipe – from manufacturer to logistics provider to operating personnel on the rig. Some common benefits shared by all members include effective inventory management, storage and handling improvements, keeping track of age and usage of the pipe, and preventing fatigue failure (Gupta, 2005; Gaukler et al., 2009).

With the emergence of alternative and renewable energy techniques, the oil and gas industry is now considering a range of digital technologies to enhance the productivity, efficiency and safety of their operations while minimising capital and operating costs, health and environment risks, and variability in the oil and gas project life cycles (Wanasinghe et al., 2020). RFID adoption in this industry has proven to provide greater and faster quality control, optimise production scheduling, increase production yields and reduce production overhead (Felemban and Sheikh, 2013; Wanasinghe et al., 2020). While it is worthwhile to study applications of RFID in the oil and gas industry, very few studies have examined factors that influence RFID adoption in oil and gas supply chains (Wanasinghe et al., 2020). When considering the geographical distribution of the technology adoption-related research in the oil and gas industry, the United States (US) is the leading country, followed by Norway, the United Kingdom (UK), Canada, China, Italy, the Netherlands, Brazil, Germany, and Saudi Arabia (Wanasinghe et al., 2020). To the best of our knowledge, there is no technology adoption study in the context of the oil and gas sector of the UAE. Additionally, the majority of the publications presented theoretical concepts rather than industrial implementations. The introduction of RFID into the oil and gas industry within the UAE thus serves as an important premise for analysing factors influencing RFID adoption. RFID technology application in the oil and gas industry is bound to be affected by various factors. Identifying these factors will play a key role in RFID technology adoption. This study thus investigates the process and factors of technology adoption with special reference to the Abu Dhabi National Oil Company (ADNOC) in the UAE oil and gas sector.

ADNOC remains a force to reckon with in the global oil and gas industry. With over 55,000 workers, the company reaches beyond the production, processing and distribution of the oil and gas sector. The company also controls all the oil and gas reserves in the Emirate of Abu Dhabi, reaching over 100 billion barrels; one of the top 10 largest oil reserves in the world. With 17 subsidiaries (recently 14 after combining two oil & gas producing subsidiaries to form ADNOC Offshore and combining all logistics subsidiaries to form ADNOC LNS), ADNOC Offshore remains at the forefront of the company's money-making machinery in the areas of exploration and production.

Even though the UAE – and Abu Dhabi, in particular – continues to implement measures to diversify its economy, the oil and gas proceeds continue to play an essential role in overall government expenditure. With ADNOC overseeing all government oil and gas proceeds in the Emirate, the company's critical role in the past, present and future of the Abu Dhabi Emirate cannot be over-emphasised. Adopting efficient and performance-focused methods in this sector remains critical for the people and government of the Emirate.

The selection of ADNOC for the present investigation is in the interests of Abu Dhabi's people and government. It is also an attempt to provide a validated model of change management through technology adoption, which can be implemented in other areas of the globe in the bid to improve oil and gas performance. Even for economies that do not depend heavily on the proceeds of oil and gas, it is still essential to ensure effectiveness in oil and gas institutional operations as the repercussions of a weak oil and gas market go beyond the companies' borders to severely affect global economies (Bagirov and Mateus, 2019; Cuñado and Perez de Gracia, 2003; Faff and Brailsf, 1999; Lele, 2016; Yahia, 2008).

Therefore, as highlighted in the above section, there still remains some ambiguity surrounding factors such as the organisational decision to adopt and implement RFID, and the interaction of RFID with technological and organisational characteristics. The next section describes how this study contributes towards closing some of these research gaps.

1.4 Research Aim

The main aim of this study is to investigate the change management factors that influence the adoption of RFID technology by its end users in the context of ADNOC UAE. The successful technical integration of RFID technology does not guarantee its successful adoption by the end users. This seemingly successful change can be resisted by the end users for various reasons, leading to a negative impact on adoption and eventually system sabotage. Further to investigating the change and innovation management factors, this study also aims to develop an integrated model that will provide a holistic view on why RFID adoption/implementation fails and how to avoid RFID failure pitfalls. Given this context, this study aims to answer the following research questions:

1. What are the key factors that influence employees' positive attitude and behaviour towards RFID adoption in the context of ADNOC UAE?

2. How do known factors influence RFID adoption and what are the most key factors to consider when implementing RFID in ADNOC UAE?

3. What is the level of validity of the proposed factors (technology, organisational and environmental) in Abu Dhabi in terms of employees' acceptance for technology-based change?

This thesis sets out to investigate the research questions listed above, with the objective of attaining the aims of the study. The following section gives an overview of the significance of the study.

1.5 Significance of the Study

As noted in earlier sections, there is a gap in our knowledge relating to UAE oil and gas sector employees' predispositions to adopt RFID. The research undertaken in this study tries to fill that gap by providing insights from its empirical study with adopter and non-adopters, and thus it provides incremental insights towards the literature of change and innovation management, and the culture of the Middle East according to Corley and Gioia's (2011) classification of what constitutes a theoretical contribution. Additionally, there is a shortcoming in the literature relating to technology acceptance, in that most of the models developed thus far have focused on the influence of technology characteristics on the individuals' attitudes towards adoption of an innovation; they have overlooked the importance of individuals' personal characteristics in shaping adoption behaviour (AbuShanab et al., 2010; Montazemi and Saremi, 2013).

This research provides a new way of approaching RFID user adoption by integrating technology adoption and change management factors. This identifies key points of failure that often lead to resistance. Secondly, this novel approach and model adds to existing literature by exploring the underpinning change management factors that influence the adoption of RFID systems, by identifying the underlying constructs and explicitly showing the consequences of deviating from addressing these constructs.

Moreover, the study is unique in a way that it integrates two well-known and respected technology acceptance models, i.e., technology acceptance model (TAM) and technology, organisational and environmental (TOE) framework, such that both user-related and external environment-related factors were included in the research model in addition to the original constructs of the two models. Hence, it provides revelatory insights (Corley and Gioia, 2011) as a contribution to the theory of technology adoption in general, and in the oil and gas sector in particular. In addition, findings should benefit similar countries in the region, and the study brings empirical evidence from a relatively new cultural context, taking into account that most of the technology-based studies have US/Anglo-centric origins.

Since the model developed in this research is grounded in reality by employees from the organisation who have experienced technology-based change, thus, the managers may use this model to precisely identify the failure points that can lead to resistance during the RFID implementation. Even though the concept of technology adoption and change management are not new, their integration to produce a practical model explaining the cause and effects of the factors that influence adoption is novel. The model and adoption index tool developed in this research should be used to assess failed implementations and during new implementation plans for effectiveness. This will save organisations from the cost associated with failed technology implementations.

1.6 Layout of the Thesis

In seeking to identify the reasons for technology implementation failure, how to mitigate these failures and the role change management plays, this introductory chapter has set the context, scope and structure of the study. The proceeding chapters will answer the research questions and achieve the overall aim of the study by addressing each set objective in detail. The forthcoming chapters will be structured as follows:

Chapter 2 – Literature Review

A systematic review of literature is conducted and presented as position papers. It critically reviews a combination of adoption theories and information system (IS) success framework studies, highlighting contributions and gaps with respect to change management and resistance to change. Finally, a conceptual framework is developed which presents the variables and conceptual model.

Chapter 3 – Conceptual Framework Development

The construct of this chapter is to develop research hypotheses to examine employees' acceptance predictors for organisational change. To address the hypotheses effectively, the researcher reviews and integrates subject areas such as organisational change and its impact on an individual employee, conceptual approach, theoretical frameworks, employees' commitment to the organisation and career, social relationships in the workplace and demography. This leads to the clarification of the research area and development of a conceptual framework, which consists of key constructs adopted from the literature. The constructs of the theoretical framework are categorised as technology, organisational and environmental factors. The main purpose of the proposed conceptual framework is to be used as a road map for empirical data collection and analysis, and to establish a comprehensive overview of change process in the UAE oil and gas context.

Chapter 4 – Research Methodology

This includes a detailed discussion of the empirical research methodology including data collection and data analysis procedure. The data collection section is described in five parts as: (a) data collection, (b) sample selection and participation, (c) developing the survey questionnaire, (d) measurement scales and (e) pilot study. After that, reliability and validity are discussed to justify the data. The chapter also discusses what kind of data is required to examine the variables. Then, data analysis processes and statistical techniques are selected to analyse the data. Finally, the target population and sampling strategy in each phase are described, and data analysis techniques are presented. The chapter ends by discussing ethical considerations made in the study.

Chapter 5 – Quantitative Data Analysis

This chapter presents the analysis and findings of the main survey. The researcher uses the Statistical Package for Social Sciences (SPSS version 26) to run tests on the questionnaire answers. The chapter begins with data management, data screening, demographic characteristics, factor loading, exploratory factor analysis and assessment of model fit. The chapter ends by showing the outcomes of hypotheses testing.

Chapter 6 – Discussion

This chapter provides an interpretation of the main findings in light of the literature reviewed in chapters 2 and 3. It concentrates on how these findings provide answers to the research questions highlighted in Chapter 1, and thereby satisfy the aim of the study.

Chapter 7 – Conclusion

The final chapter summarises the key findings of the research, draws a conclusion based on these findings, discusses the limitation of the research, presents theoretical and managerial implications, and highlights the contribution to the existing body of knowledge. Additionally, the concluding chapter provides guidelines that will help policy makers and managers to implement technology effectively. Finally, suggestions for future research are offered.

Having now outlined the background, purpose, significance and structure of this study, the relevant aspects of our current knowledge of change management, organisational development and technology adoption will be considered next in the literature review section. Following this, research methods and strategies will be considered.

Chapter 2: Literature Review

2.1 Introduction

Since the inception of information systems, there has been an ongoing quest among researchers to discover the key factors that may influence people to accept/adopt and make use of new systems. This issue is of particular importance for organisations because, by understanding influencing factors, management will be able to understand employees' perceptions and intentions towards a given IS. Furthermore, this will also enable system designers and developers to enhance the use and acceptance of newly developed systems through focusing on user-centred design choices. Over the decades, researchers have been investigating the factors predicting user acceptance of new technology into an organisation. In this regard, researchers have developed and used various models to understand and enhance user acceptance of new technologies.

In this chapter, the researcher mainly discusses the research that has been conducted in the field of individuals' acceptance of information systems and technology integrations. Additionally, the literature review covers sufficient ground to ensure a solid perspective on the factors that may support the development of positive employee attitudes and behaviours. The literature review demonstrates a clear understanding of the research topic, identifies the major studies related to the research area, indicates the different points of view on the research topic, draws clear and appropriate conclusions, and demonstrates the relevance and importance of the research problems. The chapter begins with an overview of technology-based organisational change and the behaviour of employees in difficult times of organisational change. Previous studies on employees' acceptance/adoption predictors are then reviewed. Finally, the research gap is highlighted and discussed.

2.2 Integrating New Technology into an Organisation

To remain competitive in a global economy, businesses need to adapt to an ever-changing environment (Al-Haddad and Kotnour, 2015; Gwaka et al., 2016). Staying competitive means continuing to evolve as an organisation and making changes to both process and technology to gain a competitive edge over their competition (Karlsson et al., 2010; Wetzel and Van Gorp, 2014). Repeated economic crises and steadily increasing competition, brought about in particular by the globalisation of markets, are forcing an unprecedented rationalisation of resources (Gagnon and

Dragon, 1998; Karlsson et al., 2010). Improved productivity has thus become a concern of all organisations, both public and private. At the same time, technology is developing with salient speed and is becoming the principal instrument for meeting this concern (Andrade et al., 2016; Luo et al., 2006). Technology change has been beneficial to both organisations and their employees. Leading firms often seek to shape the evolution of technological applications to their own advantage (Lai, 2017). In general, technology change can bring increased efficiency, improved quality, assist in bringing products to market quicker and expand the skill set of employees (Gwaka et al., 2016; Delaney and D'Agostino, 2015). Technology can also bring benefits such as improved communication and reduced costs, and help foster new innovations (Andrade et al., 2016; Lee and Jung, 2016; Lai, 2017). Additional benefits may be seen depending on the specific type of technology that is being implemented. However, the advantages offered by technologies, especially in terms of enhancing productivity, depend upon how these technologies are integrated into an organisation (Delaney and D'Agostino, 2015).

The use of technology to support business processes for success and growth has been widely studied by scholars. Many studies have shown a positive correlation between employing technology and improved business processes (see for example, Indarti and Langenberg, 2004 and Aragón-Correa et al., 2008). However, much of the research relating to the performance of businesses through technology is dedicated towards information systems rather than looking directly at technology and innovation concurrently to establish a link with performance. This is supported by Love and Roper (2015), who identify this weakness and suggest that evidence related to the connection between innovation and technology to performance is simplistic in nature. Whilst most organisations understand the role that innovation can play to transform their businesses, introducing technological innovation is not always cost effective. Considerations must be made to distinguish two different circumstances, the first one being the likelihood that some businesses may not have the financial stability to implement these changes. The other consideration that has to be made is a failure to adopt and implement technologies into organisations (Hossain et al., 2017; Karlsson et al., 2010).

Information system researchers have found understanding the acceptance and use-behaviour of organisations towards innovation a major challenge (Karlsson et al., 2010). They agree that the adoption of a technological innovation, particularly one that is complex and expensive, is unlikely to occur in a single stage; organisations first accept it, the full use would be incrementally adjusted by defining the extent of use (Hossain et al., 2017). Introduction of new technology can provide significant benefits to an organisation but can also present many challenges that need to be managed to gain a positive outcome. Managers thus need to understand and tenaciously manage the factors which affect the technology integration process (Karlsson et al., 2010). However, problems arise when organisations attempt to bring in a new technology without proper management and training for their employees (Delaney and D'Agostino, 2015). Implementing technology thus needs efficient and successful management. Changes cannot always be claimed to be easily and successfully implemented. The reason for such a difficulty is reluctance, unpreparedness, lack of understanding and, finally, resistance that the employees and consumers show when encountering changes (Val and Fuentes, 2003; Yilmaz and Kılıçoğlu, 2013; Mullins, 2005). Introducing changes within an organisation can cause disruptions in patterns or behaviours that can cause uncertainty and stress among employees (Agboola and Salawu, 2011). Adopting new technology can mean changes to job responsibilities, added workload, additional training and leaving the comfort zone (Yilmaz and Kılıçoğlu, 2013). Thus, employees often resist the implementation of new technology (Canning and Found, 2015; Bovey and Hede, 2001). On the other hand, some researchers suggest that promotion-focused employees would embrace the new technology because it would provide them with a sense of achievement and accomplishment (Halvorson, 2011; Delaney and D'Agostino, 2015). Given that technology integration is a management challenge, which impacts on the success of the business as a whole, this research sets out to identify the mechanisms which enable the integration process and to portray the conditions under which the use of each mechanism is appropriate.

Technology adoption has become a mature field. Scholars and practitioners have investigated technology usage behaviour in various sectors like banks, telecommunication, oil and gas, manufacturing, finance, and government (Al-Jabri and Al-Hadab, 2008). However, despite the growing importance of technology integration into organisations, we do not know enough about how to manage the process of technology integration, particularly in cases where the new technology is sourced externally (Karlsson et al., 2010). Additionally, while there are many studies which identify specific integration mechanisms (Legris et al., 2003), we know little about how to harness them effectively in combination and in different sets of circumstances (Karlsson et al., 2010).

There is a wide agreement among academics and practitioners that successful technological change execution would be strongly fostered and carried out both by employees (Montargot and Lahouel, 2018; Randhawa et al., 2016), and in the way they acquire, organise and make sense of this change (Bean and Eisenberg, 2006; Montargot and Lahouel, 2018). Although the successful integration of modern technology is accepted as a necessity in order to survive and succeed in today's highly competitive and continuously evolving environment (Andrade et al., 2016; Legris et al., 2003), several researchers report a failure rate of around 70% of all technology-based change programmes initiated (see for example, By, 2005 and Aladwani, 2001). It may be suggested that this poor success rate indicates a fundamental lack of a valid framework of how to implement and manage organisational change, as what is currently available to academics and practitioners is a wide range of contradictory and confusing theories and approaches (By, 2005; Burnes, 2005). In conclusion, technology change can be difficult to manage; however, organisations can increase their ability to successfully implement these changes if they plan, communicate, manage conflict and monitor all aspects of the change they are making. The next section discusses different aspects of organisational change management in detail.

2.3 Organisational Change Management: An Overview

Change management refers to the adoption of an idea, procedure, process or behaviour that is new to an organisation (Makumbe, 2016; Stanleigh, 2019; Berger, 1994). According to By (2005), change management has been defined as the process of continually renewing an organisation's direction, structure and capabilities to serve the ever-changing needs of external and internal customers. Burnes (2000) depicted that change is a multi-level, cross-organisational process that unveils a disorganised and incompetent trend over a period of time and comprises a series of interlocking projects. He also considered organisational change management as a continuous process of experiment and adaptation intended to match an organisation's capabilities to the needs of a volatile environment. The general aim of the organisational change is an adaptation to the environment and improvement in performance (Val and Fuentes, 2003). Due to the importance of organisational change, its management is becoming a highly required managerial skill (Senior, 2002; Gwaka et al., 2016).

Research literature on organisational change suggests that terms such as organisation change, change management and organisation development have been used interchangeably (see for example, Al-Haddad and Kotnour, 2015; Stanleigh, 2019; By, 2005). Change management and organisational development literature suggest that, in the current era of globalisation, there is a constant pressure on organisations to adopt new technologies, be competitive, and revise strategies for their survival and growth (Burnes, 2005). Therefore, organisations need to have an ability to adopt and implement change in order to remain competitive (Makumbe, 2016). Organisational performance is positively influenced by the presence of change management practices, which tend to make a significant contribution to organisational competencies, and this in turn becomes a great boost for further enhancing innovativeness (Ndahiro et al., 2015). Organisations' top management often link the maximisation of performance with change management practices. Although the successful management of change is accepted as a necessity in order to survive and succeed in today's highly competitive and continuously evolving environment, Makumbe (2016) and Stanleigh (2019) report a high failure rate of all change programmes initiated. It may be suggested that this poor success rate indicates insufficient consensus or unequivocal understanding of the mechanisms by which change can most effectively be implemented into organisations (Karlsson et al., 2010; Burnes, 2005). In particular, there is a lack of clarity over what factors influence the change process, and how these are related.

Even though it is difficult to identify any agreement regarding a framework for successful implementation of organisational change management, there seems to be an agreement on two important matters. Firstly, it is agreed that the pace of change has never been greater than in the current business environment (Kotter, 2010; By, 2005). Secondly, there is a consensus that change, being triggered by internal or external factors, comes in all shapes, forms and sizes (Burnes, 2005; Carnall, 2003; Kotter, 2010; Luecke, 2003; By, 2005), and therefore affects all organisations in all industries. Therefore, there is an ever-growing generic literature emphasising the importance of change and suggesting ways to approach it. The complexity of the issues related to management of change has led to a number of different ways of categorising organisational change management. For instance, incremental and radical change (Burnes, 2005); strategic and non-strategic change (Pettigrew and Martin, 1987); episodic and continuous change (Kitchen and Daly, 2002; Weick and Quinn, 1999); transitional and transformational change (Ackerman, 1997); change at individual and organisational level (Burnes, 1992); planned change and emergent change (Wilson, 1992); small-scale and large-scale change (Al-Haddad and Kotnour, 2015) ; and top-down change and bottom-up change initiatives (Ackoff, 2006).

Technological advances in the form of new scientific knowledge and technological developments are causing significant change in the business arena (Gwaka et al., 2016; Karlsson et al., 2010). The consumption of large-scale information systems has increased greatly in recent years. Enterprise Resource Planning Systems, Customer Relationship Management Systems, HR Management Systems and Supply Chain Management Systems are some examples of information technology-driven techno changes which have been progressively more implemented in different organisations (Harison and Boonstra, 2009). The search for new solutions to the issues of managing and organising commercial success has found new approaches. In recent years, the radio frequency identification (RFID) system has emerged as a means of integrating the diverse functions of organisations, resulting in reforming operations for organisational success. Management control systems, information management systems and the use of RFID provide real-time information to assist managers in their decision making to achieve desired organisational outcomes or goals efficiently (Badru and Ajayi, 2017). However, as mentioned previously, the rate of successful implementation of technological change to improve organisational performance is very low (Lunenburg, 2010; Sarker, 2006). The largest contributor to the failure of the technology-based change initiatives is an inability to manage people in difficult times of change. Organisational change is rooted in personal change (Steinburg, 1992), meaning that, if organisational change is to take place, individual change is needed as well (Johannsdottir et al., 2015). People are at the heart of the change process (CIPD, 2017; Choi, 2011) and paying attention to peoples' engagement can make the process smoother, quicker and ultimately more effective. Moreover, the literature related to organisational development and change management intensely suggests that employees' beliefs, perceptions and attitudes are critical in difficult times of change (Schalk et al., 1998; Weber and Weber, 2001). An employee's decision to accept or reject change is often affected by how the change is seen to affect the sense of the individual's identity in the organisation. The reactions of change recipients, including low-ranking members of the organisation, play a key role in determining whether a change programme will succeed (Cai et al., 2018; Bartunek et al., 2006). The next section discusses the employees' (change recipients') possible attitude and reaction towards change.

2.4 Employees' Attitude towards Change

Employee attitude towards organisational change is defined as an employee's psychological tendency expressed by overall positive or negative evaluative judgement of a change (Lines, 2004). It is also described as a continuum ranging from strong positive attitudes (e.g., readiness for change, openness to change) to strong negative attitudes (e.g., cynicism about organisational change, resistance to change) (El-Farra and Badawi, 2012; Bouckenooghe, 2009; Bovey and Hede, 2001). Change recipients can display affective, cognitive and behavioural reactions (Oreg et al., 2011). This study is focused on behavioural reactions, typically considered as a dichotomy of acceptance and resistance (Bovey and Hede, 2001; Val and Fuentes, 2003). It is important to study change recipients' reactions to organisational change as the failure of many corporate change programmes is often directly attributed to employees' resistance (Mosadeghrad and Ansarian, 2014; Pieterse et al., 2012; Bovey and Hede, 2001). Lack of employees' support and involvement is the most frequently cited problem encountered by management when implementing change (Dievernich and Tokarski, 2015; Bovey and Hede, 2001). Moreover, successfully managing people is a major challenge for change initiators and is arguably of greater importance than any other aspect of the change process (Dievernich and Tokarski, 2015). An organisation's senior management usually focuses on the technical elements of change with a tendency to neglect the equally important human element which is crucial to the successful implementation of change (CIPD, 2017; Devos et al., 2007; Hameed et al., 2017). Therefore, in order to successfully lead an organisation through major change, it is important for management to balance both human and organisation needs (Bovey and Hede, 2001).

When an organisation undergoes changes, organisational members develop different interpretations and expectations about these changes (Chiang, 2009; Lines, 2004). Thus, understanding of the structure and functioning of attitudes towards organisational change is important for predicting reactions to change, and for suggesting interventions that minimise negative reactions to change (El-Farra and Badawi, 2012). In recent change management literature, changing the mindsets and attitudes of people towards change is considered to be a greater challenge compared to other factors such as cost, leadership and project complexity (Hechanova et al., 2018). Organisational change is driven by personal change and individual change is required in order for organisational change to succeed. Organisational scholars have shown that the success of change initiatives may be determined by the individual's response to the change. An organisation's functioning is composed of the functioning of all its members; thus, it can only change when members' behaviour changes (Kavanagh and Ashkanasy, 2006). Change in individual organisational members' behaviour is thus at the core of organisational change (Kotter, 2010; Wittig, 2012; Weber and Weber, 2001). Employees' attitude towards change may be affected by the type of change being implemented. For example, incremental change occurs over time in small, orderly steps and with democratic leadership that includes employee consultation. As this type of change involves employee participation in the change, employees are more likely to have positive attitudes about the change (Jones et al., 2008). In contrast, radical change involves sudden, substantial changes to organisational processes. Thus, the vision, identity, strategies and values of the organisation are redefined, resulting in significant and permanent changes to the organisation's structure (Hernandez and Leslie, 2000; Jones et al., 2008). A relative lack of employee participation in such change is likely to lead to more negative attitudes about the change.

Every individual experiences change in a unique way. For some, it implies a source of joy, benefits or advantages, whereas for others it is a source of suffering, stress and disadvantages. In the same vein, Edmonds (2011) explains that the people undergoing the change are crucial, and there will naturally be some who will resist the change and some who will buy-in. This variety in perceptions and reactions is also reflected in the work of scholars using a variety of ways for conceptualising people’s reactions towards change (Bouckenooghe, 2010). Some use positive terms such as readiness for change or commitment to change (Connor, 1993; Herscovitch and Meyer, 2002; Bernerth et al., 2007), whereas others use negative terms such as resistance (Yilmaz and Kılıçoğlu, 2013; Pihlak and Alas, 2012), and others prefer the more all-encompassing term attitude towards change (Bouckenooghe, 2010). To enable leaders of change to identify employees' acceptance and resistance, it is important to understand and operationalise definitions of reactions to change. The next sections thus discuss the employees' attitude (acceptance and resistance) towards change in detail.

2.4.1 Employees' Resistance to Change

Even though change is implemented for positive reasons (e.g., to adapt to changing environmental conditions and remain competitive), employees often respond negatively towards change and resist change efforts (Jones et al., 2008). Prevailing views of resistance to change often are dominated by negative interpretations offering resistances as irrational and dysfunctional reactions conducted by the recipients of change (Val and Fuentes, 2003; Jones et al., 2008; Bouckenooghe, 2010). Resistance to change has long been recognised as a critically important factor that can influence the success or otherwise of an organisational change effort. The notion of 'resistance to change' is often attributed to the work of Kurt Lewin (1951). Lewin developed his concept based on the 'person' as a complex energy field in which all behaviour could be conceived of as a change in some state of a field. The status quo represented equilibrium between the obstacles to change and the forces supporting change (Ansoff, 1988). It was considered that some difference in these forces – a weakening of the barriers or a strengthening of the driving forces – was essential to produce the unfreezing that started a change. Emphasis was laid on the effectiveness to weaken the barriers than to strengthen the drivers (Rumelt, 1995). Lewin's (1951) early force-field analysis clearly placed the people at the centre of attention, with forces for change battling against individual resistance to change such as habits, routines, fear of insecurity and the unknown (Waddell and Sohal, 1998; Nakhoda and Tajik, 2017; Cai et al., 2018).

Resistance is an undeniable reaction towards important changes. People naturally attack changes to defend the present situation, especially when they feel that their security and condition are endangered. While resistance to change can have positive effects in terms of reconsidering strategies, goals and plans (Cai et al., 2018), resistance to change is normally a negative factor that results in members of an organisation being unwilling to put in the effort required to successfully implement a change initiative, thus causing the change initiative to fail (Val and Fuentes, 2003; Jacobs et al., 2013; Cai et al., 2018). The main reasons for this resistance include being accustomed to the existing situation, the changes that occur in social relations, and psychological, monetary and economic reasons (Val and Fuentes, 2003; Yilmaz and Kılıçoğlu, 2013; Mullins, 2005). The organisational changes can muster the feeling of uncertainty and resistance, a fact that makes improvement difficult or even impossible (Nakhoda and Tajik, 2017). Employee resistance should not simply be treated as an obstacle to be overcome but as a valuable source of knowledge and critique of the change programme (Val and Fuentes, 2003). Some authors view resistance as any set of intentions and actions that slows down or hinders the implementation of change (Bouckenooghe, 2010). Others view resistance as part of a process that fosters learning among organisational participants (Msweli-Mbanga and Potwana, 2006). Managers often bring in change without seriously considering the psychological effect it may have on the other members of the organisation, especially those who have not been part of the decision to make the change. Particularly, in the context of technology-based changes, many projects have suffered the consequences of not investing enough time and resources in the people side of projects, highlighting the following: no change management methodology was implemented, failure to involve users within the early stage of the project, inadequate communication of change processes, poor management of user resistance within the organisation and over-emphasis of the technical aspects of project delivery (Brown and Jones, 1998; McGrath, 2002; Hughes et al., 2016). Similarly, Ruben (2009) has developed an extensive list of factors that may negatively influence the reactions of organisational members: not seeing a need for change; regarding the change as a threat to their comfort level, self-interests, self-concepts, or self-identities; fear of changing routines and approaches that may require new knowledge and skills, fear of a change in status; lack of confidence and trust in leaders; and, finally, viewing the change as a threat to the organisation’s future. Regardless of the different factors and perspectives for the concept, it would be fair to say that resistance, at different degrees, is a part of the change process. There is an increasing number of works that draw attention to the positive role that resistance can play, for example, forcing management to rethink or re-evaluate change in terms of plausible concerns raised by organisational members and an opportunity to engage and educate members (Dawson, 2003; Bovey and Hede, 2001; Yuksel, 2017). Considering the centrality of this issue, there is an abundance of literature regarding factors that influence resistance as well as means and methods to overcome, minimise or manage change. In identifying the main causes of resistance, most researchers point out the need for stability, a sense of reduced control, uncertainty, instability, insecurity, conflict, or a fear of losing power, status and benefits (Canning and Found, 2015; Bovey and Hede, 2001; Yuksel, 2017). Similarly, Dent and Goldberg (1999) noted that other potential causes that lead to resistance include fear of change, fear of unpleasantness, lack of trust, uncertainty, poor training, surprise and personality conflicts. Consequently, it is accurate to state that all of the aforementioned factors influence the degree of resistance and receptivity towards planned change efforts. Accordingly, understanding of these factors and ways in which to manage the planned organisational change process will increase the likelihood of a successful implementation of a change effort (Yuksel, 2017).

Most change management writers recognise that employee resistance is to be expected in any major organisational change programme (Pihlak and Alas, 2012; Ansoff, 1988; Yilmaz and Kılıçoğlu, 2013; Mullins, 2005). Whilst there is little disagreement amongst the change experts that resistance is complex, there are differing opinions as to the forms in which this resistance can manifest. Smollan (2011) identifies that resistance can be active (being critical, finding fault, appealing to fear and selective use of facts) or passive (agreeing but not following through, procrastination and withholding information) (Canning and Found, 2015). Similarly, Singh et al. (2012) agree with the concepts of passive and active resistance, but also identify aggressive resistance. Chawla and Kelloway (2004), however, classify resistance into two components: attitudinal, a psychological rejection of the need to change, and behavioural, behaviours that reflect an unwillingness to support the change. One area of little disagreement is the importance of communication (Canning and Found, 2015).

Chawla and Kelloway (2004) identify that good communication is a predictor of trust in the organisation and therefore leads to openness, leading to a positive approach to change. Weller and Bernadine (2007) argue that effective change can be measured through the organisation's ability to present, argue and describe the change. Singh et al. (2012) assert that, not only is communication important, if this is lacking or inaccurate, then employees will fill in the blanks themselves, with inaccurate or damaging information. Found and Harvey (2007) follow a similar line, stating that change success depends on communicating an unambiguous reason and need for the change. In the same vein, Dutton and Jackson (1987) determine that a positive attitude is more likely if the change is framed as having a positive outcome. Further consistent agreement is the concept of the need to engage employees being affected in the management of the change. Many researchers suggest that participation and involvement of everyone in the organisation can reduce resistance, obtain commitment and increase the quality of change decisions (Canning and Found, 2015). Through a variety of experiments, many studies have concluded that groups that were permitted to participate in the design and the development of the changes showed much lower resistance than those which did not participate (Val and Fuents, 2003). Similarly, Levasseur (2010) states that, to overcome resistance to change, mangers need to ensure that change recipients are involved early and often.

Whilst there is general agreement among researchers that resistance to change is a complex issue, there are differing opinions as to the forms in which this resistance can manifest. Smollan (2011) explains that employees' resistance can be active (being critical) or passive (agreeing but not following through). Singh et al. (2012) agree with the concepts of passive and active resistance, but also identify aggressive resistance. Chawla and Kelloway (2004), however, classify resistance into two components: attitudinal, a psychological rejection of the need to change, and behavioural, behaviours that reflect an unwillingness to support the change. Chreim (2006) posits the view that resistance is influenced by people's previous experiences. Similarly, Canning and Found (2015) suggest that studying how employees interpret their experiences of past changes can indicate how they will respond to future changes. In conclusion, change and resistance to change are complex, multi-dimensional concepts that contain many subsidiary issues. These issues can have a heap of effects on those involved, often in ways that are not immediately obvious to organisations. Employees do not actually resist change itself, but, rather, resist the perceived effects of the change, particularly when those effects are misaligned with their personal agendas, they appear to be the precursor to loss, or when they have previous experience of poorly managed change efforts (Canning and Found, 2015). From the above-discussed literature, it can be concluded that change programmes that address the subtle indirect issues of communication, involvement and resistance have more potential for acceptance. Therefore, change agents attempting to achieve organisational change will be well served by paying attention to the need to reduce resistance to change and create readiness for change at both individual and organisational levels. Having now outlined the concept of resistance to change and its implications, the next section discusses the importance of employees' readiness for and acceptance of change.

2.4.2 Employees' Positive Reaction to Change

The broaden-and-build theory proposed by Fredrickson (2001) holds that positive emotions broaden people's awareness and encourage them to try new things. Such positive emotions incline people towards new possibilities and enable them to make worthy choices. This theory partly inspired the present 'acceptance of change' construct and particularly the 'positive reaction to change' dimension because positive emotions predispose people to experience change positively and to benefit from it (Fabio and Gori, 2016). Acceptance for change can be seen as the tendency to embrace rather than shy away from change (Bernerth et al., 2007; Fabio and Gori, 2016). Acceptance for change thus stems from the belief that, in their work and other activities, people who are able to accept change often find that the change has a positive impact on their working lives and their resource levels (Madsen et al., 2006; Rafferty and Simons, 2006). In the change management literature, acceptance is defined as a belief, intention, attitude and behaviour regarding the extent to which change is needed and the organisational capacity to achieve it successfully (Herold et al., 2007; Bernerth et al., 2007; Susanto, 2008; Rafferty and Simons, 2006). Studies on change management and organisational development have stressed the value of ensuring employees' positive reaction for change (see for example, Connor, 1993; Herscovitch and Meyer, 2002; Bernerth et al., 2007). Particularly, in the past few years, individual-level factors for organisational readiness for change have remained the focal point of research (Cai et al., 2018; Hechanova et al., 2018; Hameed et al., 2017). When organisations decide to change strategies or structure, or to implement new processes, the outcome depends greatly upon the awareness, attitude, cooperation and support of employees (Kotter, 2007; Chawla and Kelloway, 2004). Moreover, a fit between organisational culture and personal goals of change recipients has an impact on readiness, and there is a strong positive relationship between employees' active participation and the ultimate achievement of a firm's goals (Johannsdottir et al., 2015; Lines, 2004). Employees' commitment and participation are based on their faith in management and willingness to accept the risk embedded in the changes that take place (Chawla and Kelloway, 2004). If employees are to accept change willingly, they need to believe that the leadership is trustworthy (Johannsdottir et al., 2015). Indeed, the risks that people are prepared to accept are largely dependent on whether they trust their leaders (Cai et al., 2018).

When implementing changes in structure, system or process, individual change has a mediating role because change starts with individual change, and, unless the majority of individuals change their attitudes or behaviours, no organisational change occurs (Kotter, 2007; Alas, 2007). Employees' positive attitudes and behaviours about organisational change are often cited as an essential factor in determining the success of organisational change (El-Farra and Badawi, 2012; Herold et al., 2007). In the context of the technology-based change, employees' readiness has been defined as an individual's propensity to adopt or utilise new technology. When a technological change is being implemented, managerial and operational personnel may decide to adopt it or resist it, based on their perceptions of the technology (Montargot and Lahouel, 2018; Lapointe and Rivard, 2005). Positive user perceptions could lead to higher acceptance and better usage of the new technology. Similarly, negative user perceptions or unmet expectations could lead to resistance and more workarounds, both of which will increase costs for the company (Abdinnour and Saeed, 2014). Regardless of how expensive and up-to-date the technology being implemented, if end users avoid the use of the system and do not accept it well, then the expected benefits of the new technology will not occur. According to Shivers-Blackwell and Charles (2005), there are several reasons that cause individuals in an organisation to have a low readiness for technological change: the purpose is not made clear, participants are not involved in planning, the habit patterns of the individuals are ignored, excessive work pressure is involved, and/or the current condition seems satisfactory. Despite the increasing use of technology in organisations, especially in the private sector, employees' roles as accepters or rejecters have been less examined in previous studies as determinants of technological change implementation success (Hu et al., 2009). Many researchers, however, suggest that employees' positive attitude, particularly within the value chain, will increase the speed of technology acceptance (El-Farra and Badawi, 2012; Montargot and Lahouel, 2018). Similarly, Nicolaou (2004) reported that technology implementation success relies on user participation and involvement in system development, assessment of business needs, and data integration into the new system. More recently, Coeurderoy et al. (2014) explained that the understanding of the factors affecting employees' decisions to accept change is essential to the technological change management. In the literature, many research articles have sought to determine what factors inhibit the acceptance of new technologies by employees (Nah et al., 2001; Nicolaou, 2004; Bradley, 2008), but only few of them have explored the influence of these factors over time (Coeurderoy et al., 2014). The review of the technological change management literature suggests that there is inadequate consensus and understanding among researchers about the strategy and procedure by which technology can most effectively be implemented into organisations. In particular, there is a lack of clarity over key factors that may influence the integration process and people's decision to accept and use the technology (Karlsson et al., 2010). In addition, there is a need to understand the applicability of such integration mechanisms in different contexts and circumstances.

Based on the above discussion, it can be seen that managing employees' acceptance of technological change can be a challenge for any organisation. To successfully implement a technology change, several areas need to be affectively addressed. Challenges with internal conflict or resistance by staff to the change must be managed. Employee training, communication and a multi-generational workforce should all be considered and planned for when selecting a new technology. These factors can be addressed with a well-defined implementation plan, an effective training plan, and open communication between employees and management (Gwaka et al., 2016; Delaney and D'Agostino, 2015). In conclusion, organisations can increase their ability to successfully implement these changes if they can bring people on board and promote positive perceptions about change. Therefore, researchers and practitioners need to focus on the conditions under which employees support organisational change. To this end, researchers have asked the question regarding what indicates employees' support for organisational change. As a result, they have focused on various attitudinal constructs that represent employees' attitudes towards organisational change. Constructs such as readiness for change, commitment to change, openness to change and acceptance for organisational change are examples (Eby et al., 2000; Choi, 2011). All these concepts are similar to each other and are often used interchangeably; they all reflect the level of an individual's overall positive or negative evaluative judgement of a specific change initiative (Choi, 2011). The following table, Table 2.1, provides a summary of these possible positive attitudinal reactions to technology-based organisational change.

Table 2. 1 Comparison of the Attitudinal Constructs

Employees' Positive Reactions to Change	Common Citations	Definition
Openness to Change	Miller et al. (1994); Wanberg and Banas (2000); Choi (2011)	Willingness to support the change and positive affect about the potential consequences of change.
Readiness for Change	Choi (2011); Jansen (2000); Madsen et al. (2006); Rafferty and Simons (2006); Eby et al. (2000); Neves and Caetano (2009); Neves (2009); Herscovitch and Meyer (2002); Bernerth (2004); Weiner (2009)	Evaluation of the individual and organisational capacity for making a successful change, the need for a change, and the benefits the organisation and its members can gain from a change.
Commitment to Change	Jaros (2010); Bernerth et al. (2007); Hechanova et al. (2018); Peccei (2009); Herold et al. (2007); Jones et al. (2005)	Organisational commitment is the employee's psychological attachment to the organisation. Moreover, it is a force (mind-set) that binds an individual to a course of action deemed necessary for the successful implementation of organisational change.
Adoption/Acceptance of Change	Rogers (1995); Hultman (2003); Khasawneh (2008); Musawa and Wahab (2012)	Change adoption is a decision to make full use of an innovation as the best course of action available. However, the change acceptance phenomenon is normally associated with technology-based reforms. Moreover, acceptance/adoption is a collective term for the process in which individuals decide to accept/reject specific technology.

The four constructs explained in the above table are the most frequently cited constructs in change management literature. These constructs are similar as they all reflect an individual's overall positive judgement of a specific change initiative (Choi, 2011). However, as the table shows, the four constructs have distinct meanings and focuses. The four constructs represent different aspects of employees' attitudes towards organisational change, and the lack of one attitude does not simply represent the lack of another. The information provided in the above table also suggests that, when employees feel they are involved in decision making and significant information is shared in their work settings, they are more likely to be ready for and open to change, and to be less cynical (Eby et al., 2000; Ertürk, 2008; Choi, 2011; Kotter, 2007; Miller et al., 1994). Similarly, when employees believe in organisational capabilities to accommodate change, they are likely to be ready for and committed to a change initiative (El-Farra and Badawi, 2012; Herold et al., 2007; Eby et al., 2000; Jones et al., 2005). Thus, employees' attitudes towards organisational change are shaped significantly by the way each individual experiences and regards the change situation. However, most organisational studies that have focused on technology integration and implementation use 'acceptance for change' and 'adoption of change' constructs as dependent variables (see for example, Ali and Osmanaj, 2020; Cruz-Jesus et al., 2019; Lee and Jung, 2016). Since the scope of this study is to investigate factors that may influence employees' decision to adopt and use RFID systems, the research has used 'adoption of change' as the main construct. As discussed earlier, there have been a large number of studies on technology adoption in the information systems field. However, the sensing capabilities offered by RFID distinguish it from other technologies (Curtin et al., 2007); this merits further investigation around RFID adoption specifically (Brown and Russell, 2007). The next section discuses RFID adoption in detail.

2.5 Adoption of RFID: Opportunities and Challenges

Organisations utilise modern information systems to acquire, interpret, retain and distribute information (Brown and Russell, 2007; Lee and Jung, 2016). Innovations in information technology continue to improve the cost-performance capabilities of organisations to perform these four basics IS tasks (Curtin et al., 2007; Angeles, 2005). For example, knowledge management systems allow managers to interpret data and information to create useful managerial knowledge. Further, advances in technology-based real-time information gathering and decision support systems promote real-time decision making that allow firms to refine operational performance. Occasionally, a new technology emerges that provides a major shift in the organisational performance and capabilities. Radio frequency identification (RFID) is one such technology that dramatically changes the capabilities of the organisation to acquire a vast array of data about the location and properties of any entity that can be physically tagged and wirelessly scanned within certain technical limitations (Want, 2004; Angeles, 2005; Musa and Dabo, 2016). RFID is an automated data-collection technology that enables equipment to read tags at a distance, without contact or direct line of sight (Lee and Jung, 2016; Want, 2004; Brown and Russell, 2007). RFID uses radio frequency waves to transfer data between a reader and an item that is to be identified, tracked or located. A typical RFID system comprises three components: an antenna, RFID tags (transponders) that are electronically programmed with unique information, and a radio frequency module (reader) with a decoder (transceiver) (Musa and Dabo, 2016; Woods et al., 2003; Want, 2004; Angeles, 2005).

RFID technology, which uniquely identifies every product and tracks its movements in a value chain, offers an unprecedented real-time view of assets and inventories throughout the global supply chain (Lai et al., 2005). In addition, RFID allows the management to monitor and control the physical world remotely. This may result in radical changes to a number of industries, such as manufacturing, retail, transportation, healthcare, life sciences, oil & gas, pharmaceuticals, and to government. Current RFID applications include airport baggage handling, electronic payment, retail theft prevention, library systems, automotive manufacturing, parking, postal services and homeland security (Smith and Konsynski, 2003; Lai et al., 2005; Musa and Dabo, 2016). The adoption of RFID technology is now becoming a global trend (Lee and Jung, 2016). However, RFID remains a niche technology whose benefits have eluded its widespread and invasive adoption in many companies (Dovere et al., 2015). Some of them have experienced a disappointing return on investments from their RFID implementation, while others have found themselves unable to overcome the technological and managerial obstacles. As a result, though it is widely acknowledged that RFID will become the primary technology for improved organisational performance, companies embracing such a technology should carefully consider beforehand challenges associated with adopting such technology. The main aim of this study is to fill the gap by providing an empirical model for implementing RFID successfully. This would allow practitioners to focus on key factors that can facilitate or impede the implementation process of RFID, particularly in the oil and gas sector.

The impact of RFID adoption is primarily related to the data which RFID generates (Dwivedi et al., 2017). For example, RFID generates large amounts of data (Big Data), which is often of better quality than data generated by traditional means, being: 1) of higher granularity and often greater accuracy; 2) being of greater heterogeneity, coming from a multitude of sources; 3) being more timely than traditional data, often being real or near real time; and 4) having substantially larger volumes (Borous et al., 2019). However, RFID-generated Big Data also carries associated risks, often related to the management of the data and to IT infrastructural limitations. Secondly, the open aspect of RFID means that data which is created for one particular use may be used in multiple applications to achieve multiple goals and reveal previously unforeseen insights. However, this open aspect can also provide challenges related, for example, to security. Chui et al. (2009) suggest that timely information from RFID improves decision making, allowing for improved analysis with regard to tracking or situational awareness. RFID applications not only enable more efficient data gathering but, through automation, they also allow the capturing of new data with higher granularity about processes and work activities (Angeles, 2005; Chui et al., 2009). In short, RFID applications can deliver a variety of benefits related to the real-time measurement and analyses of sensor data efficiency of services, improved effectiveness of services and improved flexibility of services (Borous et al., 2019). Previous studies recognise, however, that RFID technology is not without its drawbacks. The researchers have identified the main drawbacks as: (i) technical issues such as interference, reliability and a lack of a common standards; (ii) costs including hardware, software, training, infrastructure and interoperability; and (iii) privacy and security concerns (Ting et al., 2011; Yao et al., 2010).

RFID has an extensive range of applications across multiple industrial settings. Accordingly, numerous review papers have been published in the last decade to provide a comprehensive overview of RFID applications in operational and supply chain processes in those industrial settings. For instance, Sarac et al. (2010) review and classify RFID literature that focuses on alleviating the bullwhip effect, inventory inaccuracy and optimising replenishment policies. Nemeth et al. (2006) gave an overview of the current development of RFID technology and processes at that time by investigating the potential benefits and challenges of RFID integration in supply chains. Table 2.2 on page 44 provides a summary of the contents and outcomes of some of the relatively recent literature reviews on RFID.

An exploratory study on RFID adoption in the South African retail sector conducted by Brown and Russell (2007) found that organisations generally were deemed to lack readiness for RFID implementation, and there was a perceived lack of RFID expertise. They further concluded that cost and standards are key factors that were holding back organisations from adopting RFID.

In the context of the oil and gas sector, a study initiated by the Norwegian oil and gas association (OLF) concluded that a successful deployment of RFID depends on a solid understanding of the technology and how it can improve work processes and decisions (OLF, 2010). The study recommended the following preparation steps for successful deployment of RFID in the oil and gas industry: (i) define and create an RFID policy, (ii) document the reasons to consider RFID for adoption, (iii) define requirements, (iv) develop an implementation model, (v) develop the deployment plan and (vi) manage the stakeholders.

Curtin et al. (2007) investigated the adoption, usage and impact of RFID in profit-oriented organisations. They concluded that, as with many technological innovations, as the technical problems associated with implementing and using RFID are addressed and resolved, the managerial and organisational issues have emerged as critical areas for IS research. In a more recent study, Lee and Jung (2016) investigated determinants of RFID adoption around the world. They found that the technological factor is the most powerful factor in adopting RFID technology, followed by environmental factor and organisational factor, respectively. They also reported interesting findings that the environmental factor is important in Southeast Asia and Europe and the government-driven policy variable is much more important in Europe than in Southeast Asia.

In the context of China, Lai et al. (2005) investigated the opportunities and challenges associated with the adoption and implementation of RFID in the industry. They state that, although Chinese companies are exposed to several challenges in the adoption of RFID, there are numerous opportunities for RFID deployment. Challenges include China’s standards, costs, business environment, business models and untested market. They further highlighted the opportunities, which include China’s market size, advances of several industries, a rapid increase in logistics demand, and China’s role as a world-class manufacturing centre. In the same vein, Rahman et al. (2013) investigated and prioritised factors affecting RFID adoption in Chinese manufacturing firms. China, being the largest manufacturing nation in the world, needs to sustain and increase further by improving its competitiveness and achieving operational excellence. The adoption of new technologies such as RFID can play an important role to enhance the industry's competitiveness. Using six case studies and employing the analytical hierarchy process (AHP) approach, Rahman et al. (2013) found that the critical factors affecting RFID adoption are top management support, hardware & software cost, tag cost, industry force, and compatibility. They further suggest that, for successful adoption of RFID technology, management of the manufacturing firms must take these factors into account.

In the fashion industry context, Huyskens and Loebbecke (2007) explored the key factors for successful adoption of RFID. They found that availability of technology and business process information drive adoption, especially in the case of early adoption where best practices did not yet exist. They further concluded that, concerning perceived organisational benefits, a successive adoption process allowed prohibitively high integration efforts to be circumvented. Similarly, in order to understand the determinants of RFID adoption in the manufacturing industry, Wang et al. (2010) collected data from 133 manufacturers in Taiwan. Out of nine hypothesised variables, six variables (i.e., information intensity, complexity, compatibility, firm size, competitive pressure and trading partner pressure) were found to be significant determinants of RFID adoption, but three variables (i.e., relative advantage, top management support and technology competence) were found to be insignificant determinants of RFID adoption. In addition, among the six determinants, information intensity and complexity were found to be inhibitors of RFID adoption, while the remaining determinants were facilitators of RFID adoption. They finally concluded that information intensity and complexity are the most influential predictors of RFID adoption.

Schmitt et al. (2007) reviewed related works and found 25 adoption factors in the technology, organisational and environment categories. They extracted the five most important factors (i.e., compatibility, costs, complexity, performance and top management support) affecting RFID adoption and diffusion in the automotive industry. They also suggested that the RFID adoption and diffusion was still in an early stage and therefore basic technological issues had to be solved first. Thus, the organisational and environmental factors are less important compared to the technological factors at that moment.

The previous studies discussed in the above section suggest that RFID adoption rates have been variable across different sectors (see Table 2.2). While many organisations, especially retailers, have either adopted RFID or announced plans for adoption, industries such as manufacturing and the oil & gas industry have been slower in adopting the technology. The adoption of RFID is driven and constrained by numerous factors, as summarised in the following table presented in the next page.

Table 2. 2 Summary of RFID-related Studies

Reference	Focus of Study	Summary of Outcome
Lee and Jung (2016)	Determinants of RFID adoption around the world	This paper finds that government supportive policy is more effective in Europe but not in America, while external pressure is still more effective in Southeast Asia. These results imply that developmentalism or government-driven policy can be effective not only in developing countries but also in the case of developed countries.
Reyes et al. (2016)	Determinants of RFID adoption and perceived benefits in manufacturing sector	The findings show that RFID adoption stage has a significant positive impact on each perceived benefit. The results also show that firm size has a significant impact on perceived customer service and productivity benefits
Lim et al. (2013)	The benefits, challenges and applications of RFID in warehouse management	The review provides insights into extant works on the integration of RFID into various warehouse functions. It identifies the strong and vital link between the ability of RFID to capture accurate and timely data and warehouse operational performance. It also evaluates the current status of RFID solutions in warehouse functions and suggests future trends and research challenges in this domain.
Rahman et al. (2013)	Factors affecting RFID adoption in Chinese manufacturing firms	Using six case studies, they found that critical factors affecting RFID adoption are top management support, hardware & software cost, tag cost, industry force and compatibility.
Wang et al. (2010)	Understanding the determinants of RFID adoption in the manufacturing industry	Out of nine hypothesised variables, six variables (i.e., information intensity, complexity, compatibility, firm size, competitive pressure and trading partner pressure) were found to be significant determinants of RFID adoption, but three variables (i.e., relative advantage, top management support and technology competence) were found to be insignificant determinants of RFID adoption.
Brown and Russell (2007)	Adoption of RFID in South African retail organisations	The study found that the RFID adoption intention was explained by technological factors (i.e., relative advantage, compatibility, complexity and cost), organisational factors (i.e., top management attitude, information technology expertise, organisation size and organisational readiness), and external factors (i.e., competitive pressure, external support and existence of change agents)
Wamba and Chatfield (2009)	RFID Adoption issues in retail supply chain	The firms that have not yet adopted RFID are more concerned about “acquisition costs”, “replacement costs” and “ongoing costs”. Firms adopting RFID are more concerned about “information visibility” and “competitive differentiation” and less concerned about the “costs”. Both RFID adopters and non-adopters are driven by the promise of greater data accuracy, improved information visibility, service quality, process innovation, and track and trace capabilities.

Zhu et al. (2012)	The benefits, challenges and applications of RFID in a variety of industries	The study identifies the use of RFID for inventory management, improving business processes, and improving supply chain efficiency and performance. Furthermore, the security and privacy issues of RFID are discussed, and the current and future trends in RFID research are identified and suggested, respectively.
Liao et al. (2011)	RFID publications in journals that are indexed in SCI and SSCI from 2004 to 2008	This review identifies relevant technical SCI-indexed journals and a variety of less specialised journals that have published RFID literature between 2004 and 2008. It also provides profiles of RFID publication authors and co-authors, their locations and demographics, as well as the dominant RFID research topics, and citation indices of publications in RFID.
Costa et al. (2013)	RFID adoption research in the agriculture sector	This review provides an overview of developments in RFID research in the agriculture-food sector. It identifies and evaluates the current and potential applications of RFID in the production and distribution of agricultural produce and products. It also discusses the technical and economic challenges hindering wide implementation of the technology in the agriculture-food sector.
Moon and Ngai (2008)	Adoption of RFID in fashion retailing	The study investigated factors related to RFID implementation in the fashion retailing industry. Improved operational efficiency and effectiveness, and increased sales and profits, are the major perceived benefits, while implementation cost, compatibility with current systems, data accuracy, top management attitude and staff acceptance are the key challenges.
Wamba et al. (2013)	RFID applications in healthcare settings	This paper provides a comprehensive review of articles focusing on RFID applications in healthcare operations. It provides a classification framework that categorises RFID publications in the healthcare sector into three groups, namely, asset management, patient management and staff management-related applications. The review provides managerial insights into the usefulness and relevance of RFID in effective management of operations across the healthcare industry. It concludes by identifying data management, security and privacy as future research directions.

Source: Developed by the Researcher

The review of the literature related to RFID adoption suggests that a number of findings are consistent throughout the articles reviewed. Most researchers agree that the actual benefits of RFID adoption can only be realised if there is co-operation and collaboration. If all actors collaborate, share costs, develop shared information management systems and co-ordinate adoption efforts, potential benefits can be achieved. This is due to not only having to implement a new technology project but also having to deal with the wider issues of organisational change and re-engineering during the process of adoption. The review articles also consider the reasons why organisations may not want to adopt RFID. The common issues were the lack of shared standards, the cost compared to other similar technologies and perceived performance of the technology in certain environments.

On the other hand, as evident from the above table, the majority of published work concerning RFID has hailed from Europe and North America. In addition, a study conducted by Lai et al. (2005) concluded that national contextual conditions have a bearing on the adoption of RFID. Previous studies of other technologies such as e-government, e-commerce and internet banking confirm that national environment has an impact on adoption, justifying the need for contextual studies (Reyes et al., 2016; Brown et al., 2004; Brown and Russell, 2007; Schmitt et al., 2007). There has been a dearth of scholarly empirical studies published on RFID adoption in the Arab world, particularly the UAE. This study draws from existing theories on technology adoption in organisations in order to identify a comprehensive set of factors likely to influence RFID adoption. The next section provides technology adoption theories in detail.

2.6 Review of Technology Adoption Theories

In the recent era of globalisation and technological innovations, efforts to implement technology in organisations have grown immensely. However, the consequential benefits of such investments on the development of new technological systems are not guaranteed, until these systems are accepted and utilised by the intended users (Venkatesh and Davis, 1996). Therefore, there is a need to know why people are keen or reluctant to use new technological systems in order to enhance the users' response and acceptance of such systems (Davis, 1989). Various scholars have measured user adoption from differing perspectives. These perspectives broadly fall under three categories – People, Technology and Process. However, even though the technology is successfully integrated through well set out processes, the people dimension plays the largest role in the adoption of new technology such as RFID. In addition, literature has confirmed an individual's 'intention' as a significant predictor of the acceptance and usage of new technology-based systems (Schmitt et al., 2007; Reyes et al., 2016; Brown et al., 2004; Brown and Russell, 2007) and suggested models that have a theoretical base in social psychology.

An extensive review of the technology adoption literature reveals that a large body of empirical research has attempted to understand employees' adoption behaviour. Furthermore, the absence of a well-established theory in the IS domain, including RFID, has led researchers to borrow theories and models developed in other areas to support their RFID-related investigations. Consequently, several robust and well-validated theories and models have been widely used by researchers in order to predict people's intentions to adopt RFID in different contexts. Adoption theories examine the individual and the choices they make to accept or reject a particular innovation. In some models, adoption is not only the choice to accept an innovation but also the extent to which that innovation is integrated into the appropriate context. Among the known technology acceptance models, the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Technology-Organisational-Environmental (TOE) framework and the Theory of Planned Behaviour (TPB) have emerged as the most appropriate for the current study. The next section discusses these models in detail.

2.6.1 The Theory of Reasoned Action

The Theory of Reasoned Action (TRA) suggests that a person's behaviour is determined by their intention to perform the behaviour and that this intention is, in turn, a function of their attitude towards the behaviour and subjective norms (Fishbein and Ajzen, 1975). The foundations of the TRA lie in the assumption that the behaviour of the users is rational and that the users evaluate the existing data systematically. In other words, TRA suggests that a person's actual behaviour could be determined by considering his or her prior intention along with the beliefs that the person would have for the given behaviour.

The model of TRA, as shown in Figure 2.1, defines relationships among beliefs, norms, attitudes, intended behaviour and actual behaviour. In the TRA, attitudes and subjective norms affect an individual's intention, which predicts their behaviour. Thus, the TRA comprises two main constructs, i.e., attitude and subjective norms. Attitude refers to the individual's negative or positive assessment of the behaviour. On the other hand, subjective norm refers to the individual's perception of social pressure to perform or not to perform the behaviour.

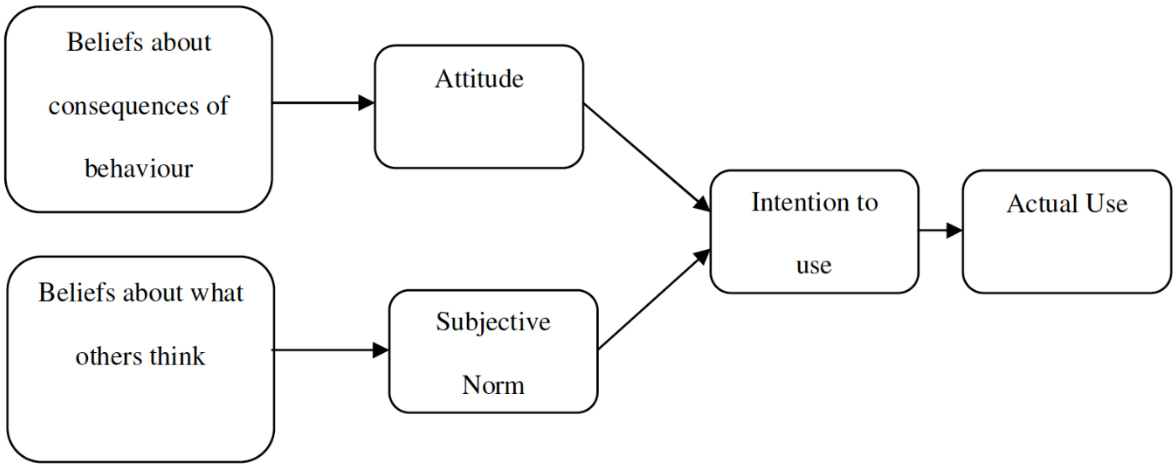

Figure 2. 1 Model of TRA

Source: Adopted from Fishbein and Ajzen (1975)

TRA as shown in the above figure defines ‘attitude’ as the individual’s evaluation of an object, ‘belief’ as a link between an object and some attribute, and ‘behaviour’ as a result or intention (Lai, 2017). Attitudes are affective and based upon a set of beliefs about the object of behaviour (e.g., e-transactions are convenient). A second factor is the person’s subjective norms of what they perceive their immediate community’s attitude to certain behaviour (e.g., “My peers are using e-transactions and it’s a status to have one”).

Despite the broad use of the TRA theory in different disciplines, it was criticised for being unsuitable to predict situations where individuals have low levels of volitional control (Lai, 2017; Chuttur, 2009). To address these limitations, Ajzen in 1991 extended the TRA and proposed a new theory called the theory of planned behaviour (TPB), which is discussed in the next section.

2.6.2 Theory of Planned Behaviour

Ajzen (1991) developed the Theory of Planned Behaviour (TPB) as an extension of TRA. TPB is about one factor that determines the behavioural intention of the person’s attitudes towards that behaviour, as shown in Figure 2.2. The first two factors are the same as in the Theory of Reasonable Action; however, the third factor, which is known as the ‘perceived control behaviour’, is the control which users perceive that may limit their behaviour (e.g., “Can we acquire an e-transaction system and what are the requirements?”) (Lai, 2017; Chuttur, 2009).

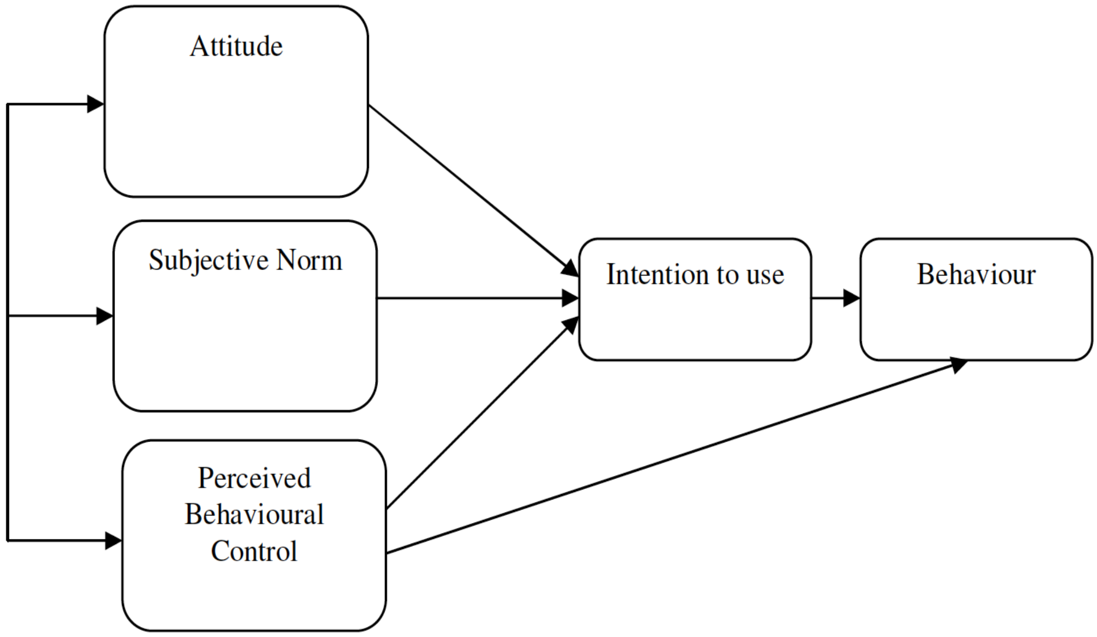

Figure 2. 2 Theory of Planned Behaviour

Source: Adopted from Ajzen (1991)

In order to overcome limitations associated with the TRA, Ajzen (1991) added the ‘perceived behavioural control’ construct in the TRA model to accommodate situations in which individuals lacked full volitional control (Chuttur, 2009). The theory of planned behaviour provides a useful conceptual framework for dealing with the complexities of human social behaviour. The theory incorporates some of the central concepts in the social and behaviour sciences, and it defines these concepts in a way that permits prediction and understanding of particular behaviours in specified contexts (Ajzen, 1991). Attitudes towards the behaviour, subjective norms with respect to the behaviour, and perceived control over the behaviour are usually found to predict behavioural intentions with a high degree of accuracy. In turn, these intentions, in combination with perceived behavioural control, can account for a considerable proportion of variance in behaviour (Chuttur, 2009; Ajzen, 1991; Lai, 2017).

2.6.3 Technology Acceptance Model

The Technology Acceptance Model (TAM) was introduced by Fred Davis in 1986 for his doctorate proposal, as shown in Figure 2.3 below.

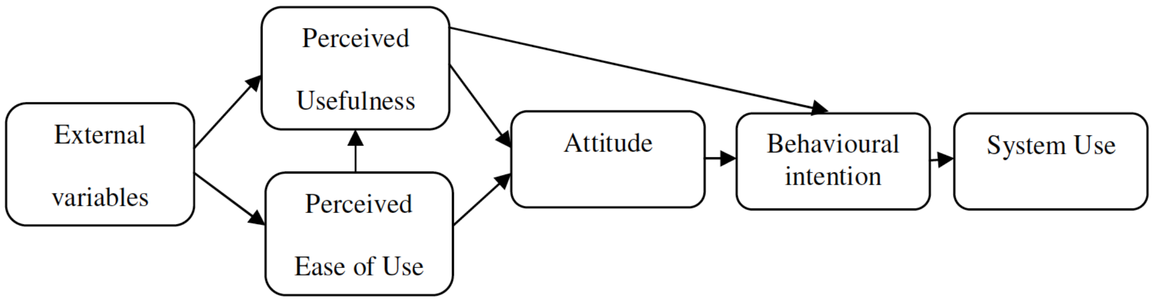

Figure 2. 3 Technology Acceptance Model

Source: Adopted from Davis (1989)

The TAM is an information systems theory adapted from the theory of reasoned action (TRA), which was specifically designed for modelling acceptance of information systems by potential users. An adaptation of the Theory of Reasonable Action, TAM is specifically tailored for modelling users' acceptance of information systems or technologies. In 1989, Davis used TAM to explain computer usage behaviour, and the main aim of Davis's TAM is to explain the general determinants of computer acceptance that lead to explaining users' behaviour across a broad range of end-user computing technologies and user populations. Since then, the TAM-based theories and models have been widely and successfully utilised by a large number of studies in a range of disciplines including information systems, marketing, social psychology and management (Montargot and Lahouel, 2018; Williams et al., 2015).

The technology acceptance model (TAM) was developed to conceive, predict and explain an individual's technology acceptance. TAM can be termed a mature model as it has been validated in different contexts thanks to its theoretical simplicity and the robustness of its standardised measurement (Chuttur, 2009; Montargot and Lahouel, 2018; Harryanto et al., 2018). The TAM model suggests that, when individuals encounter new technologies, two main variables influence how and when they will use the system. These variables of the TAM are perceived usefulness (PU) and perceived ease of use (PEU). PU is defined as the degree to which an individual believes that using a particular system would enhance his or her job. PEU is defined as the degree to which an individual believes that using a particular system would be free of physical and mental effort (Lai, 2017; Montargot and Lahouel, 2018).

TAM has an advantage over the other adoption models because it has a validated instrument. Davis (1989) developed six item measurement scales for the core constructs such as PU and PEU. Both PU and PEU measurement item scales achieved high reliability and were proven to demonstrate convergent and discriminant validity. This is an important benefit as it facilitates the easy comparison of results across studies, and the theoretical development of the model. On the other hand, one of the most significant shortcomings of the TAM has been the lack of actionable guidance to managers (Harryanto et al., 2018; Lee et al., 2003). Venkatesh and Davis (2000) also identified that TAM had some limitations in explaining the reasons for which a person would perceive a given system useful, and so they proposed that additional variables could be added as antecedents to the perceived usefulness variable in TAM. They called this new model the TAM 2 model, which is shown in the following figure, Figure 2.4.

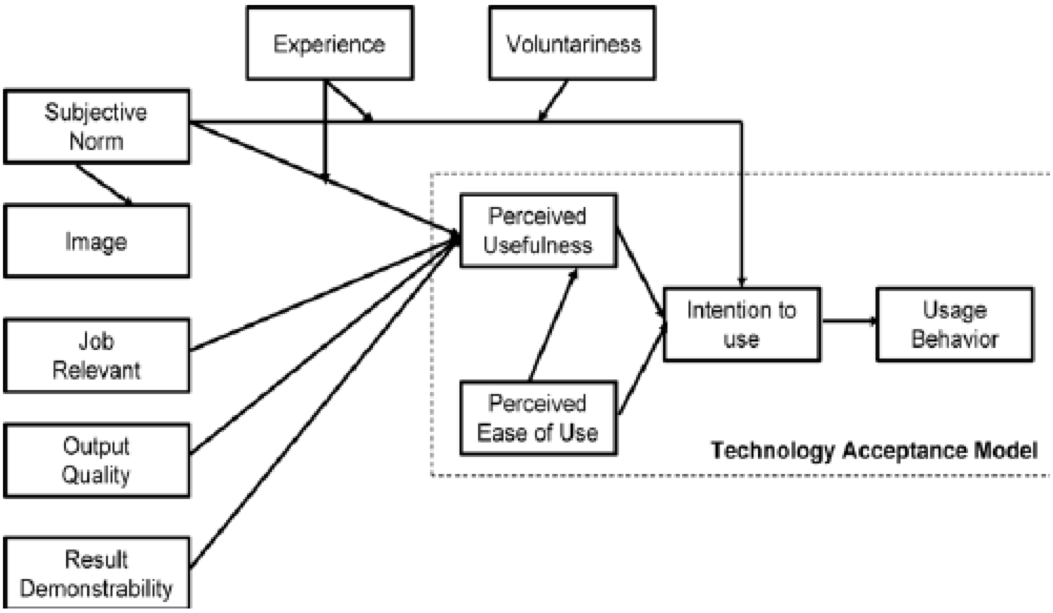

Figure 2. 4 TAM2 Model

Source: Adopted from Venkatesh and Davis (2000)

Using the extra variables, Venkatesh and Davis (2000) were able to provide more detailed explanations for the reasons participants found a given system useful. Their results also indicated that TAM 2 performed well in both mandatory and voluntary settings (Chuttur, 2009).

2.6.4 Technology–Organisation–Environment Framework

The Technology–Organisation–Environment (TOE) theory was proposed by Tornatzky and Fleischer (1990), to study the adoption of technological innovations. The TOE theory set out three factors as the main factors that determine innovation technology adoption. Those factors are the organisational characteristics factor, technological characteristics factor and environmental characteristics factor (see Figure 2.5 on next page). The technological context refers to both the internal and external technologies relevant to the organisation. This includes existing technologies and the equipment internal to the organisation, as well as the set of emerging technologies external to the firm (Brown and Russell, 2007). Key constructs for technological construct are relative advantage, compatibility and complexity (Troshani et al., 2011; Ebrahim and Irani 2005). Organisational factors generally represent internal organisational characteristics such as organisation culture, size, financial support, managerial beliefs and top management support that influence change adoption decisions (Bhattacharya and Wamba, 2015). The environmental context is the arena in which an organisation conducts its business. This arena includes the industry, competitors and dealings with the government Troshani et al., 2011; Tornatzky and Fleischer, 1990; Thi et al., 2014).

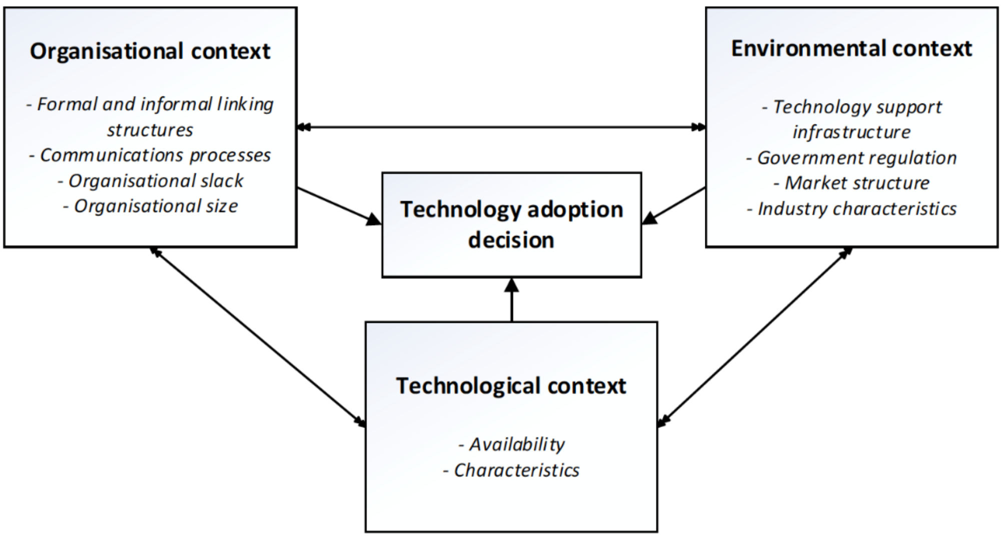

Figure 2. 5 TOE Framework

Source: Adopted from (Tornatzky and Fleischer, 1990)

According to Wang et al. (2010), the weaknesses of the TOE framework may be twofold: (1) it may not explicitly point out what are the major constructs in the framework and the variables in each context, and (2) specific determinants identified within the three contexts may vary across different studies. However, the TOE framework has a solid theoretical basis and consistent empirical support and has been found useful in understanding the adoption of technological innovations. The TOE framework has been used in numerous technological, industrial and cultural contexts, owing to its wide-ranging applicability and explanatory power (see for example, Ramdani et al., 2009; Srivastava and Teo, 2007; Thi et al., 2014).

As shown from the above discussion, the literature reviews share the difference of technology adoption models and theories with different theoretical insights, research problems, variables and measurements. However, the development of the new theoretical research framework depends on a number of factors such as the research problems and objectives, gap analysis, the target market (users or developers, etc.), the organisations' goals and the understanding of technology adoption models (Lai, 2017). In addition, key change adoption models such as TAM and TOE do not take into account prior experience, age, gender, and many other characteristics that may influence attitudes about technology, which in turn influence intention to use an innovation (Straub, 2009; Harryanto et al., 2018). The next section provides an overview of different technology adoption studies using different models/constructs in different settings.

2.7 Review of Technology Acceptance Studies in Different Contextual Settings

An extensive review of the technology adoption literature reveals that a large body of empirical research has attempted to understand employees' adoption behaviour. Furthermore, the absence of a well-established theory in the IS domain, including RFID, has led researchers to borrow theories and models developed in other areas. Among the key adoption models discussed above, TAM and TOE are the most robust and well-validated models, which have been widely used by researchers in order to predict employees' intentions to adopt innovation in different contexts. Thus, the TAM and TOE have emerged as the most appropriate for the current study. Accordingly, a critical review of change adoption studies conducted in different research settings using the TAM or/and TOE framework is now undertaken in this section.

The TAM model has been used in a wide range of application settings across various user populations, and its reliability and validity have been established in predicting user acceptance of technologies (Lai, 2017; Chuttur, 2009). In an empirical study based on extended version of TAM, Chau (2001) investigated the influence of computer self-efficacy and computer attitude on individuals' information technology usage behaviour. The model was empirically tested using data obtained from 360 business students by applying structural equation modelling software and their results supported the hypothesised model. They found that PU was a strong predictor of behavioural intentions. In addition, their results revealed that inclusion of computer related self-efficacy and attitude towards computer in the model significantly improved the explanatory power of the research model on the variance of PU.

Using an extended version of the TAM, Wang et al. (2003) validated the TAM suitability in context of Taiwan's banking sector. Perceived credibility and individual difference (computer self-efficacy) were added to the original TAM constructs in an attempt to increase the model's explanatory power. The results showed strong support for the proposed model in determining the user's intention to adopt internet banking in Taiwan. Moreover, the results suggested that PU, PEU and perceived credibility significantly influenced behavioural intention to use internet banking. PEU was also found to be the most important predictor of intention to use. However, since the explanatory power of the extended model was relatively low, the researchers advised that more additional variables should be identified.

Using the basic TAM model, Weng et al. (2018) explored the effects of the information technology environment on the perceived usefulness, perceived ease of use, and attitude towards using multimedia, and the relevance and influence of these attitudes on the behavioural intention. Their survey comprised 460 teachers in Chiayi County, Taiwan, who were selected using a random sampling technique suggests that the ease of use of the multimedia material may enhance the intention to use. The attitude towards use also influences the intention to use. Similarly, in the education sector, a study on using mobile devices was conducted in a university. The data collected from

678 participants (primary education teachers) showed that a strong relationship exists between perceived usefulness and behavioural intention (Sanchez-Prieto et al., 2016). Using the TAM model, another study considered the teaching–learning activity by adopting YouTube as a teaching resource (Chintalapati and Daruri, 2017). One of the findings presented the significance of the relationship between different variables and the behavioural intention, validating the TAM.

Using the TAM2 framework, Rauniar et al. (2014) investigated social media users' attitudes towards usage. The findings suggest that functional orientations of perceived usefulness and trustworthiness of a social media site are important determinants of a user's intention to use the social media, which, in turn, is the indicator of the actual social media usage behaviour. Based on the TAM model, this study validates the attitude-intent-behaviour relationship in the context of the social media site Facebook. Further, the authors have also explored and added additional important constructs, such as 'perceived playfulness', to make the TAM model more meaningful in the context of understanding the acceptance and usage of social media.

Gefen et al. (2003) developed an integrated model based on trust and TAM's fundamental constructs, i.e., perceived usefulness (PU) and perceived ease of use (PEOU), in the context of online commerce. They conducted a field study to investigate the effects of trust and TAM on behavioural intention to shop. The integrated model was tested with business students in the USA, who had previous experience with online sites. The results of the study suggest that trust, perceived usefulness, and perceived ease of use are significant determinants of online shopping intention.

Pool et al. (2018) applied both the technology-organisation-environment (TOE) framework and technology acceptance model (TAM) to gain insights into influences on the adoption intention of RFID in the hotel industry. By adopting the TOE framework and TAM as a theoretical base, this descriptive-survey study used a questionnaire to collect data in 92 different hotels in Iran. The proposed research model is tested using structural equation modelling (SEM). The results showed that the TOE framework and TAM have positive effects on intentions to use RFID.

In order to gain an understanding of the factors that influence the use of RFID systems in the library context, Kapoor et al. (2014) empirically tested the relevant constructs from the extended technology acceptance model (TAM). A questionnaire-based survey approach was employed for collecting the relevant data from 197 respondents who were active users of an RFID-based library system in the UK. Findings from this study suggest that perceived usefulness and system quality positively influence the user attitude, and user attitude and system quality significantly influence the use of the RFID services.

Table 2. 3 Review of TAM-based studies

References	Technology Examined using TAM	Context	Findings
Chintalapati and Daruri (2017)	YouTube as a Learning Resource	Higher education institutes in India	Significant relationship between different TAM variables and the behavioural intention is reported.
Gefen et al. (2003)	Online Commerce	USA retail sector	Trust, perceived usefulness, and perceived ease of use were significant determinants of online shopping intention
Chau (2001)	Information Technology	Primary schools in China	PU is a strong predictor of behavioural intentions.
Abbasi et al. (2011)	Internet	Public sectors of the south-Asian countries	Perceived usefulness is the most important construct of the internet acceptance.
Kapoor et al. (2014)	RFID	Library sector in the UK	Perceived usefulness and system quality positively influence the user attitude.
Pool et al. (2018)	RFID	Hotel industry in Iran	All TAM-related constructs have positive effects on intentions to use RFID.
Hossain and Quaddus (2014)	RFID	RFID adoption in voluntary and mandatory contexts	Compatibility is the major concern in a mandatory setting whereas cost and expected benefits are the main for voluntary adoption.

In summary, almost all of the empirical studies presented here suggested that the basic constructs of TAM, i.e., PU and PEOU, are significant determinants of behavioural intention to use, and that the TAM demonstrates significant prediction power in explaining user acceptance of new information systems in different contextual settings, as described above. Table 2.3 above presents the review of the TAM studies.

One of the most established approaches in studying change adoption entails identifying contingency factors that can affect adoption decisions in organisations (Troshani et al., 2011; Ciganek et al., 2014). As mentioned previously, similar to the

TAM model, the TOE framework that identifies three contextual factors (technology, organisation and environment) can influence people's successful innovation adoption, which ultimately impacts upon organisational performance (Srivastava and Teo, 2007; Ciganek et al., 2014). A number of empirical studies using the TOE framework have been undertaken in different countries, which are discussed next. Each study contributes in providing a strong theoretical understanding of the TOE factors.

The TOE framework has consistent empirical support and has been found useful in understanding the adoption of technological innovations (Wang et al., 2010). For example, Kuan and Chau (2001) applied the TOE framework to study technology adoption in small businesses. Hong and Zhu (2006) examined six variables based on the TOE framework to successfully differentiate non-adopters from adopters of e-commerce.

Ramdani et al. (2013) empirically explored the TOE factors influencing small to medium-sized enterprises' (SMEs') adoption of enterprise applications (EA) within the UK. The findings of the study revealed that technological context had a positive impact on SMEs' adoption of EA. Relative advantage, compatibility, complexity, trialability and observability were all found to be significant technological factors in determining EA adoption by SMEs. Similarly, organisational context had a positive impact on SMEs' adoption of EA. Size, top management support and organisational readiness were found to be significant organisational factors in determining EA adoption by SMEs. Environmental context also showed a positive impact on SMEs' adoption of EA. Industry, market scope and competitive pressure were found to be significant environmental factors in determining EA adoption by SMEs.

Wamba et al. (2013) identified 21 factors in the four categories that were related to the evaluation and decision to invest in RFID. The four categories are similar to the TOE framework. The technology and automation categories are the technology context in the TOE framework. The resource category is the organisational context, and the supply chain category belongs to the environmental context in the TOE framework. In addition, they revealed the differences in the relative importance of the 21 factors for RFID investment decisions between RFID adopters and non-adopters. The firms that have not yet adopted RFID are more concerned about "acquisition costs", “replacement costs” and “ongoing costs”. Firms adopting RFID are more concerned about “information visibility” and “competitive differentiation” and less concerned about the “costs”. Both RFID adopters and non-adopters are driven by the promise of greater data accuracy, improved information visibility, service quality, process innovation, and track and trace capabilities.

Lee and Jung (2016) explored various factors associated with RFID adoption with quantitative meta-analysis. More specifically, their study measures key variables of RFID adoption mainly derived from the TOE framework and examines how state intervention influences the process of RFID adoption. This study compares, relying on a meta-analysis, various mean effect sizes among technological, organisational and environmental factors (i.e., government-driven policies).

In the context of the retail sector, Brown and Russell (2007) investigated factors that may influence RFID adoption in South Africa. This positive intention was explained by technological factors (e.g., perceived benefits), organisational factors (e.g., top management awareness and interest) and external factors (e.g., the efforts of standards-making bodies).

Grounded on the TOE framework, Hossain et al. (2017) developed a two-stage model of radio frequency identification (RFID) adoption in livestock businesses. Empirical evidence collected through survey data of 318 livestock businesses in Australia showed that interoperability, organisational readiness, competitive market pressure and data inconsistency significantly influence acceptance of RFID technology in livestock businesses. In addition, the extended use of RFID is determined mainly by interoperability, technology readiness, organisational market scope, and data inconsistency. The results suggested that data inconsistency had differential effects – it had a negative influence on RFID acceptance but a positive impact on the extent of its use.

Table 2. 4 Review of TOE-based studies

References	**Technology Examined using TOE**	**Context**	**Findings**

Awa et al. (2016)	Integration of technology	Nigerian private sector	The relationship between adoption and the factors within the contexts of TOE and task were statistically supported though some had negative coefficients.
Thi et al. (2014)	e-government	Jordanian public sector	TOE factors have a significant effect only on advanced adopters of e-government that mainly use e-government for financial and business integration purposes.
Ramdani et al. (2013)	Enterprise application (EA)	SMEs within the UK	Industry, market scope and competitive pressure are found to be significant environmental factors in determining EA adoption by SMEs.
Brown and Russell (2007)	RFID	South African retail sector	Positive intention is explained by factors such as perceived benefits, top management awareness, interest, and the efforts of standards-making bodies.
Lee and Jung (2016)	RFID	RFID adoption around the world	Compatibility is the major concern in a mandatory setting whereas cost and expected benefits are the main concerns for voluntary adoption.
Kapoor et al. (2014)	RFID	Library sector in the UK	Perceived usefulness and system quality positively influence the user attitude and user attitude.
Hossain et al. (2017)	RFID	Australian livestock businesses	Data inconsistency is found to have a negative influence on RFID acceptance but a positive impact on the extent of its use.

Source: Developed by the Researcher

Drawing upon the empirical evidence, combined with the literature review and theoretical perspectives discussed earlier, it can be seen that the TOE framework is an appropriate foundation for studying RFID adoption. RFID is enabled by the technological developments in radio and automated identification, driven by organisational factors such as firm size and management support, and influenced by environmental factors related to business partners and competitors.

2.8 Gap in the Literature

The literature review in previous sections reveals several directions for further research in the field of change adoption. First, there has been a long debate over the reaction of employees to organisational change and innovation implementation. Some authors, such as Cunningham et al. (2002), Madsen et al. (2005) and Holt et al. (2007), suggest that employee attitudes and behaviours can be developed by organisational factors, and others argue that individual factors are more important for that (see for example: Eby et al., 2000; Peach et al., 2005; Elias, 2009). Similarly, some researchers have highlighted the importance of both individual and organisational factors that may enhance employees' positive intentions to accept change (Blackman et al., 2013; Shah, 2009). However, issues related to both individual and organisational categories are equally important and require extensive study because these factors provide support in developing employees' attitudes for change acceptance.

Despite RFID being considered the prime technology of the recent era (Hossain et al., 2017; Pool et al., 2018), its adoption is still being weighed down by a variety of issues including technological uncertainties, competition with established bar code-type technologies, expensive software and services, data management challenges, unclear return-on-investments, and global standardisation issues (Brown and Russell, 2007; Li et al., 2006; Wamba et al., 2013). Subsequently, organisations often struggle to make informed, optimal decisions on whether or not to adopt the technology. Numerous studies on factors that influence the adoption and diffusion of RFID (Hossain et al., 2017; Pool et al., 2018; Wamba et al., 2013; Wu et al., 2006; Brown and Russell, 2007) have been conducted. However, the majority of these studies fail to draw important conclusions that can be applied in practice, as they are limited to simply focusing on the technology itself, often disregarding complex organisational, cultural and environmental factors that determine how a new technology is adopted, its diffusion within organisations, and how benefits derived from its implementation interact with organisation characteristics (Oliveira and Martins, 2011; MacVaugh and Schiavone, 2010). Thus, there remains a need to develop a comprehensive framework, one which considers quantifiable firm characteristics and the costs and benefits of implementing RFID, in guiding organisational and people's decisions to accept/reject RFID implementation. For example, it is necessary to determine key factors that influence employees' decision to adopt RFID.

Although various attempts have been made to investigate effective ways of implementing technology successfully, there remains insufficient consensus or unequivocal understanding of the mechanisms by which technology can most effectively be integrated into organisations (Karlsson et al., 2010). Moreover, there is a lack of clarity over what factors influence the integration process, and how these are related. Thus, there is a need to understand the applicability of such integration mechanisms in different contexts and circumstances. Implementing technological change requires an organisation to have a unique model that fits its specific environment because, despite similarities between change/innovation initiatives, one model does not fit all (Pettigrew et al., 2001; Kuipers et al., 2013; Coram and Burnes, 2001). Therefore, there is no one best way and each organisation must find its own. In addition, compared to the developed world, less research work has been found so far in developing countries, particularly in the Arab world. This requires more attention by researchers and practitioners to establish employees' acceptance determinants in different work settings, environments and cultures. Therefore, it can be seen that there is a knowledge gap in terms of the applicability of existing technology adoption theories in non-Western countries and in particular the Middle East. Finally, very few RFID-related studies have focused on the oil & gas sector, which is the scope of this research.

2.9 Summary

The key objective for this chapter was to review the literature and find out how innovation management and technology adoption have been studied during the past two decade and what lessons can be learnt to have a better understanding of the best practice, with the view of benefitting the current technological change project (RFID integration) in the UAE oil and gas sector. This chapter also aimed to provide an overview of various theories and models that have been used to understand and investigate knowledge regarding user acceptance of technology-based change. Among them, the Technology Acceptance Model and Technical-Environmental-Organisational framework have been used extensively by IS researchers. This is mainly because of their specific focus on technical usage, and the parsimony, validity and reliability of the measuring instruments. Moreover, the literature review shows that there is a pressing need to identify and closely investigate the determinants of positive behaviour towards change acceptance and adoption.

The review also highlights that multiple benefits can be derived from RFID implementation. However, RFID system implementation is complex and not only relates to the technical aspects of system development and deployment but also involves human, organisational and environment issues, business processes, project management skills and knowledge, and support and commitment from management and staff. Therefore, the next chapter proposes a research framework for RFID system adoption and implementation that consists of a multi-stage process and takes these factors into account. Using the findings of the literature reviewed and presented in this chapter, the next chapter thus provides a theoretical framework, which this researcher has developed for an empirical study conducted by the researcher.

Chapter 3: Theoretical Framework Development

3.1 Introduction

As highlighted in the previous chapter, several studies provide evidence that a variety of factors influence decisions to accept/reject RFID. However, most of the studies simply focus on the technology itself, often disregarding broader societal, organisational, cultural and economic factors that often determine how a new technology is adopted (Baker, 2011). Thus, they have fallen short of drawing important conclusions that can be applied in practice (Hsu et al., 2006). Thus, RFID adoption and benefits remain the key focus for organisations. This chapter proposes a theoretical framework to investigate and understand key factors that may influence RFID adoption, and its subsequent implementation processes and benefits. It aims to meet the need for a more comprehensive approach to investigating drivers and barriers of RFID adoption; one which should include external factors of RFID adoption. The extant literature on RFID, along with the Technology Acceptance Model and technology–organisation–environment (TOE) framework, are used as the theoretical models to identify the key factors.

The main aim of the proposed framework is to offer an effective guide to better understanding RFID adoption decisions and benefits. The framework requires empirical validation by the researcher, which is reported in Chapter 5 of the thesis.

3.2 Developing the Theoretical Framework

A research framework is a written or visual presentation which explains, either graphically or in narrative form, the main issues to be studied – the key factors, concepts or variables and the presumed relationship among them (Maxwell, 2005; Huberman and Miles, 1998). Frameworks are useful because they help researchers to organise and incorporate the diverse aspects of the research problem in a simple and consistent way, assuring the attainment of the pursued outcomes (Montagna, 2005). According to Swanson and Chermack (2013), a research framework must demonstrate an understanding of theories and concepts that are relevant to the research aim and questions and relate to the broader areas of knowledge being considered.

A research framework is also used to limit the scope of the relevant data by focusing on specific variables and defining the specific viewpoint (framework) that the researcher will take in analysing and interpreting the data to be gathered. It also facilitates the understanding of concepts and variables according to given definitions and builds new knowledge by validating or challenging theoretical assumptions (Trochim, 2006; Swanson and Chermack, 2013). One of the Keep steps in initial stages of the research process is to review the theories, assess their relevance to the research question, and formulate hypotheses to be investigated (Swanson and Chermack, 2013). While RFID is often considered simply as an input device to an information system (IS) (Kapoor et al., 2014), many practitioners consider and treat the technology as an IS in its own right and therefore reap more benefits from its implementation (Doerr et al., 2006). Consequently, this study reviews relevant IS literature, and particularly literature on RFID, to develop a theoretical framework.

As highlighted in the previous chapter, several researchers have used both the TOE and TAM to study and understand technology adoption decisions. Moreover, a close examination of the two models reveals that they are supplemental to one another. TAM alone used as an adoption success measure can be misleading because it cannot completely explain the reasons for the failure or success of new system implementation. Pool et al. (2018) thus used the TOE and TAM in combination to better understand RFID adoption decisions. Gangwar and Ramaswamy (2015) also used integration of TOE and TAM to investigate determinants of cloud computing adoption. TAM characteristics are similar to the technology and organisation contexts of the TOE framework; however, the TOE framework also includes a new and important component, which is the external environment context (Lee and Jung, 2016). Therefore, the integration of the TOE framework makes the TAM model able to better explain intra-firm innovation adoption (Pool et al., 2018; Hsu et al., 2006). Accordingly, several researchers suggest that combining the adoption models could result in a more comprehensive theoretical technology acceptance model, where the strengths of each model enhance the integrated model's power to predict the user's behavioural intention towards technology adoption (Tan and Teo, 2000; Lai et al., 2010). For this reason, and drawing upon the empirical support, combined with the existing literature review and theoretical perspectives mentioned earlier, the TAM model and TOE framework provide a good starting point for this study to analyse and consider appropriate factors for understanding RFID adoption decision making and processes within organisations (Gangwar and Ramaswamy, 2015; Wang et al., 2010;

Pool et al., 2018). In view of that, the proposed research framework, guided by relevant theories and literature, provides a platform to investigate and understand the key factors and sub-factors that influence RFID technology adoption decisions, implementation processes and benefits. In doing so, it gives the basis for hypotheses formulation and choice of research methods.

The current research thus applies a theoretical framework that integrates the two most commonly used and robust technology acceptance models (i.e., TAM and TOE). The framework includes all the original constructs, plus user-related and external environment-related factors, as illustrated in Figure 3.1 below. In line with the advice from Tornatzky and Fleischer (1990), the constructs/determinants are classified into three categories, which are Technical, Organisational and Environmental factors.

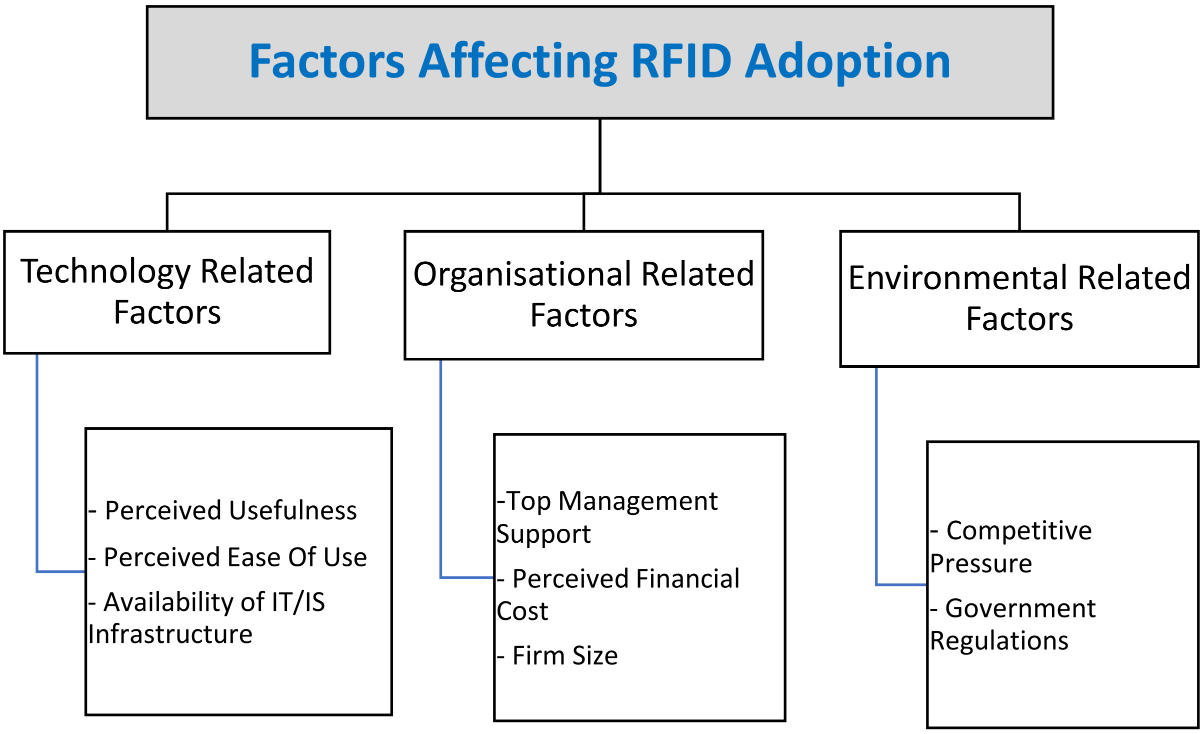

Figure 3. 1 Key Factors for RFID Adoption

The following section discusses the above-mentioned factors in detail. Justifications and rationales for choosing these factors are also provided.

3.3 Key Determinants of RFID Adoption

One of the most popular topics in technology adoption research is the identification of factors that influence the adoption process, with the aim of facilitating or guiding the way to achieving best adoption procedures (Lee and Jung, 2016). Therefore, with a view to understanding how individuals, organisations and groups may perceive the viability of adopting RFID, numerous studies (Pool et al., 2018; Hossain et al., 2017; Alqahtani and Wamba, 2012; Schmitt and Michahelles, 2008; Kapoor et al. (2014) have adopted the TOE framework, TAM model and various other technology adoption models as platforms on which to study the adoption and diffusion of RFID. These studies provide evidence that a variety of factors influence decisions to adopt RFID. However, most of the studies simply focus on the technology itself, often disregarding broader societal, organisational, cultural and economic factors that often determine how a new technology is adopted (Baker, 2011). Thus, these studies have fallen short of drawing important conclusions that can be applied in practice (Lee and Jung, 2016; Hsu et al., 2006). In that regard, there still remains a need for a more comprehensive approach to investigating key determinants of RFID adoption; one which should also include regulatory and cultural aspects of RFID adoption. Subsequently, this study investigates factors adopted from technology adoption frameworks, extant literature, and from interactions with industry experts and practitioners. This allows factors investigated to be based not only on theoretical technological adoption models but also on social and industrial processes by which adoption of technology may occur successfully.

Table 3.1 details the literature from which the determinants of RFID adoption (those constituting the research framework) are derived. This table is then followed by a more detailed discussion of the determinants.

Table 3. 1 Key Determinants of RFID Adoption

Classification	Determinants	References
Technological Determinants	Perceived Usefulness	Paydar et al. (2013); Srivastava (2004); Wamba et al. (2006); Rogers (1995); Wang et al. (2010); Chau and Tam (1997); Montargot and Lahouel (2018)
	Perceived Ease of Use	Zhu et al. (2006); Chau and Tam (1997); Lee and Jung (2016); Montargot and Lahouel (2018); Venkatesh and Davis (2000)
	Technology Competence	Khanh (2014); Applegate et al. (1996); Ndou, 2004; Mitchell and Zmud (1999); Rogers (1995); Tornatzky and Fleischer (1990); Montargot and Lahouel (2018)
Organisational Determinants	Top Management Support	Singh and Waddell (2004); Carpenter et al. (2004); Bhattacharya and Wamba (2015); Khanh (2014); Soltani et al. (2007)
	Perceived Financial Cost	Nguyen (2009); Rangone (1999); Rogers (1995); Kuan and Chau (2001); Wang et al. (2010)
	Firm’s Size	Lee and Jung (2016); Wang et al. (2010); Sharma and Rai (2002)
Environmental Determinants	Competitive Pressure	Nguyen (2009); Mole et al. (2004); Tornatzky and Fleischer (1990); Rogers (1995); Pool et al. (2018)
	Government Regulations	Zhu et al. (2006); Tornatzky and Fleischer (1990); Wang et al. (2010)

3.3.1 Technological Determinants of RFID Adoption

The technological factors include equipment, component and process-related factors that drive and constrain RFID adoption. These include Perceived Usefulness, Perceived Ease of Use and Availability of IT/IS Infrastructure, which are discussed below.

Perceived Usefulness (PU)

According to Davis (1989), the PU of new technology is the degree to which employees believe that using a particular technology would enhance their performance at work. Many researchers have recognised the importance of PU in the

RFID adoption context (Sharma and Citurs, 2005; Brown and Russell, 2007). PU represents the benefits derivable from the RFID adoption (Wamba et al., 2006; Paydar et al., 2013). According to Attaran (2012), organisations which implement RFID are driven to adoption by the promise of achieving benefits, particularly achieving higher efficiency, better supply chain monitoring and better collaboration with partners. It is reasonable that organisations take into consideration the advantages that stem from adopting innovations. Once all goods receive RFID tags, their whereabouts can be tracked automatically by radio readers, which enable complete inventory visibility and supply chain management efficiency (Wamba et al., 2006). Therefore, RFID is expected to be able to give organisations greater competitive advantage. Thus, people who perceive higher relative advantages in RFID technology tend to be more likely to adopt the technology. Similarly, Lee and Jung (2016) argue that, once people perceive the benefit of technology, the speed of adoption becomes faster. Accordingly, the following hypothesis is proposed:

H1. *Perceived Usefulness will have a positive effect on RFID adoption.*

Perceived Ease of Use (PEU)

PEU refers to the degree to which a person believes that using a particular system will be free of effort (Davis, 1989). People are often reluctant to leave their comfort zone (Yilmaz and Kılıçoğlu, 2013); thus, the possibility of accepting a new technology or system increases if users perceive it as less difficult to execute. Previous research has empirically shown that ‘perceived ease of use’ is another major determinant of user acceptance which has a positive effect on intended system use (Pikkarainen et al., 2003; Wang et al., 2003; Chan and Lu, 2004; Gefen, 2003; Venkatesh and Davis, 2000). According to the previous findings, the more the new technology is perceived to be easy and free of effort, the more the chance it will be considered useful by the employees. As discussed in the previous chapter, the TAM model postulates that, depending on external variables, the PEU of innovation influences the attitude of a user towards using the new system. This attitude (either positive or negative) subsequently defines the user’s behavioural intention to use the system, ultimately leading to the acceptance or rejection of the system. In the context of RFID adoption, Pool et al. (2018) argue that PEU affect a user’s attitude towards using the new technology and the user’s attitude directly relates to their intention, which will, in turn, determine the system usage of the technology. These considerations lead to the following hypothesis:

H2. *Perceived Ease of Use will have a positive effect on RFID adoption.*

Technology Competence (TC)

The IT infrastructure of an organisation determines its potential to acquire new technologies and technical resources for operational practices and processes. Similarly, Thi et al. (2014) explain that technical infrastructure plays a significant role in a firm's adoption decision as it determines the firm's ability to benefit from change (reform) initiative. The role of IT and IS for organisational development has been widely discussed and many researchers remark that IT has now become a major component for innovation management (Khanh, 2014). The availability of adequate IT resources influences the deployment of RFID technology and determines performance requirements and subsequent critical success factors of the RFID system (Rogers, 1995; Tornatzky and Fleischer, 1990). According to Wang et al. (2010), IT infrastructure refers to installed network technologies and enterprise systems, which provide a platform on which the RFID applications can be built. However, the integration of an RFID system is still relatively new to many organisations. Implementing RFID applications requires new IT skills, new IT components and adaptation of existing information systems (Chao and Yang, 2007; Ngai et al., 2007). Therefore, we can expect that firms with greater technology competence are in a better position to adopt RFID. Therefore, consistent with the above discussion, it is hypothesised that:

H3. *Technology competence particularly IT infrastructure will have a positive effect on RFID adoption.*

3.3.2 Organisational Determinants of RFID Adoption

The organisational context describes the nature of organisational characteristics that may facilitate or inhibit innovation adoption (Troshani et al., 2011). The organisational factors refer to the characteristics and resources of the firm that influence the adoption processes of RFID systems (Acar et al., 2005). Key organisational determinants of

RFID adoption include the Top Management Support, Perceived Financial Cost and Firm Size, which are discussed next.

Top Management Support (TM)

Top management can provide the vision, support and commitment to create a positive environment for innovation adoption (Bhattacharya and Wamba, 2015). In the organisational development literature, top management's commitment is one of the most important and critical success factors for change (innovation) adoption (Bhattacharya and Wamba, 2015; Khanh, 2014; Soltani et al., 2007). Top management support is more critical for RFID technologies since the RFID implementation requires adequate resources, process reengineering and user coordination (Wang et al., 2010). Top management also can send signals to various parts of the organisation about the importance of the innovation (Teo et al., 2004; Khanh, 2014). In difficult times of change, a key role of top managers is to develop clear strategies around re-design, restructuring and promoting a shared vision about the innovation to be adopted or introduced (Tornatzky and Fleischer, 1990; Park and Rim, 2012). Brown and Russell (2007) and Loebbecke and Palmer (2006) furthermore note that, with RFID in particular, success depends on the management challenges associated with implementation being addressed. Attaran (2007) identified top management involvement as a critical success factor that might influence RFID adoption. Similarly, Reyes et al. (2016) argue that top management involvement is a critical enabler of RFID because the deployment of RFID requires a significant investment in time and money. Thus, the proposition is:

H4. *Top management attitude towards RFID positively influences its adoption*.

Perceived Financial Cost (PFC)

As Lai et al. (2014) point out in their study about RFID adoption in a Taiwanese hospital, adoption of brand-new technology can be interrupted if there are not enough financial resources. Positive correlation between financial readiness and technology adoption has been proved in many empirical research works (such as, Krasnova et al., 2008 and Lee and Jung, 2016). Similarly, Tung et al. (2008) concluded that PFC had a strong negative impact on nurses' behavioural intentions to use an electronic logistics information system in Taiwan. Moreover, Wu and Wang (2005) noted that cost is considered an important predictor of mobile commerce acceptance in Taiwan. Thus, in these situations, PFC has a significant negative effect on potential users' intentions to use the technology. The implementation of an RFID system has a number of associated costs. For example, there is the purchase cost of tags and readers and the software to run the system (Li and Visich, 2006). Once the tags and readers have been purchased, there is the installation cost, followed by the cost to maintain the system. Based on these projected costs, the return on investment in an RFID project can become a barrier to adoption and implementation. Reyes et al. (2016) are of the opinion that a higher level of cost can lead to a lower level of RFID adoption. Financial resources are thus critical for RFID project scoping, analysis of existing systems, and determining performance requirements and subsequent critical success factors (Nguyen, 2009). In light of the above discussion, the following hypothesis is suggested:

H5. *Perceived Financial Cost for RFID negatively influences its adoption*.

Firm's Size (FS)

Many studies have found that firm size facilitates innovation (Lee and Jung, 2016; Wang et al., 2010). Bigger firms usually have more resources to experiment with new innovations and have a greater ability to absorb the risks and costs of implementing innovations (Sharma and Rai, 2002). Larger firms' flexibility to absorb more risk facilitates innovativeness. Since the cost of RFID tags and the systems needed to read and track tags are expensive, only large companies have the financial resources to invest in RFID installations (Wang et al., 2010). Therefore, considering the size of the firm would be very important when it comes to technology adoption because usually big-sized firms keep the extra capacity to discover new technology and generate the economy of scale (Lee and Jung, 2016). Lee and Jung (2016) further explain that, usually, big-sized companies have a stronger will to adopt brand-new technology because of their financial resources. On the other hand, smaller organisations may not have the resources to experiment and pilot RFID projects (Brown and Russell, 2007; Wang et al., 2010). Accordingly, the following hypothesis is proposed:

H6. *Firm size will have a positive effect on RFID adoption***.**

3.3.3 Environmental Determinants of RFID Adoption

The environmental context represents the arena where organisations conduct their business, and includes industry characteristics, government regulation and supporting infrastructure (Troshani et al., 2011). Organisations are increasingly confronted by numerous social and ecological issues within the environments in which they operate. Competitive Pressure and Government Regulations are key environmental determinants that can influence organisational adoption of technology (Sharma and Citurs, 2005; Teo et al., 2004). These factors are explained below.

Competitive Pressure (CP)

Many organisations adopt new technology in order to become more competitive (Nguyen, 2009; Troshani et al., 2011; Lee and Jung, 2016). According to Nguyen (2009), organisations generally integrate new technology into a system to: (i) respond or react to an event; (ii) respond to pressure from the internal and external environment; and (iii) respond to pressure from customers to improve efficiency. In the case of RFID, media pressure, dominant partner pressure, regulatory pressure and trade association pressure also drive organisations towards adopting the technology (Wang et al., 2010). As market competition increases, organisations may feel the need to seek competitive advantage through innovations. By adopting RFID, firms may benefit from better inventory visibility, greater operation efficiency and more accurate data collection (Pool et al., 2018; Wang et al., 2010). Similarly, Lee and Jung (2016) explain that, when one company adopts and starts using brand-new technology, other competitors start to feel impatient because they are anxious about the potential benefit that the first mover to use the technology might have and dispossess from them. As competition from other players in the market increases, an organisation is more prone to seek ways of achieving sustainable competitive advantage through innovative technologies (Cruz-Jesus et al., 2019). RFID fulfils this objective as, with RFID adoption, organisations may benefit from improved services and advanced logistics. Finally, many previous researchers have empirically established the positive relationship of competitive pressure and an organisation’s decision to adopt RFID (Jones et al., 2005; Brown and Russell, 2007; Pool et al., 2018). Thus, the following hypothesis is proposed:

H7*: Competitive pressure positively influences RFID adoption.*

Government Regulations (GR)

Obeidat and Abu-Shanab (2010) found that absence of required legislation in the Jordanian public sector hindered the adoption of e-government. Similarly, Tan and Teo (2000) observed that government intervention through introduction of adequate legislations could play an important role in the diffusion of an innovation in any country, concluding that, in the diffusion of ITs in Singapore, it has been a major contributor. There is lack of global standards for RFID adoption. Government initiatives and policies could directly and/or indirectly stimulate the development of RFID infrastructure and information provision to energise faster technology diffusion (Ghobakhloo et al., 2011).

While security and privacy concerns have been noted as issues for technology adoption, to date, few government regulations have been developed (Ali and Osmanaj, 2020). Furthermore, governmental regulation issues related to RFID adoption have not been widely researched; these issues should be researched as RFID becomes more widespread. As a result, it is important to not only recognise the risks associated with RFID-related technologies but also to create strategies that allow organisations to better manage, organise and mitigate these risks. Practitioners believe that the development and adoption of official standards, enabling interoperability between applications or devices, can significantly accelerate the adoption of RFID technology. Global standards are required in order to ensure end-to-end interoperability of RFID systems to track goods through the global supply chain (Finkenzeller, 2003). In light of the above discussion, the following hypothesis is suggested:

H8: *Government Regulations positively influences RFID adoption.*

3.4 Theoretical Research Model

Having reviewed the change management, innovation adoption and RFID implementation-related literature, the researcher has developed a model to exhibit the potential causal relationships among the independent variables (TAM and TOE-related factors) and the dependent variable (employees' intention to adopt RFID). This proposed model (Figure 3.2 below) explains the intention towards the adoption of RFID, postulating eight determinants: PU, PEU, TM, GR, CP, FS, TC and PFC. The model shows the presumed relationships among all research variables through the research hypotheses.

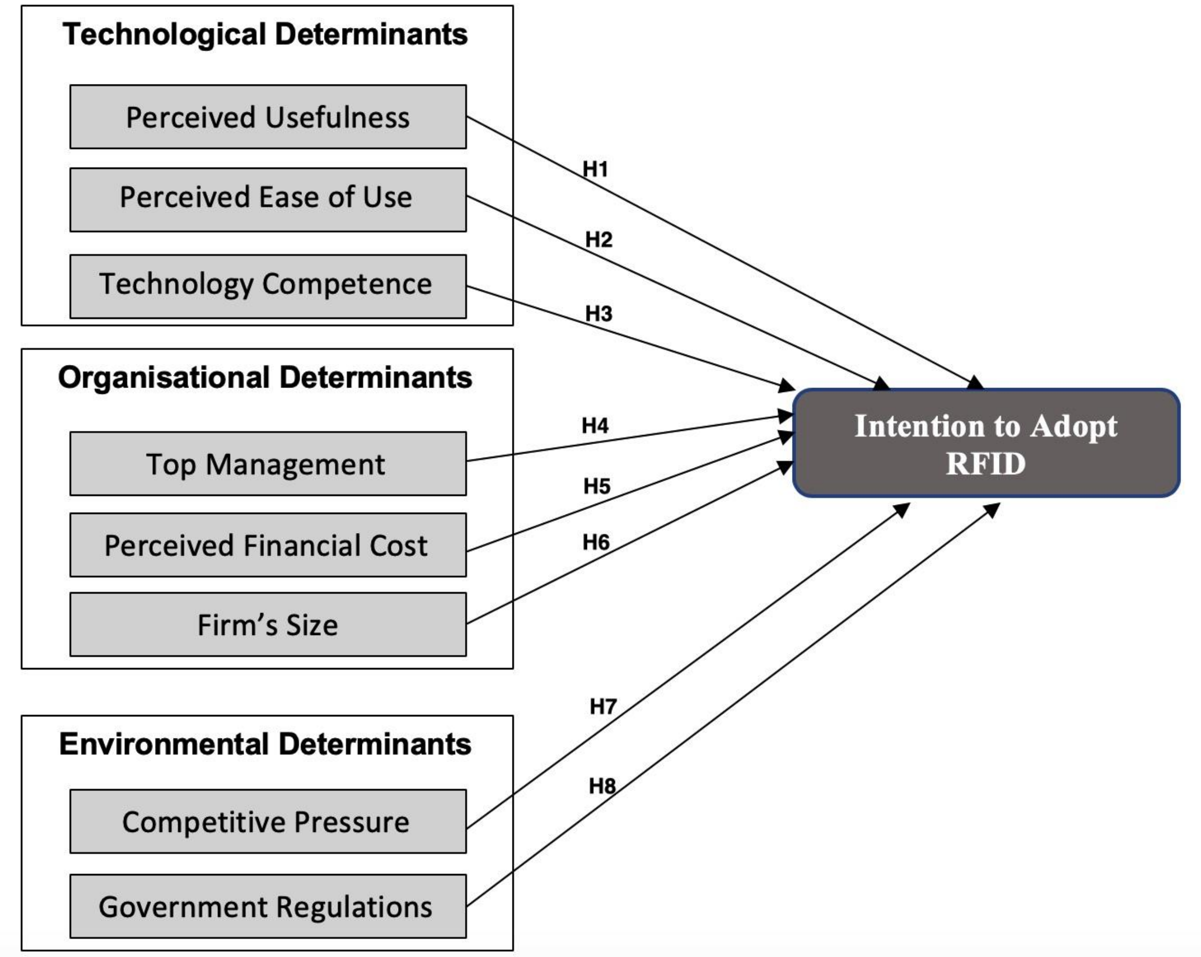

Figure 3. 2 Theoretical Research Model

Source: Developed by the Researcher

3.5 Summary

The increasing demand and use of new technical systems in organisational and individual contexts indicate that the issue of user acceptance should continue to be of great importance. In order to understand the determinants that influence user acceptance of RFID systems in the oil and gas sector, this research extends the well-known technology acceptance model (TAM) by adding variables from the Technology-Organisational-Environmental (TOE) framework. These factors have been identified on the basis of their significant effect on user acceptance of technology in IS and technology acceptance literature. Thus, firstly, this chapter presents the research framework which investigates the impact of TAM and TOE-related factors on RFID system deployment and implementation. Secondly, discussions on the different elements that make up the research framework and their inter-relationships are also presented. Justification for the research framework was used to provide an account of the relationships between the research constructs, the factors and dimensions of each of the construct, and the hypotheses enacted to investigate the relationships between the constructs.

The next chapter presents an overview and justification of the research methodologies adopted in this research. The method of data collection is also highlighted, alongside an outline of the statistical tools and techniques adopted to achieve the research objectives.

Chapter 4: Methodology and Research Methods

4.1. Introduction

This chapter discusses and justifies the research methodology and methods adopted by this study in order to collect and analyse data to achieve the research objectives. In essence, this chapter is concerned with the choice of appropriate methodology and methods by which the research validity is measured. Thus, this chapter shows clearly and justifies how the research is to be conducted and why particular data collection instruments were selected and why others have not been considered. This research has been developed on the basis of the relevant literature review, the nature of the problem and the research objectives.

The overall purpose of this research study was to examine as well as extend the body of knowledge and understanding regarding user acceptance of RFID systems. Based on the published literature review, a conceptual model and hypotheses concerning users' acceptance of the RFID system was developed. In order to examine the key determinants of RFID acceptance, users will be asked to respond to a number of survey questions measuring the different constructs included in the proposed theoretical model. This chapter outlines the data collection and statistical analyses methods that were used in this research study.

This researcher employed a quantitative data collection method using a survey approach to collect data concerning the usage of RFID systems by intended users in the oil and gas sector of the UAE. In order to ensure its reliability and validity, the survey questionnaire was created on the basis of previously validated scales and survey instruments. The wording of questionnaire items included in the survey measuring constructs of the proposed model, presented in the previous chapter, was adapted as necessary from the previously published literature to fit within the context of this study. Data analysis for the final conceptual model (see Figure 3.2) was performed by Structural Equation Modelling (SEM) using the latest version of Analysis of Moment Structures (AMOS 26) software. The primary intent of this statistical approach is that it allows a researcher to model and predict relationships between constructs in the hypothesised manner.

This chapter begins with a discussion regarding the philosophical stance adopted for the study (section 4.2). The research purpose, approach and strategies are discussed in sections 4.3 and 4.4, respectively, before a detailed discussion of the research methods used to obtain data for evaluation appears in sections 4.5, 4.6, 4.7 and 4.8. Statistical tests utilised to analyse the collected data are described in section 4.9. Section 4.10 clarifies the ethical considerations taken into account by the researcher in conducting the study, and, finally, a brief summary is offered in section 4.11.

4.2 Philosophical Perspectives

According to Saunders et al. (2012), a philosophy means the use of argument and reason in seeking truth and knowledge and is a framework that guides us regarding how scientific research should be conducted. Smith et al. (2009) noted that the study of philosophical issues has several advantages: it can help researchers to clarify research designs; it guides researchers in identifying and creating designs that may be outside their previous experience; and it helps them to recognise which designs will work and which will not. Moreover, Saunders et al. (2009) argue that researchers in social sciences must start their research design by acknowledging the theoretical and philosophical assumptions underpinning their investigations. Research philosophy is thus considered as a belief about how data about a phenomenon should be gathered, analysed and used. Generally, a research paradigm provides a set of boundaries within which a researcher is expected to conduct his/her research work and it is a worldwide view that guides researchers (Guba and Lincoln, 1994). It is thus important to fully understand the philosophical underpinnings of a research project because it enhances a researcher's ability to select the appropriate methodology (Holden and Lynch, 2004). Guba and Lincoln (1994) pointed out that the bases for research paradigms are ontology, epistemology and methodology.

The terms ontology and epistemology define the nature of reality and how that reality is captured, respectively (Carson et al., 2001). Ontology is related to what exists and the nature of the world whereas epistemology is a theory that deals with how the knowledge of the external reality is acquired (Sekaran, 2003). In the social sciences, ontology refers to those primary principles that individuals hold about the nature of the issue in question (Kaufmann and Clément, 2015). On the other hand, Clark et al. (2008) define epistemology as the area of philosophy that uncovers the answer to the question "What does it mean to know?" or "How does a researcher acquire the sought-after knowledge?" The term 'epistemology' is viewed by MacKay (2014) as the type and level of proof required for something to be accepted as true. In conclusion, ontology is considered as the reality that the researcher investigates whilst epistemology is the relationship between that reality and the researcher. On the one hand, reality is objective, absolute and the truth is single. On the other, the world is made up of multiple realities and truths. As social constructs are plural and reliant on subjective interests, researchers need to show where they stand.

In this study, the researcher has attempted to be objective by keeping himself detached by maintaining distance from the subjects (research participants) under observation to make the inquiry objective, so that time- and context-free generalisations could be made possible (Nagel, 1986). In addition, the researcher tried to remain disinterested throughout the inquiry by eliminating his biases, keeping himself emotionally detached, and being uninvolved with the objects of the study.

In the domain of methodology, there are two main research approaches, namely positivist and interpretivist (Hussey and Hussey, 1997; Aliyu et al., 2014). Positivism is well known as a scientific approach and is quantitative, and interpretivist is known as non-positivist and qualitative. However, both philosophical approaches have positive and negative impacts on different contexts of research in one way or another, but the main concern is the same (Bryman, 2001). In order to select the appropriate approach to carry out this research, it is necessary to understand and explain both approaches. Therefore, they are discussed in the next sections along with the rationale for the selection of the particular research philosophy adopted for this survey research.

4.2.1 Positivist Approach

A positivist takes the stance of a natural scientist, and seeks the causes or evidence of occurrences, with little regard to the subjective state of the individual (Hussey and Hussey, 1997). Positivist research is deductive in nature and includes surveys and fact-finding questions of different kinds in which the researcher has control over the subjects or variables in question with closed questions. However, to obtain further details and opinions from the respondents, open-ended questions are usually included. Positivist researchers adopt a controlled and structured approach to conducting research by outlining a research topic, formulating appropriate hypotheses and adopting a suitable research methodology. Additionally, a neutral stance between the studied phenomena and the researcher is maintained by making a clear distinction between reason and feeling (Carson et al., 2001). Positivism has a successful historical association with the physical and natural sciences. However, it has often been criticised for its inability to consider the characteristics of the human elements in the organisation and has been labelled ‘unrealistic’ (Uduma and Sylva, 2015; Aliyu et al., 2014).

According to the positivistic school of thought, researchers need to remain disinterested by putting their biases aside and being emotionally uninvolved with the objects and participants of study. Therefore, researchers who use a positivist approach traditionally remain neutral, and use a formal writing style and the impersonal passive voice and technical terminology (Tashakkori and Teddlie, 1998).

The research methods used in the positivistic approach were originally developed in the natural sciences meant for studying natural phenomena. The most common quantitative methods used in management information systems are survey methods, laboratory experiments, formal methods and numerical methods (Orlikowski and Baroudi 1991). The quantitative research approach is based on deductive reasoning. A postulate is set a priori, and data is gathered to test the validity of the hypothesis.

4.2.2 Interpretivist Approach

This is an anti-positivist school of thought that usually implies adopting an empathetic philosophical stance, thus seeking to understand the world of the research subjects from their own viewpoint (Saunders et al., 2007). Interpretivism is a philosophy that believes in the study of phenomena in their natural environment and contends that it is only through subjective interpretation that reality can be fully understood (Hudson and Ozanne, 1988; Thanh and Thanh, 2015). Although interpretivism has become an increasingly important perspective in social research, criticism of interpretive approaches exists to a certain degree. Arguments range from concerns about false consciousness to the relativism of the paradigm (Aliyu et al., 2014).

Unlike positivists, interpretivist researchers believe that reality is subjective, complex, multiple and continuously changing (Collins and Hussey, 2009; , 2014). Researchers of the interpretivist school of thought assume that only the subjective interpretation and intervention in reality would enable the investigator to fully understand the reality (Davison, 1998). Interpretivists do not accept the clear distinction between black and white (facts) like positivists, but believe that there are shades of grey (values) in between, and rather see them as interlinked. The interpretivist approach considers people and their interpretations, perceptions, meanings and understandings, as the primary sources of data. In its very nature, the interpretivist approach promotes the importance of qualitative data in the development of knowledge (Kaplan and Maxwell, 1994). Therefore, for the interpretivist, a good understanding of an organisation can only be achieved subjectively using qualitative techniques (Uduma and Sylva, 2015).

Clearly, these two paradigms (positivism and interpretivism) present different perspectives and methodological choices; however, it is important to select the correct methodological paradigm in order to appreciate methods and decisions that can be controversial. Table 4.1 provides a summary of the main differences between these two approaches.

Table 4. 1 Key Features of Positivist and Interpretivist Paradigms

Paradigm	**Positivism**	**Interpretivism**
Ontology	Reality is considered objective and singular (knowledge governed by the laws of nature)	Reality is considered subjective and multiple (knowledge is socially constructed and interpreted by individuals)
Methodology	An experimental approach is adopted where research questions and/or hypotheses are formulated in advance, subject to empirical investigations	Takes an investigative approach, where the researcher elicits individual constructions and refines them hermeneutically, with the aim of generating constructions on which there is substantial consensus
	Researcher adopts a deductive approach, uses a predetermined research design, and attempts to position the research to a generalisable state	Researcher adopts an inductive approach, studies the topic within its context, and uses an emerging design

Source: Adopted and Adapted from Guba (1990)

In conclusion, positivism believes that truth exists concretely, independent of the observer, and that reality is separate from the individual who observes it. In contrast, interpretivism holds the belief that truth is a construct shaped or influenced by the observer and that reality is relative and not detached from the individual who observes it. In addition, positivism relies on experiments and empirical evidence to discover truth. Interpretivism relies on meaning obtained from interviews and subjective observation to describe perceived truth.

4.2.3 The Research Philosophy Selected for this Study

The research questions and objectives of this study are the driving force behind the choice of philosophical paradigm. Given that the main purpose of the study is to identify the factors that influence the RFID acceptance and to explore the relationships among these factors, based on various theories and models in the field of technology acceptance, a hypothesised model of RFID system acceptance was developed. In order to empirically test and validate the hypotheses in the proposed model, this study used the positivist (quantitative) approach, as it was consistent with the topic. In fact, Hussey and Hussey (1997) suggested that the normal process under a positivistic approach is to study the literature to establish an appropriate theory and construct hypotheses. Therefore, this research study was within the domain of the positivist approach rather than the interpretivist approach.

The positivist approach was chosen for this study with careful consideration of the characteristics of the other different paradigms, the objectives and type of study being reviewed. Some other considerations made in deciding to adopt a positivist stance for this study are explained next. Firstly, after an intense review of literature in the field of technology acceptance, the hypotheses are formulated. These hypotheses will then be tested by collecting data through self-administered questionnaires. Thus, a positivist approach is most suited. Secondly, positivism uses deduction, which starts with a theory and ends with drawing an inference to support or revise the hypothesised model (Al-Jalahma, 2012). This is one of the objectives of this study. Also, since deduction has been established as an approach to be used by this study, a positivist stance is justified. Thirdly, since technology acceptance is a normative science, whereby reality is perceived to be objective and quantifiable, this makes the positivist approach more suitable for this research. Fourthly, according to Creswell (2009), the positivist paradigm is applicable when the researcher and the reality are not connected; and the findings should be replicable without regard to who conducts the study. The researcher’s position remains neutral throughout the research process; thus, the positivist paradigm is suitable. Finally, this approach is appropriate because it allows the researcher to study the attitudes and behaviour of a large population. A structural equation modelling technique which is suitable to analyse large datasets will be used to test the hypotheses and develop a causal model. Referencing Straub et al. (2005), this kind of statistical measurement is characteristic of a positivist approach.

4.3 Research Approach

The two most commonly cited and utilised research approaches in adoption studies are deductive and inductive. They are both associated with different epistemological stances – positivism or interpretivism – and both employ either a quantitative or a qualitative method of inquiry (Creswell, 2014). The deductive approach is usually associated with positivism and the inductive approach is associated with interpretivism (Bryman and Bell, 2011).

Deductive research advocates for theory testing by empirical observation. Deduction involves deducing logical conclusions from a set of input propositions and the available information. The propositions might be assumptions that the researcher is investigating or those that the researcher believes (Bryman and Bell, 2007, 2003). Deductive reasoning is associated with positivism and natural science models of social research, and quantitative research (Bryman and Bell, 2003). Deductive content analysis is often used in cases where the researcher wishes to retest existing data in a new context (Elo and Kyngas, 2008). The deductive approach is thus a top-down approach, which can be explained as developing hypotheses which are derived from some existing theory, and then formulating a research strategy for hypotheses testing (Wilson, 2010). A conceptual framework has been developed for this study (see Figure 3.2 on page 76) and will be tested to better understand the factors for RFID successful adoption and implementation. Based on the characteristics of the deductive approach explained above, this stance will be employed for this study.

On the other hand, the inductive approach is a bottom-up approach, as the researcher collects data and then develops a theory based on the findings (Lodico et al., 2010). Unlike the deductive approach, the emphasis in inductive research is on defining an event as a narrative, taking into consideration the importance of describing the context and considering the views of those who are influenced by a phenomenon when trying to assign meaning to it. Therefore, the inductive approach is best used to acquire in-depth information about a problem, and to reveal fundamental motives, feelings, values and perceptions (Hair et al., 2004). To conclude, inductive studies are interpretivist in nature and seek to explore a new phenomenon using qualitative data.

Since this study has been established as a quantitative one, the inductive approach is not suitable and will not be adopted.

4.4 Research Strategies

Research strategy is the broad plan of how to achieve the determined research objectives. The choice of which strategy to follow is dependent upon the nature of the research problem (Noor, 2008). Saunders et al. (2009) argue that there are six research strategies that can be employed in any research design: ethnography, experiment, survey, case study, grounded theory and action research. This section describes each of them and provides justification for the preferred strategy.

Ethnography deals with the scientific description of specific human cultures. It is rooted firmly in the inductive approach. It aims to explain the social world. It is a time-consuming strategy – conducted over an extended period of time – and, hence, requires a great deal of adaptability and responsiveness to reflect new changes and patterns in the study. The main method of data collection in ethnography is through participant observation, where the researcher becomes a full working member of the group studied (Collis and Hussey, 2003).

Action research, developed by Collier (1945), refers to a specific way of understanding and managing the relationship between theory and practice. This approach requires the involvement of the researcher in the social system being studied and is used by qualitative studies. The action research strategy goes through an interactive and iterative process of diagnosing, planning, taking action and evaluating. This type of strategy is useful for 'how' questions. This method does not test theories or variables to generalise findings, which is the main purpose of the study. It is usually time consuming and expensive and, even though it is aimed at integrating theory and practice, this study will not be employing this approach.

The experimental strategy includes studies that take place within a designed, controlled environment and usually involves special treatment of different groups to contrast the precise relationships among variables (Galliers, 1991). In conducting an experiment, it is important to address the internal validity (the extent to which the findings can be attributed to the intervention method of the study) and external validity (generalisability of the findings). Experiments are used in exploratory and explanatory research to answer ‘how’ and ‘why’ questions. Critics of experiments argue that, since the laboratory situation is abstract and unrealistic (in that it contains fewer considerations, dimensions and confounds than the real world), no results from the lab can be used to predict behaviour in the world. Since this study cannot be initiated in a controlled environment, the experimental strategy will not be adopted.

Case studies allow exploration of the phenomenon in depth with context and with people’s perceptions taken into consideration. Yin (1984) describes a case study as a group of methods that are usually associated with qualitative studies. Data collected from case study research is typically from a small number of organisations through in-depth interviews, and observational and longitudinal studies. In a case study, a particular individual, programme or event is studied in depth for a defined period of time.

Grounded theory, which was originally introduced by Glaser and Strauss (1967), is a research method that aims to systematically gather and analyse data in order to develop a theory that is grounded in the data (Glaser and Strauss, 1967). Data collection starts without the formation of an initial theoretical framework or specific hypotheses. Theory is developed from data collected by observations at the initial stage. Findings are then tested in further observations – with continual reference to the data – in order to develop the final shape of the grounded theory. Since the approach of this study is deductive (top-down), the grounded theory is not suitable to test the conceptual framework that was developed in the previous chapter.

The survey research strategy is one of the most widely used methods of data collection in business and management research (Mathers et al., 2009). It allows the collection of a large amount of data from a sizeable population in a highly economical/efficient way through such data collection instruments as interview (oral) and/or questionnaire (written). Surveys are commonly used because they allow researchers to collect a considerable amount of data by investigating a large number of subjects in a highly effective manner, thereby facilitating the generalisability of research findings to the whole research population (Sekaran, 2003; Saunders et al., 2012).

In this research, the survey method is used because it is designed to deal more directly with the respondents' thoughts, feeling and opinions, especially when collecting information regarding attitudes and beliefs is concerned (Yin, 1994; Zikmund, 2003). In addition, the survey method offers a more accurate means of evaluating information about the sample and enables the researcher to draw conclusions about generalising the findings from a sample to the population (Creswell, 2011). Moreover, the survey method is considered to be quick, economical, efficient and can easily be administered to a large sample (Churchill, 1995; Sekaran, 2000; Zikmund, 2003). In addition, surveys are also commonly used when empirically testing hypotheses, the extent of the researchers is minimal, and the assumptions of the study are based on positivist, mainly quantitative methodologies (Clark and Creswell, 2008). The need to test several hypotheses within the model, and the generalisation of the findings, justifies the use of a survey approach as opposed to case studies and other approaches.

4.5 Research Methods for Data Collection

Creswell and Clark (2011) asserted that there are two key methods that can be used by researchers in conducting their research: quantitative and qualitative. Quantitative research is linked to the positivist philosophy, and it represents the use of numerical data, which is objective in nature. Quantitative research seeks to test theories by examining the causal relationships among variables (Bryman, 2012, Saunders et al., 2012). Quantitative research, usually associated with a positivist stance, deductive (or top-down) approach, survey strategy and correlational studies, uses methods with pre-determined, observable and highly structured data collection techniques to test hypothetical generalisations (Hoepfl, 1997; Creswell and Clark, 2011).

Since the main purpose of this study is to investigate the key determinants that influence user adoption of RFID systems, to be able to test the hypotheses posited, and generalise the study findings, the fundamental characteristics discussed above make the quantitative method an integral part of the research methodology. Key advantages of using this method are that the results from quantitative research can be generalised, measured and used to develop statistically robust and significant theories.

On the other hand, qualitative research covers a variety of naturalistic and interpretive approaches and methods concerned with understanding the meanings that people attach to actions, decisions, beliefs and values within the social world (Ritchie and Lewis, 2003). Qualitative research, associated with the interpretivism philosophy, involves the collection of a variety of empirical materials in order to interpret certain phenomena, events, problems, occurrences, behaviours, experiences, etc. Qualitative research seeks to capture the wealth of people's experience in their own terms. This kind of research does not use statistical techniques and is used when not much is known about the research topic. Qualitative research attempts to investigate more than one perspective to view the research problem comprehensively. This method also involves face-to-face interviews and observations of behaviour. To develop a statistically robust and significant causal model, a qualitative approach is not primarily suitable for this study. Consequently, this research will not use qualitative data.

To conclude, in this study, the researcher employed a quantitative data collection method and survey approach to obtain data concerning the acceptance/adoption of RFID systems by intended users. Table 4.2 presents the overall approach employed in this research.

Table 4. 2 Research Approach of the Study

Research philosophy, approach and strategy of this study	
Research Philosophy	Positivism
Research Approach	Deductive
Research Strategy	Quantitative
Data Collection Method	Survey Questionnaire

Source: Developed by the Researcher

4.6 Questionnaire Design and Instruments

Measurement is one of the most fundamental parts of research. Saunders et al. (2012) reported that there are two types of questions: open and closed. Open questions, sometimes called open-ended questions, are useful when a researcher is seeking more detailed answers that may require the writing of words or numbers. Although this type of question allows respondents to give their answers in their own way, it can become off-putting if the researcher leaves too much space. On the other hand, closed questions or closed-ended questions provide a number of alternative answers from which the respondents are instructed to choose. The answers can be a range represented by three, five, seven or more answers ranging from positive to negative, or a yes/no choice. This type of question is easier and quicker for the respondent to answer.

According to Collins and Hussey (2009), researchers aiming to gather opinions and feelings from a large sample, and at relatively low cost, tend to develop questionnaires involving lists of carefully structured and pre-tested questions. In respect of this study's questionnaire, the researcher found from reviewing change management literature that the use of previously validated measurement scales was a common research practice for many scholars in the field (see for example: Shah, 2009; Weber and Weber, 2001; Madsen et al., 2005; Holt et al., 2007). Moreover, Bryman and Bell (2011) highlight that, by employing other researchers' questions, a researcher is usually able to develop a more credible research instrument that will provide more valid and reliable research results. This research thus used previously validated instruments to investigate the factors influencing employees' intention to accept RFID in the oil and gas sector of the UAE.

At an early stage of the design process, the researcher developed a preliminary pool of measurement items for all constructs in the research model, based on information derived from the literature review. In the next stage, an initial screening of these items was made, bearing in mind the UAE's national culture. In line with the advice from Easterby-Smith et al. (2002), the aim was three-fold: firstly, to ensure that the chosen questions were appropriate for the UAE's culture; secondly, to confirm that they were directly related to the research questions, to ensure these overall questions can be answered by the obtained data; and, finally, to ensure that they were clear and did not include any ambiguous, complex, unfamiliar or highly technical terms, to ensure effective and straightforward measurement of the answers.

In the final stage of the questionnaire development process, appropriate items for each research construct were incorporated into an initial questionnaire copy, which was then reviewed by four experts (academics from LJMU in the UK and managers of the

ADNOC in the UAE) in order to ensure the clarity of questionnaire statements and the comprehension of measurement scales.

The questionnaire contains detailed brief and clear instructions and was arranged to facilitate ease of response. Respondents were advised by the information letter (see Appendix 1 on page 207) about the nature of the research, the researcher's background, and why the research was being carried out. They were assured of privacy and confidentiality, and were offered the opportunity to receive a copy of the research upon its completion. In addition, they were informed that they could fill in the questionnaire in about 15 to 20 minutes. The original questionnaire was developed in the English language and translation of the questionnaire into the local language (Arabic) was not necessary because most of the respondents from the oil and gas sector understand English very well.

4.6.1 Questionnaire Structure

As mentioned previously, all measurement scales used in this study’s questionnaire were based on a combination of previously validated instruments from several TAM and TOE-based studies in technology adoption fields. A five-point Likert scale was the main instrument in the questionnaire to explore participants’ agreement or disagreement with the statements. In survey questionnaires, a Likert scale is commonly used to measure attitudes (Miller and Brewer, 2003). In line with the advice from Oppenheim (2009), a Likert scale was adopted in the survey partly because the reliability of Likert scales tends to be good and partly because of the greater range of answers permitted to respondents. In addition, as was suggested by Bryman and Bell (2011), the shorter and most straightforward questions were placed at the beginning of the questionnaire. The questionnaire was structured with a variety of response opportunities, and was arranged as follows:

Part A is concerned with the demography of participants, providing information about participants’ personal attributes (Appendix 1). Four items from question numbers 1 to 4 are concerned with the demography. These variables – gender, age, educational level and years in present job – have been applied as an intervene which may affect the level of acceptance for RFID implementation. Many similar researchers who investigated the determinants of technology acceptance, such as Shah (2009), Weber and Weber (2001), Madsen et al. (2005) and Holt et al. (2007), applied demographical factors to know the context of individuals.

Part B is concerned with critical factors related to technology adoption in ADNOC in the UAE. Respondents were asked to indicate whether they agree or disagree with the presence and importance of independent variables (factors) related to recent technology-based change initiatives being implemented in the UAE's oil and gas sector. The theoretical constructs were operationalised using validated items from prior relevant research. The adapted items were validated, and wording changes were made to tailor the instrument for the purposes of this study. This section offered an agreement/disagreement level, in which rating was done on a scale of 1-5, with 1 = Strong Disagreement and 5 = Strong Agreement. This part (theoretical constructs) was divided into three main sections, as illustrated below:

B1. Technological Determinants

As discussed in Chapter 3, the technology context focuses on the manner in which technology characteristics can influence change. Fundamental technology-related factors such as Perceived Usefulness, Perceived Ease of Use and Availability of IT/IS Infrastructure are included in section one. In order to minimise any potential confusion, each construct's items were grouped together as follows:

(i) Perceived Usefulness (PU) comprises six items that were used to determine the level of respondents' agreement/disagreement with statements regarding the value of the RFID system for them in terms of productivity, speed, convenience, etc. These items were adopted from Venkatesh et al. (2003), Wang et al. (2010), Sukkar and Hasan (2005), Gefen et al. (2003) and Davis (1989). The items (statements) included in this section are presented below.

PU1. Using the RFID system enhances the productivity of my daily activities.
PU2. Using the RFID system makes it easier to do my day-to-day activities.
PU3. Using the RFID system enables me to accomplish daily activities more quickly.
PU4. Using the RFID system improves my performance of daily activities.
PU5. Using the RFID system enhances my effectiveness of regular activities.
PU6. Overall, I find the RFID system useful for my day-to-day activities.

(ii) Perceived Ease of Use (PEU) comprises six individual items that were used to measure the extent to which respondents believed that the RFID system is user friendly and could be used easily without effort. The items were also adopted from Chintalapati and Daruri (2017), Wang et al. (2010), Venkatesh et al. (2003), Sukkar and Hasan (2005), Gefen et al. (2003) and Davis (1989). The items (statements) included in this section are presented below.

PEU1. Learning to operate the RFID system is easy for me.
PEU2. I find it easy to get the RFID system to do what I want it to do.
PEU3. My interaction with the RFID system is clear and understandable.
PEU4. I find the RFID system to be flexible to interact.
PEU5. It is easy for me to become skilful at using the online banking information system.
PEU6. Overall, I find RFID system easy to use.

(iii) Technology Competence (TC) comprises four items that were adapted from prior studies (Gangwar and Ramaswamy, 2015; Wang et al., 2010; and Chao and Yang, 2007), as follows:

TC1. The technology infrastructure of my company is available for supporting RFID-related applications.
TC2. My company is dedicated to ensuring that employees are familiar with RFID-related technology.
TC3. My company contains a high level of RFID-related knowledge.
TC4. The technology infrastructure of my organisation is available for supporting RFID-related applications.
TC5. My company colleagues are qualified to adopt new technology such as RFID.

B2. Organisational Determinants

As discussed in Chapter 3, the organisational factors refer to the characteristics and resources of the firm that influence the adoption processes of RFID systems. Key organisational determinants of RFID adoption include the Top Management Support, Perceived Financial Cost and Firm Size, which are discussed next. Again, in order to minimise any potential confusion, each construct's items were grouped together as follows:

(i) Top Management Support (TM) refers to the extent to which one feels that the organisation's leadership and management are or are not committed to and support or do not support implementation of the prospective change. This construct comprises four items which will determine the level of support provided by the top managers of ADNOC UAE. These items were adopted and modified from Wang et al. (2010), Holt et al. (2007), Van der Voet et al. (2016), Bordia et al. (2004) and Bouckenooghe et al. (2009). The items (statements) included in this section are presented below

TM1. My top management is likely to invest funds in RFID.

TM2. My top management is willing to take risks involved in the adoption of the RFID.

TM3. My top management is likely to be interested in adopting the RFID applications in order to gain competitive advantage.

TM4. My top management is likely to consider the adoption of the RFID applications as strategically important.

(ii) Perceived Financial Cost (PFC) refers to the high cost which is often associated with new technology, particularly RFID. The following four items were incorporated to discover the degree to which the cost associated with using RFID has influenced respondents' behaviour. These items are adopted from Poon (2008) and Nguyen (2009).

PFC1. Costs of needed equipment required to implement RFID are reasonable.

PFC2. Setup costs for RFID system are reasonable.

PFC3. Running costs for RFID system are reasonable.

PFC4. Training costs for RFID system are reasonable.

(iii) Firm's Size (FS) refers to an organisation's capacity to implement large-scale technological change. The following three items were incorporated to discover the degree to which the firm's size is associated with RFID implementation. These items are adopted from Wang et al. (2010) and Zhu et al. (2006).

FS1. The capital of my company is high compared to the industry.

FS2. The revenue of my company is high compared to the industry.
FS3. The number of employees at my company is high compared to the industry.

B3. Environmental Determinants

The environmental context represents the arena where organisations conduct their business and includes Competitive Pressure and Government Regulations. Like other determinants discussed above, previously validated constructs and items are used for the environmental context, as explained below.

(i) Competitive Pressure (CP) refers to the increased market competition which encourages organisations to adopt and implement new technology to be competitive. The following four items were incorporated to discover the degree to which the competitive pressure is associated with RFID implementation. These items are adopted from Wang et al. (2010) and Gangwar and Ramaswamy (2015).

CP1. We are aware of RFID implementation in our competitor organisations.
CP2. We understand the competitive advantages offered by RFID in our industry.
CP3. My company experienced competitive pressure to implement RFID.
CP4. The major trading partners of my organisation encouraged implementation of RFID.

(ii) Government Regulations (GR) refer to the government initiatives and policies that could directly and/or indirectly stimulate the development of RFID. Three items attempted to measure respondents' attitudes towards the role of the UAE government in supporting RFID applications' development in the country. These items were adopted from Tan and Teo (2000).

GR1. The government encourages and promotes the usage of RFID system.
GR2. The internet infrastructures are sufficient for RFID system implementation.
GR3. The government has adequate regulations and laws for RFID system.

Part C: Dependent Variable (IA) refers to people's intention to adopt (IA) RFID in the organisations. The following four items were incorporated to discover the degree to which people intended to adopt/accept RFID in ADNOC UAE. These items are adopted from Pool et al. (2018) and Gangwar and Ramaswamy (2015).

IA1. Given the chance I intend to use RFID technologies.

IA2. Given the chance I plan to use RFID technologies.

IA3. Overall, I think that using RFID is advantageous.

IA4. Overall, I am in favour of using the RFID system.

4.7 Pre-testing and Pilot Study

Conducting a pilot test is advantageous as instrument weaknesses can be identified before the administration of the instrument to the actual population intended (Saunders et al., 2009). According to Sekaran (2003), pre-test and pilot study are both essential parts of questionnaire survey design and they must be conducted prior to the initial data collection phase or main survey in order to validate the instrument and to ensure that the survey questionnaire is free of errors and doubts. Moreover, the pilot study functions to ensure that the instrument is capable of collecting the data required to answer the research questions, and this implies testing the usefulness and efficiency of the questions formulated, and the administrative procedures (Herbert et al., 2015). Therefore, one pre-test and a pilot study were conducted prior to using the survey questionnaire in the main study. The purpose of pre-testing and pilot study was to avoid participants' confusion and misinterpretation as well as to identify and detect any errors and ambiguities. Similarly, the process of pre-testing or piloting a questionnaire was applied to ensure that the questions are worded correctly, follow a logical flow, and the instructions are clear and adequate.

4.7.1 Data Collection for the Pilot Test

At this stage, the final version of the questionnaire (see Appendix 1 on page 207) was distributed to a sample of 30 randomly selected employees from different departments of ADNOC UAE. The respondents were asked first to complete the questionnaire, and then to comment on issues such as wording, length, and the clarity of questions and instructions. This initial pilot test revealed that, on average, the questionnaire took about 10-13 minutes to be fully answered. Moreover, there were no significant complaints about the clarity of the questionnaire's language or instructions. The next logical step was to ensure the validity and reliability, which is explained below.

4.7.2 Reliability and Validity of the Questionnaire

It is important that consideration is given to the reliability and validity of the survey instruments. Generally, survey instrument (questionnaire) validation demonstrates that accumulated information obtains evidence of appropriate inferences in relation to the population based on the statistical analysis used (Creswell, 2009). The validity of the survey tool can be assessed by the researcher checking its content, construct and criteria. Assessment can be undertaken by referring to existing literature in regard to the validation of the instrument or through face validity with instrument validity determined by an appropriate expert panel (Pallant, 2001; Creswell, 2009).

Reliability refers to the consistency of a measuring instrument (Heyes et al., 1986). The result from the pilot study is used to test the validity and reliability of the questionnaire (Pallant, 2001). As discussed in the previous section, in order to ensure the reliability and validity of the instrument (questionnaire), only previously validated constructs and items are used. In addition, several reliability tests are employed to confirm the consistency of an instrument output, but the most widely held method by academics for measuring reliability is checking for internal consistency, which can be examined through the inter-item consistency reliability test. The scale of alpha should ideally be above 0.7 (Nunnaly, 1978; Sekaran, 2003; Field, 2009; Ghauri and Gronhaug, 2002). Thus, in order to assess the internal consistency of the measurement items in the questionnaire, a Cronbach’s alpha test was performed on the data using SPSS 26 software. In this study, using all 38 variables, the Cronbach’s Alpha Coefficient was 0.961, which indicates that the measuring instrument (questionnaire) has a good internal consistency that makes it reliable. Moreover, Cronbach’s alpha values for each construct under investigation are above the acceptable level (0.70). Table 4.3 displays the final pilot study reliability coefficients of the questionnaire.

Table 4. 3 Reliability Analysis

Constructs	No of Items	Cronbach's Alpha
Perceived Usefulness (PU)	6	0.823
Perceived Ease of Use (PEU)	6	0.712
Technology Competence (TC)	5	0.934
Top Management Support (TM)	4	0.845
Perceived Financial Cost (PFC)	4	0.957
Firm's Size (FS)	3	0.963
Competitive Pressure (CP)	4	0.885
Government Regulations (GR)	3	0.886
Intention to Adopt (IA)	4	0.938
All Constructs	39	0.919

4.8 Questionnaire Sampling Strategy

The concept of sampling is referred to as taking a portion of the population, creating observations on this chosen smaller group and then generalising the findings to the larger population (Burns, 2000). A sample is defined as any part of the population, regardless of whether it is representative or not. A population is defined as the full set of cases from which a sample is taken (Saunders et al., 2012).

Collecting data from the total population in a survey method is sometimes impractical, hence a sample, which is the subset or a fraction of the total population that is under investigation, is selected. The concept of sampling is intrinsic to survey research, as this is where the planning of the fieldwork begins. Due to the large amount of data associated with survey research, it is economical to select a sample of the total population being studied. The technique used to select a sample is also critical, not only to the internal, but also the external validity of the survey (Bryman, 2010). The sample selected must be representative of the larger population to determine generalisation.

Sampling methods can either be probability or representative sampling, and non-probability or convenience sampling (Bryman, 2010). Probability sampling means that each case in the population has the chance to be selected or the probability of each case is usually equal. Probability sample types include simple, systematic, stratified and cluster sampling (Saunders et al., 2012). On the other hand, non-probability sampling means that the probability of each case being selected from the total population is not known (Saunders et al., 2012). The types of non-probability sample include convenience sampling, quota sample and snowball sample (Bryman and Bell, 2011).

The current study is considered as a large-scale survey as its population is defined as all ADNOC UAE employees working in different departments. Therefore, it is clear that the assessment of all members of the research population is impossible, especially given the limited availability of finance, time and effort to the researcher. Consequently, the study uses a sample. To improve external validity, probability sampling was used. According to Tashakkori and Teddlie (2010), external validity relates to the generalisability of findings from a quantitative study of a population, research settings, and time horizon and so on. Patton (2002) noted that the aim of probability sampling is to choose a large number of cases that are representative of the population under study, which leads to a breadth of information. As mentioned above, all employees working for ADNOC UAE are the target population of the study; therefore, the sampling strategy for this study involved simple random sampling, which is the most widely used probability sampling technique. The next section explains the sample size used for the study.

4.8.1 Sample Size

The role of sample size is crucial in all statistical analysis. According to Luck and Rubin (1987), the more sophisticated the statistical analysis, the larger the sample size needed. Therefore, the sample size requirement in this study was based on the selected statistical analysis technique used; that is, structural equation modelling (SEM). SEM, like other statistical techniques, requires an appropriate sample size in order to obtain reliable estimates (Hair et al., 2006). Gorsuch (1983) suggested at least five participants per construct and not less than 100 individuals per data analysis. Kline (2005) and Hair et al. (2006) proposed a sample size of 200 at least to guarantee robust structural equation modelling.

In line with the above recommendations and assumptions, the main concern of this researcher was to achieve a minimum of 200 usable responses. Assuming a very conservative response rate, 850 questionnaires were distributed to the participants in order to obtain the required sample size.

4.9 Statistical Analysis Techniques Used for the Study

A major part of a research project is the preparation made for analysing the data, which depends upon whether the data is qualitative or quantitative (Collis and Hussey, 2003). In this current study, data collected from the questionnaires was used to perform quantitative data analysis. Following the collection of the responses, the next step was their coding. Once coding was completed, data was fed into the SPSS. The data (hard copies) was entered by the researcher with the process being completed within a month. Watling and Dietz (2007) consider there to be four essential steps for the successful analysis of results: (i) statistical tool availability; (ii) using conditions for each tool; (iii) acquiring the statistical result's meaning; and (iv) knowledge of how to perform the statistical calculations. Both parametric and non-parametric statistical tests were considered. Field (2005) stated a number of conditions for the use of parametric tests, as follows:

- Data should be obtained from one or more populations that are normally distributed.
- The same variance should be apparent throughout the data, meaning that there should be stability in the variance of a variable at all other levels as well.
- There should be interval-level measurement of the data, i.e., equal distance between the attitude scale points.
- The data of the different participants ought to be kept independent from each other, so that one response does not influence another.

Although parametric statistical tests require normally distributed data, it is suggested by the Central Limit theorem that, in the case of large samples, even when raw scores are not normal, the sampling distributions are normal (Tabachnick and Fidell, 2007). Therefore, parametric tests were used for this study and, consequently, analytical and descriptive methods of statistical analysis were used, with the former being given priority. Moreover, the proposed framework was validated using Structural Equation

Modelling (SEM) techniques, a popular method for model testing. Prior to SEM, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were employed. Table 4.4 provides a summary of the analysis used in the study. A more detailed description of the data analysis procedures used in the study is provided in Chapter 5.

Table 4. 4 Summary of Statistics Used for the Study

Statistics	Software Used	Purpose of Use
T-Test	SPSS 26	To determine if there is a significant difference between the means of two groups.
ANOVA	SPSS 26	To determine whether there are any statistically significant differences between the means of two or more independent (unrelated) groups.
Correlation	SPSS 26	For investigating the relationship between two quantitative, continuous variables.
EFA	SPSS 26	To identify the underlying relationships between measured variables.
CFA	AMOS 26	To test whether measures of a construct are consistent with the researcher's understanding of the nature of that construct (or factor).
SEM	AMOS 26	To analyse the structural relationship between measured variables and latent constructs.
Frequency Test	SPSS 26	To calculate the mean, median and mode to help users analyse the results and draw conclusions.

4.10 Ethical Consideration

Ethics refer to the moral values and principles that form the basis of a code of conduct and the term research ethics refers to the manner in which the research is conducted and how the results are reported (Collis and Hussey, 2009). Ethical issues play an important role when research is to be conducted among human subjects. According to Neuman (1995), the researcher must protect human rights, guide people and supervise their interests. According to Bryman (2012), Key ethical considerations in research include addressing unethical research practices so as to avoid harm to participants and invasion of privacy, informed consent and avoiding the use of deception.

In addition, Busher (2002) believes that ethical codes vary from person to person, culture to culture, and from one context to another. Something acceptable in one setting may be considered unethical or even unacceptable in another. Moreover, ethical decisions involve trade-offs, where a researcher should have a compromising attitude. In the research, privacy involves issues regarding the usage of the information received from the participants (Denier and Crandall, 1978) while confidentiality involves the issue of safeguarding the identity of the participants (Cohen et al., 2013). This study has considered all ethical requirements through all phases of the research. The participants were informed about the aim and importance of the study and why their participation was required for the research. The participants were also assured that participation was voluntary and that they could withdraw at any stage of survey completion. Additionally, the participants were assured that their confidentiality and anonymity would be protected. Prior to the data collection (questionnaire distribution), the research design application was prepared and submitted to the university for approval by the University Ethics Committee in November 2019. The research was conducted according to the prescribed guidelines, including observing confidentiality of information observed and accessed during the conduction of the research. The consent form and letter of information for the research participants can be found in Appendix 9, page 222.

4.11 Summary

The aim of this chapter was to discuss and choose the appropriate methodology and to discuss statistical techniques used in this study. It was identified that, in the domain of methodology, two main research approaches are highly appreciated, namely positivist and interpretivist. The positivist approach is widely known as a scientific approach, and it is quantitative in nature, while the interpretivist approach is commonly known as a qualitative approach. However, both philosophical approaches have positive and negative impacts on different research contexts in one way or another, but the main concern is the same. Both of these approaches were discussed in detail with the proper justifications for the selection of a particular research methodology.

This study adopted the quantitative (positivist) approach, as it was consistent with the topic. In fact, prior research suggested that the normal process under a positivistic approach is to study the literature to establish an appropriate theory and construct hypotheses. Therefore, this study was within the domain of the positivist approach rather than the interpretivist approach, as the model was developed after thorough investigation of the literature and the hypothesised model was proposed (see Chapter 3, Figure 3.2), in order to determine acceptance of the RFID system. In addition, a cross-sectional quantitative approach using a survey tool was employed to collect the data. The survey method was used because it was designed to deal more directly with the respondents' thoughts, feelings and opinions, especially when collecting information regarding attitudes and beliefs is concerned. Moreover, the survey approach offers more accurate means of evaluating information about the sample and enables the researcher to draw conclusions about generalising the findings from a sample to the population. Additionally, surveys methods are quick, economical, efficient and can easily be administered to a large sample.

In this chapter, details of the statistical analysis of the internal reliability have been included along with the need for reliability, validity and replicability. Finally, the ethical considerations used to gather the data in the research process have been highlighted. The next chapter presents the detailed analysis of the quantitative data obtained from the questionnaire (survey).

Chapter 5: Quantitative Data Analysis

5.1 Introduction

In the previous chapter, research methodology details were provided; also, a significant portion was dedicated to the research methods employed in the study. Since quantitative methods were adopted in this study, a survey was applied to obtain the primary data; this chapter presents results collected by the survey (questionnaire) which forms the foundation of the investigation. This study employed various statistical techniques to analyse the quantitative data in order to achieve the research objectives. Mainly, the Statistical Package for Social Sciences (SPSS) software version 26.0 and analysis of moment structures (AMOS) software version 26 were used to analyse the preliminary data.

This chapter contains three main sections. The first section reports the descriptive data analysis results and starts with initial data consideration; this involves the process of data management and data screening. The preliminary reliability check for the main constructs is conducted and the demographic profiles of the participants are discussed. In the second section, factor analysis (data-reduction/factor-extraction) is applied and reported through the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA). Accordingly, the procedures and the findings relating to the measurement model validation and the structural equation model (SEM), and the causal relationships among the proposed model variables are reported. Based on the hypothesis test results, an alternative structural model achieved through SEM is presented. Finally, one-way analysis of variance (ANOVA) is presented to determine whether there are any statistically significant differences between the means of demographic groups.

5.2 Data Collection, Preparation and Preliminary Analyses

This quantitative data collection activity was undertaken from September till December 2019. The survey questionnaire was distributed by post, email and personal visits to 850 participants who were selected by random sampling from ADNOC UAE. The participants were all employees of ADNOC UAE with different pay grades, and levels of education and experience. The researcher started the procedure by contacting a randomly selected sample of the population to ask for their willingness to participate in the research study and asked if they had any queries regarding the instrument and privacy (see participant information sheet in Appendix 9 on page 222). After obtaining consent from the participants, a set of survey questionnaires along with a covering letter prepared by the study supervisors were handed over during personal visits or any statistical analyses, data must be properly checked and prepared to meet the criteria necessary for dependable results (Hair et al., 2010). This preliminary analysis includes screening for inadmissible values, missing values and outliers. The survey response data was coded and entered into a spreadsheet, and an examination of the original data revealed almost all entries to be admissible values, with only a handful of items in need of attention.

The gathered data was reviewed and coded by the researcher for data entry. The quantitative data was analysed by using Statistical Package for the Social Sciences (SPSS) version 26 for Windows, and Structural Equation Modelling (SEM) software known as Analysis of Moment Structures (AMOS). Before entering the data into the SPSS spreadsheet, columns and rows were developed by coding of questions (items/variables). Therefore, any information about the case can be identified across the data editor. In the SPSS name column, questionnaire items were coded with numbers along with an abbreviation of the variable. Similarly, in the label column, question items were written in abbreviated format (for coding details, see the questionnaire structure section on page 92). The value section of the column was developed from ‘999’, showing information not provided, and then ‘1’ for ‘Strongly Disagree’ to ‘5’ ‘Strongly Agree’ on a five-point Likert scale.

To ensure the accuracy of the statistical techniques used in the study, it was necessary to screen and clean the raw quantitative data collected. According to Hair et al. (2010), different multivariate statistical techniques including factor analysis and SEM have great theoretical ability to help researchers in different fields to test their hypotheses and assess the viability of their proposed models. That said, such techniques are not without restrictions. Therefore, data screening and cleaning is considered an important concern when the intention is to use multivariate analysis, and, whilst it might be time-consuming and exhaustive, as noted by Kline (2011), the decision not to follow this process can precipitate many disappointments resulting from wrong model estimations and poor fit. In line with the advice from Kline (2011) and Hair et al. (2010), this study further confirmed the data by screening the missing data, normality, linearity and reliability before inferring results from the data. The next sections explain the steps taken during data screening and cleaning in detail.

5.2.1 Missing Data

Addressing issues of missing data is an important preliminary data analysis step. Questionnaire items that are not answered by respondents represent missing data values. Respondents may inadvertently or purposefully not answer certain questions. This item non-response occurs for many reasons including stress, distraction, fatigue in general, or fatigue with the instrument (a survey may be complex or long), lack of knowledge, confusion or an unwillingness to answer sensitive questions. As a result of missing values, the sample size may be reduced, or bias introduced into the analysis. A large amount of missing data is problematic and can affect reliability, validity and interpretation of the data (Tabachnick and Fidell, 2001). Treatments to handle missing data depend on the quantity missing and whether the missing responses are random or not random. SPSS incorporates a ‘Missing Values Analysis’ (MVA) procedure that statistically tests whether missing values are random or non-random, by examining the distributions of missing data for possible systematic patterns and by comparing subsets of the data with and without missing values.

Scheffer (2002) claims that, regardless of how much a researcher attempts to have a full dataset in response to any particular survey, or how well s/he has designed an experiment, almost all research efforts are afflicted by missing data. Hair et al. (2010) highlight that the problem of missing data affects the statistical analysis of the original dataset in two ways: firstly, by reducing the power of the statistical techniques in indicating any relationships in the dataset; and, secondly, by generating bias in the process of parameter estimations. Typically, if the percentage of missing values is less than 5% of the sample, listwise deletion (removal of all cases with one or more missing values) is permissible (Nunnally and Bernstein, 1994). However, data imputation – replacing missing values with probabilistic substitute values – is the preferred technique as it tends to reduce estimation bias (Little and Rubin, 2002). Moreover, researchers suggest that less than 1% missing values of any variable is usually considered very slight and unimportant, 1-5% remains manageable by many statistical methods, 5-15% requires more unconventional and complicated techniques to deal with, and more than 15% missing values of a given dataset could harshly distort any kind of further data interpretation (Acuna and Rodriguez, 2004; Cohen et al., 2013).

From 311 responses, there were 10 responses marked as incomplete (see Appendix 6 on page 219). In line with the recommendations from Hair et al. (2010), questionnaires that had missing data were then no longer considered for further analysis, which related to a very small percentage (3.15%) of the total responses; Malhotra et al. (2013) describe this procedure for removing missing data as case-wise deletion. Therefore, 301 completed questionnaires were considered to be usable for further analysis, which is an acceptable number of responses for this study.

5.2.2 Outliers

After treating the missing values, the next logical step was to consider outliers (univariate and multivariate) representing those cases with odd and/or extreme scores from other dataset observations. Errors in data entry, erroneous sampling techniques, missing values in calculation, and extreme responses on multi-point scales are among the many causes of outliers. It is likely that some respondents may not have taken the survey seriously or were in a hurry to finish or simply wanted the incentive. According to Hair et al. (2010) and Kline (2011), outliers can negatively affect the results; particularly for multivariate analysis such as exploratory factor analysis (EFA), Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM), it is essential to take care of potential outliers.

In this study, all variables are on five-point Likert scales; thus, compared to an ordinal scale, there is a high possibility of extreme value outliers. To check for the presence of univariate data outliers, a box plot was examined for each variable. Using the original data, no univariate outliers were found. Five cases were found to be multivariate outliers using Mahalanobis distances outside the cumulative chi-square criteria (chi-square = 68.0, df =36). In order to improve the reliability and validity of the results, these were removed.

5.3 Assumptions in Multivariate Analysis

Estimation methods in SEM are predicated on normally distributed, continuous data, with independent observations and linearly-related variables (Kline, 2011). For the current study, all participants answered the survey questionnaire individually, resulting in independent observations. Normality and reliability of the data distribution are considered as among the most important assumptions underlying various multivariate analysis tools such as factor analysis and SEM. Each of the assumptions is explained briefly below to highlight their importance and demonstrate how these conditions have been satisfied for the current study.

5.3.1 Reliability

The reliability of a measurement instrument refers to the extent to which it yields accurate, consistent and stable responses over time. When the result is consistent, a conclusion can be drawn that the results are not affected by chance (Field, 2009; Saunders et al., 2009). It is worth mentioning that an internal consistency test was performed at this early stage of data analysis to ensure that all constructs had acceptable Cronbach's alpha scores before applying any further statistical techniques (factor analysis, SEM, etc.). Therefore, in order to assess the internal consistency of all measurement items in the survey (all scale measures), Cronbach's alpha test was performed by running the data using SPSS 26. The results shown in Table 5.1 below indicate that Cronbach's alpha scores for all individual constructs are in the range of 0.756 to 0.971, the overall score being 0.830. Hence, all were above the recommended level of 0.7 (Nunnaly, 1978; Sekaran, 2003; Field, 2009; Hair et al., 2010). Consequently, it could be said that no internal consistency problem was revealed up to this stage of data analysis.

Table 5. 1 Reliability Analysis for Full Study

Constructs	No of Items	Cronbach's Alpha
Perceived Usefulness (PU)	6	0.87
Perceived Ease of Use (PEU)	6	0.94
Technology Competence (TC)	5	0.86
Top Management Support (TM)	4	0.83
Perceived Financial Cost (PFC)	4	0.73
Firm's Size (FS)	3	0.76
Competitive Pressure (CP)	4	0.73
Government Regulations (GR)	3	0.78
Intention to Adopt (IA)	4	0.89
All Constructs	39	0.87

5.3.2 Normality

Any violation of the normality assumption could severely affect the process of data analysis as well as goodness-of-fit indices for the proposed SEM model (Kline, 2011). SEM parameter estimation using the maximum likelihood estimation method assumes that the data is multivariate normally distributed. Univariate normality is assessed first, as a necessary predecessor, followed by assessing multivariate normality. Univariate normality can be checked with histograms, and measures for skewness and kurtosis. Skewness demonstrates the symmetry of distribution, while kurtosis refers to how much the distribution is peaked or flat compared with the normal distribution (Hair et al., 2010). In general, a normally distributed distribution has skewness and kurtosis values of zero. Measures of skewness or kurtosis greater or less than +/- 1.00 are an indication of potential problems, while extreme values are considered measures approaching at least 2.0 for skewness and 7.0 for kurtosis (Yuan and Bentler, 1999). On the other hand, many researchers are less conservative, recommending that skewness less than an absolute value of 3 and a kurtosis index with an absolute value of less than 8 do not indicate a significant normality problem (West et al., 1995; Doornik and Hansen, 2008; Kline, 2011).

Multivariate normality can be checked with the Kolmogorov-Smirnof (KS) goodness-of-fit test; however, large sample sizes generally produce significant results, even with minor deviations from normality. A non-linear transformation may be beneficial, if the data is found not normally distributed. For the current study, histograms were examined for each univariate study variable, and measures for skewness and kurtosis obtained. Each of the univariate distributions had skewness and kurtosis values within the reasonable ranges, with just a few showing borderline issues (absolute values between 1 and 2). The KS test was significant, but not surprising as the sample size is large (n=301). Histograms revealed distributions that were sufficiently normal, with the possible exception of two composite variables (MSPSS significant other, MHLC God) which demonstrated negative skews. Computation of non-linear transformations (square) reduced the skew but exacerbated the kurtosis – a more problematic issue for analysis than skewness. Therefore, the transformed variables will not be used. Departures from normality were few and minor for the study dataset (for details see normality result in Appendix 7 on page 220).

5.4 Demographic Profile of the Study Sample

The results relating to part one of the questionnaire, i.e., demographic data, are now presented and described. Frequency distributions in respect of demographics are used to shed more light on the study sample characteristics.

Table 5. 2 Demographic Profile of the Participants

Demographic Variables	Categories	Frequencies	Percentage
Gender	Male	253	84.1%
	Female	48	15.9%
Level of Education	High School	96	31.9%
	Bachelor	157	52.2%
	Master	43	14.3%
	PhD	5	1.7%
Experience	3 or Less	97	3.0%
	3 – 5	66	20.9%
	6 – 10	93	30.2%
	Over 10 years	43	45.8%

Demographic characteristics of the participants as summarised in the above table show that:

Gender

A total of 301 ADNOC UAE employees participated in the study. Gender analysis of participants shows that 253 (84.1%) of respondents were male and only 48 (15.9%) female. This is generally expected, given the fact that most of the organisations in the UAE are largely dominated by males and the oil and gas sector is no different. In the UAE, women are generally underrepresented in the civil service, public sector and particularly in the oil and gas sector. In this regard, the chosen sample largely reflected the actual targeted population.

Education Level

Regarding qualifications, most of the participants were educated, i.e., bachelor's degree or above. This is because the oil and gas sector is very demanding and thus companies often prefer highly educated people to join. The demographic table above indicates that 147 participants are graduates, 43 participants hold a master's degree and five are PhDs. This further shows that educational level is very high in the UAE's oil and gas sector. The high level of education amongst the chosen participants also serves to enhance the quality of the findings of this study, since most participants were able to understand and respond to the questionnaire effectively.

Experience

In terms of experience, participants from different levels of experience were included in the study. The participants represent different levels of experience. This is a good indication that the researcher included participants from various backgrounds, as shown in the above table.

5.5 Descriptive Analysis of Research Variables

Within the context of research, a variable may be defined as "an empirical phenomenon that takes on different values or intensities" (Flannelly et al., 2014). Variables are generally divided into two broad categories in research, independent variables and dependent variables. The independent variable is the variable that is varied or manipulated by the researcher, and the dependent variable is the response that is measured. In other words, an independent variable is the presumed cause, whereas the dependent variable is the presumed effect (Flannelly et al., 2014). This section presents a descriptive analysis of the variables used in the study. As mentioned in the previous chapter, the questionnaire consists of nine major constructs, eight independent variables and one dependent variable, which were measured by 38 different items (statements) using a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. Respondents were asked about their relative agreement or disagreement with each statement. Responses were coded as follows: 5 indicated that they strongly agreed with the statement, 4 indicated that they agreed with the statement, 3 indicated that they neither agreed nor disagreed with the statement and were therefore neutral, 2 that they disagreed, and 1 that they strongly disagreed with the statement. Moreover, 3 was chosen as the midpoint on the scale in order to make a distinction between the respondent's agreement and disagreement. Frequency and mean analyses of each of the nine constructs (eight independent variables and one dependent variable) and their items are provided below.

Perceived Usefulness (PU)

Respondents were asked to indicate the extent to which they saw RFID services useful for them in performing their daily activities. The results show the mean scores of the six items used to measure PU are around 3.83 with standard deviation ranging from 0.93 to 0.97. It could be concluded that most of the respondents (mean score is more than the midpoint of 3) were agreed about the PU of RFID in terms of effort and timesaving as well as enhancing their overall routine activities.

Table 5. 3 Descriptive Statistics for 'Perceived Usefulness (PU)' Construct

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
PU1	301	4.00	1.00	5.00	3.8239	.97582
PU2	301	3.00	2.00	5.00	3.9502	.93853
PU3	301	4.00	1.00	5.00	3.9734	.99631
Pu4	301	4.00	1.00	5.00	3.8339	.94815
PU5	301	3.00	2.00	5.00	3.9435	.93102
PU6	301	3.00	2.00	5.00	3.9435	.97646
Valid N (listwise)	301					

Perceived Ease of Use (PEU)

The findings reveal that the mean score for PEU was around 3.57, thereby indicating that a significant number of respondents have no major technical concerns when dealing with RFID-related services and applications. Instead, they consider it easy to learn, understand and use. Moreover, the descriptive statistics for PEU also revealed that the respondents were not very dispersed around their mean scores on individual items (standard deviations between 0.79 and 0.87).

Table 5. 4 Descriptive Statistics for 'Perceived Ease of Use (PEU)'

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
PEU1	301	4.00	1.00	5.00	3.5515	.84548
PEU2	301	4.00	1.00	5.00	3.6146	.81096
PEU3	301	3.00	2.00	5.00	3.4651	.87728
PEU4	301	4.00	1.00	5.00	3.5349	.83043
PEU5	301	4.00	1.00	5.00	3.6047	.79990
PEU6	301	3.00	2.00	5.00	3.4485	.87264
Valid N (listwise)	301					

Technology Competence (TC)

Four questions (items) were used to examine respondents' attitudes towards the existence of Technology Competence (TC) in ADNOC UAE. The results revealed that the TC variables' mean scores were around 3.6 and the average mean for the four items was greater than 3 (above the midpoint scale). The results suggest that employees tend to agree with the existence of TC within ADNOC UAE. Table 5.5 summarises these findings.

Table 5. 5 Descriptive Statistics for 'Technology Competence (TC)' Construct

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
TC1	301	3.00	2.00	5.00	3.6611	.79043
TC2	301	3.00	2.00	5.00	3.6777	.78685
TC3	301	3.00	2.00	5.00	3.6346	.83626
TC4	301	3.00	2.00	5.00	3.6678	.76328
TC5	301	3.00	2.00	5.00	3.6721	.78681
Valid N (listwise)	301					

Top Management Support (TM)

Top Management Support (TM) was measured using four statements and the results revealed that the TM variables' mean scores were between 3.6, and the average mean for the four items was greater than midpoint 3 (3.6). This indicates a relatively large level of agreement about this construct among ADNOC employees. Table 5.6 summarises these findings.

Table 5. 6 Descriptive Statistics for ‘Top Management Support (TM)’ Construct

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
TM1	301	3.00	2.00	5.00	3.5548	.86090
TM2	301	3.00	2.00	5.00	3.5714	.87123
TM3	301	3.00	2.00	5.00	3.6312	.96965
TM4	301	3.00	2.00	5.00	3.6146	.94392
Valid N (listwise)	301					

Perceived Financial Cost (PFC)

Respondents’ attitudes towards the financial costs of RFID in ADNOC were measured by four items, the average mean score for which was 3.49 on the five-point scale, thus reflecting respondents’ agreement with the items. In addition, the average standard deviation of 0.85 indicates a little dispersion from that mean score. Essentially, respondents agreed that the financial costs associated with using RFID in ADNOC are within acceptable levels. These costs may include the necessary hardware equipment as well as the cost of employee training. Moreover, they agreed that using such technology would save them some extra costs associated with other, traditional ways of operating.

Table 5. 7 Descriptive Statistics for ‘Perceived Financial Cost (PFC)’ Construct

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
PFC1	301	4.00	1.00	5.00	3.4784	.84678
PFC2	301	3.00	2.00	5.00	3.4983	.89303
PFC3	301	3.00	2.00	5.00	3.4950	.88552
PFC4	301	4.00	1.00	5.00	3.4086	.88457
Valid N (listwise)	301					

Firm's Size (FS)

With an average mean score of 3.5, the results of the Firm's Size (FS) construct indicate strong agreement among the sample respondents on the effect of firm's size to adopt or implement technological change. The mean of the three items is 3.51 with an average standard deviation of 0.87. In more practical terms, it was found that most respondents felt that bigger firms are more likely to adopt technology successfully compared with smaller firms.

Table 5. 8 Descriptive Statistics for 'Firm's Size (FS)' Construct

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
FS1	301	4.00	1.00	5.00	3.3621	.93010
FS2	301	4.00	1.00	5.00	3.5116	.88168
FS3	301	4.00	1.00	5.00	3.4020	.87628
Valid N (listwise)	301					

Competitive Pressure (CP)

Regarding the Competitive Pressure (CP) construct, respondents were asked to respond to four statements in order to measure the extent of their observation of CP within ADNOC. The mean scores reveal an average of 2.78, indicating a level of disagreement among the respondents. To put it differently, it seems that participants do not feel that CP is required to adopt and implement RFID within ADNOC.

Table 5. 9 Descriptive Statistics for 'Competitive Pressure (CP)' Construct

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
CP1	301	3.00	2.00	5.00	2.8140	.97908
CP2	301	3.00	2.00	5.00	2.8538	.96879
CP3	301	3.00	2.00	5.00	2.9535	1.00225
CP4	301	3.00	2.00	5.00	2.8472	.88876
Valid N (listwise)	301					

Government Regulations (GR)

The GR construct was measured by three items on the five-point Likert scale where represents above midpoint between agreement and disagreement levels. All mean scores were above 3, reflecting a high level of agreement among the respondents, with the highest mean score of 3.79 being found for GR1 (The government encourages and promotes the usage of RFID system). Moreover, the average mean score was 3.61 with an average standard deviation of 0.89. Hence, the respondents believed that, to some extent, the UAE government has provided the necessary infrastructure (technically and legally) as well as taking certain actions to ensure the successful implementation of new technologies in the country.

Table 5. 10 Descriptive Statistics for ‘Government Regulation (GR)’ Construct

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
GR1	301	4.00	1.00	5.00	3.7990	.89273
GR2	301	4.00	1.00	5.00	3.2326	.91236
GR3	301	4.00	1.00	5.00	3.4090	.89492
Valid N (listwise)	301					

Intention to Adopt (IA)

As mentioned earlier, employees’ intention to adopt technology (RFID) is the dependent variable (DV) in this study. Agreement emerged among respondents to adopt change in the near future, all four mean scores being above 3 (the midpoint). The average mean score was 3.4 and the average standard deviation was 0.84. This shows that most participants are willing to accept change and they are ready to implement technology-based change in their organisation (ADNOC).

Table 5. 11 Descriptive Statistics for ‘Intention to Adopt (IA)’ Construct

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
IA1	301	4.00	1.00	5.00	3.4784	.83488
IA2	301	4.00	1.00	5.00	3.4684	.83855
IA3	301	4.00	1.00	5.00	3.4718	.84263
IA4	301	4.00	1.00	5.00	3.4419	.85290
Valid N (listwise)	301					

5.6 Factor Analysis

Factor analysis is a statistical procedure for investigating the relation between a set of observed and latent variables (Byrne, 2016). Factor analysis is mostly used to analyse the structure of all correlated variables among a large number of measurements by defining a large set of common observed and latent variables or underlying dimensions within the same group of items or separating them from other factors (Hair et al., 2014). Firstly, factor analysis reduces a large number of variables into a smaller set of variables (also referred to as factors). Secondly, it establishes underlying dimensions between measured variables and latent constructs, thereby allowing the formation and refinement of theory. Thirdly, it provides construct validity evidence of self-reporting scales (Williams et al., 2010).

Generally, factor analysis is divided into two main techniques: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Field, 2009; Tabachnick and Fidell, 2014; Blunch, 2012). EFA is designed to determine whether the factors are correlated or not. It is conducted without knowing how many factors really exist. Thus, EFA involves determining the number of factors and the pattern of the factor loadings. As a result, EFA is used to define the relationships between factors and then uses multivariate techniques to estimate the relationships. Hence, it is considered to be more of a theory generator than a theory procedure (Blunch, 2012). However, CFA is a more advanced technique to be performed when factor structure is known or at least theorised. This analysis is for testing generalisation of the factor structure of the data, through the Structural Equation Modelling (SEM) method.

In EFA, the investigator has no expectations of the number or nature of the variables and, as the title suggests, it is exploratory in nature (Williams et al., 2010). That is, it allows the researcher to explore the main dimensions to generate a theory or model from a relatively large set of latent constructs often represented by a set of items. On the other hand, in CFA, the researcher uses this approach to test a proposed theory (CFA is a form of structural equation modelling) or model and, in contrast to EFA, has assumptions and expectations based on priori theory regarding the number of factors, and which factor theories or models best fit (Williams et al., 2010; Thompson, 2004).

This study initially applied exploratory factor analysis (EFA) and then applied confirmatory factor analysis (CFA) and structural equation modelling (SEM) to confirm correlations and infer causal relationships among factors (see Figure 5.1 below). The next sections explain each process in detail.

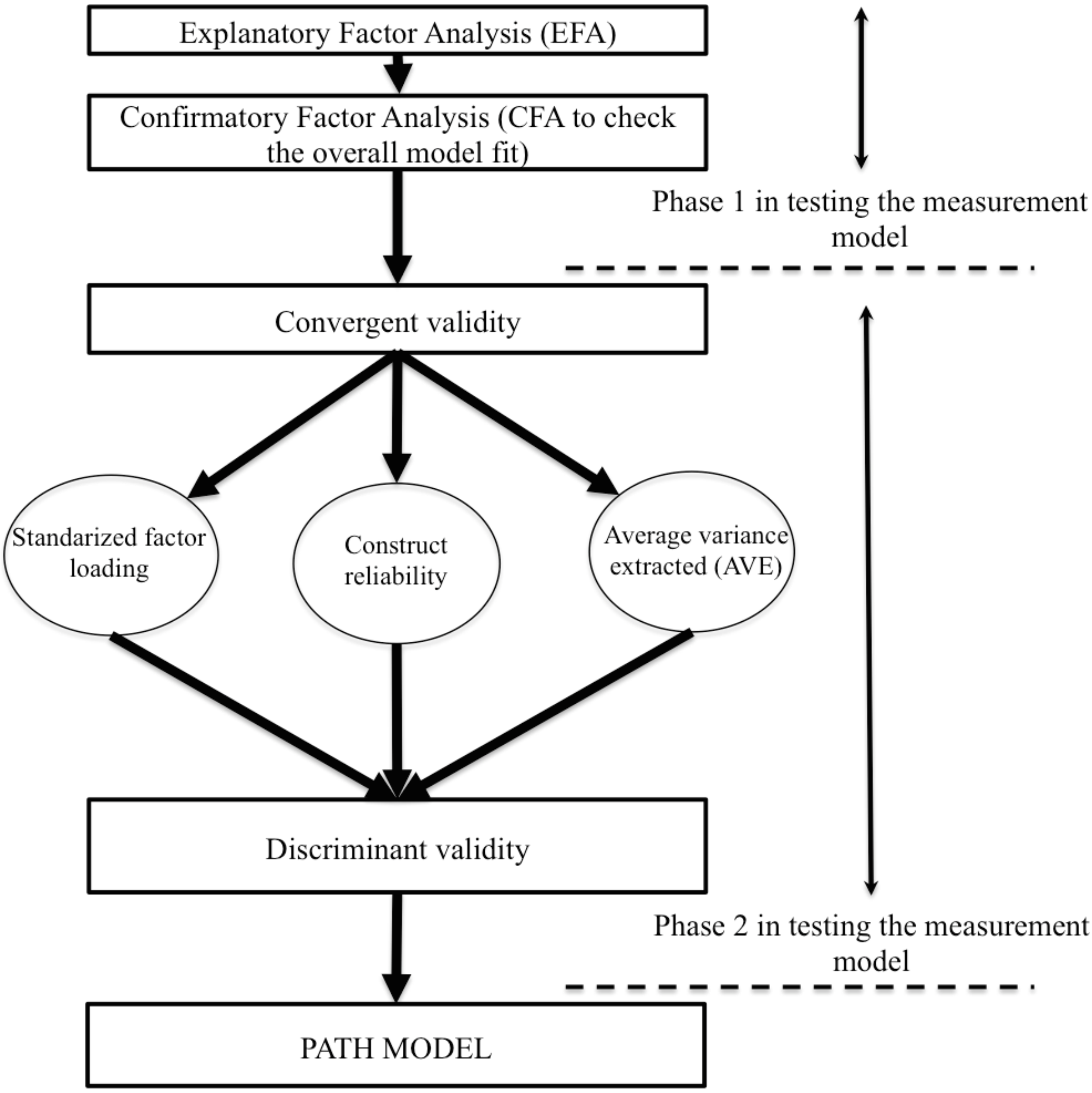

Figure 5. 1 Steps Involved in Multivariate Analysis for Hypothesis Testing

Source: Adopted from Hair et al. (2010)

The main purpose of the multivariate analysis is to create a measurement path model to accept/reject the conceptual framework and hypothesis. The measurement model is a SEM model that: (1) specifies the indicators (items) for each construct and (2) allows the assessment of construct validity (Hair et al., 2010). Each phase of the path model (SEM) is explained below.

5.7 Exploratory Factor Analysis (EFA)

To reduce the number of research variables for easier management, EFA using SPSS 26 was undertaken. This process also allowed for the main dimensions of each construct to be examined to ensure independence among those constructs, and that they were all measuring different attitudes. Exploratory factor analysis (EFA) was originally developed by Spearman (1904); it aims to explore the main constructs or dimensions of measurements (Kline, 1994). EFA is designed to investigate the relations between the observed and latent variables in order to determine how and to what extent the observed variables are linked to their underlying factors (Byrne, 1998). A factor is defined as a construct or dimension included in the relationships between a set of variables; more specifically, a factor is defined operationally by its factor loadings, which are the correlations of a variable with a factor (Kline, 1994). The relations between the observed and latent variables are measured by factor loadings, so that EFA helps to identify whether the selected items cluster on one or more than one factor; this analysis can assess the uni-dimensionality of factors (Byrne, 1998).

According to Pallant (2010), exploratory factor analysis (EFA) is a method used to keep the set of factors more manageable and minimise a large number of variables into a smaller number by grouping correlated variables to extract primary latent factors. In other words, exploratory factor analysis is used to determine whether questionnaire items were measuring what they were intended to (Stapleton, 1997). EFA is mostly useful as a preliminary analysis when there is a lack of detailed theory about the variables' relations to the underlying constructs (Gerbing and Anderson, 1993). Williams (2010) has summarised the following key objectives of exploratory factor analysis:

1. Reduce the number of variables.
2. Examine the structure or relationship between variables.
3. Detection and assessment of uni-dimensionality of a theoretical construct.
4. Evaluates the construct validity of a scale, test or instrument.
5. Development of parsimonious (simple) analysis and interpretation.
6. Addresses multicollinearity (two or more variables that are correlated).
7. Used to develop theoretical constructs.
8. Used to prove/disprove proposed theories.

Although most measured variables in the constructs were derived from previous research and an extensive literature review, EFA was deemed worthwhile since these variables had not been operated extensively within the public context (Panuwatwanich et al., 2016). Hence, EFA was conducted to establish the factors underlying each construct in this study. Thus, in order to reduce the number of research variables for easier management, EFA using the latest version of SPSS was undertaken. This process also allowed for the main dimensions of each construct to be examined to ensure independence among those constructs, and that they were all measuring different attitudes.

Prior to investigating the suitability and factorability of obtained data for exploratory factor analysis, an assumption analysis is necessary to check construct validity (Byrne, 1998). Hair et al. (2010) suggested three main assumptions for supporting the factorability of data: (1) the correlation matrix should show at least some correlation, $r = 0.30$ or greater, (2) the Kasier-Meyer-Olkin (KMO) should be 0.60 or above (Kasier, 1976), and (3) the Bartlett's Test of Sphericity should be statistically significant at $P < 0.05$ (Barlett, 1954; Field, 2009; Pallant, 2013). The KMO index usually ranges from zero to one with a minimum value of 0.6 being suggested for a good EFA, but higher values (close to one) indicate better sampling adequacy levels. The significance level for Bartlett's test should be 0.05 or less in order to determine the usefulness of EFA for the data (Field, 2009; Pallant, 2013).

In line with the advice from the above-mentioned scholars, prior to conducting EFA, the KMO measure of sampling adequacy and Bartlett's Test of Sphericity were performed to ensure the appropriateness of the dataset for EFA. Table 5.12 reports the results, which shows the KMO measure of sampling adequacy exceeds the minimum acceptable value (0.758), indicating no problem with the sample size. Moreover, Bartlett's Test of Sphericity confirmed the significance value ($p = 0.00$), thus leading to a rejection of the null hypothesis and to the conclusion that an acceptable level of correlation amongst the variables in the dataset exists, and thus making the data appropriate for subsequent EFA. Hence, the quantitative data collected from the study sample supported the use of EFA.

Table 5. 12 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.758
Bartlett's Test of Sphericity	Approx. Chi-Square	12431.639
	df	561
	Sig.	.000

Another key assumption for multivariate analysis such as EFA, CFA and SEM is multicollinearity, which refers to the existing relationship between the independent variables (Hair et al., 2010). Examining multicollinearity is important for path analysis, because the existence of multicollinearity in the path model reduces the ability to predict (Myers, 1990).

Exploring relationships between variables means searching for evidence that the variation in one variable coincides with variation in another variable (Hair et al., 2010). Several techniques can be used to estimate the relationships between variables. This study used bivariate analysis to examine multicollinearity. Bivariate analysis is used to explore the relationship between two variables; this analysis is conducted by testing two variables at a time. Values from –1 to +1 can only take in the Pearson correlation coefficients (r) (Pallant, 2013). The strength of the relation can be determined based on the size of the absolute value. Negative or positive correlation is indicated by the sign located at the front of the number.

Table 5.13 shows the recommended guidelines, suggested by Cohen et al. (2013), to interpret coefficient values between 0 and 1. No relationship between two variables can be determined if the correlation is 0. On the other hand, the correlation of 1 or –1 indicates that the value of one variable can be known by determining the value of the other variable, which shows a perfect correlation. According to Hair et al. (2010), multicollinearity exists when a correlation of r=0.9 or above exists between two independent variables. The correlation coefficients of this study fall between 0.658 and 0.088, which indicates that this study does not suffer from any multicollinearity issue.

Table 5. 13 Multicollinearity Criterion

Value of Pearson correlation	The size of the Value of Pearson correlation
r=.10 to .29 or r= –.10 to –.29	Small
r=.30 to .49 or r= –.30 to –.4.9	Medium
r=.50 to 1.0 or r= –.50 to –1.0	Large

Since all the assumptions were met, a suitable approach to EFA was then determined. This involved establishing the factor extraction method, factor retention criteria, factor rotation method and the interpretation of the resulting factor loadings, which are explained in the next sections.

5.7.1 Factor Extraction and Rotation

Several researchers argue that EFA must follow three basic steps in order to generate the proper solution needed to clarify an adequate number of factors representing a construct (Pallant, 2016; Field, 2009). These steps are factor extraction, factor rotation and interpretation. Factor extraction refers to removing the common variance that is shared among a set of variables (Kieffer, 1999).

There are several ways to extract factors: principal component analysis (PCA), principal axis factoring (PAF), image factoring, maximum likelihood, alpha factoring, unweighted least squares, generalised least squares and canonical (Tabachnick and Fidell, 2001; Thompson, 2004; Costello and Osborne, 2005). However, principal component analysis and principal axis factoring are used most commonly in studies (Tabachnick and Fidell, 2001; Thompson, 2004; Henson and Roberts, 2006). The decision whether to use PCA or PAF is fiercely debated among analysts (Henson and Roberts, 2006), although the practical differences between the two are often insignificant (Thompson, 2004) and, according to Gorsuch (1983), when factors have high reliability or there are 30 or more factors, there are no significant differences. Thompson (2004) stated that the reason why PCA is mostly used is that it is the default method in many statistical software packages. PCA is suggested to be used when no prior theoretical basis or model exists (Gorsuch, 1983). Moreover, Williams et al. (2010) recommended using PCA in establishing preliminary solutions in EFA. According to Costello and Osborne (2005), factor analysis is preferable to principal component analysis, which is only a data reduction approach. If a researcher has initially developed an instrument with several items and is interested in reducing the number of items, then PCA is useful (Williams et al., 2010; Thompson, 2004; Taherdoost et al., 2011).

The results generated by PCA and PFA can differ based on the particular method of extraction utilised. Of the techniques available, principal component analysis is the most widely used extraction method in EFA (Hair et al., 2014). To perform the factor extraction, this study used principal component analysis (PCA), which is an extraction method used widely for defining the factors needed to represent the structure of the variables. Several studies related to this study also used PCA to extract the factors. For example, in the context of information technology organisations, De Oliveira et al. (2015) used PCA to investigate the relationship between employees' attitude and innovation adoption. Similarly, Pirkkalainen et al. (2018) used PCA to assess engaging in knowledge exchange in open innovation communities.

As mentioned previously, the primary aim of the data extraction is to reduce a large number of items into factors. In order to produce scale uni-dimensionality and simplify the factor solutions, several criteria are available to researchers. However, given the choice and sometimes confusing nature of factor analysis, no single criterion should be assumed to determine factor extraction (Williams et al., 2010). Simultaneous use of multiple decision rules is appropriate and often desirable; thus, the majority of factor analysts typically use multiple criteria (Haier et al., 2014). To achieve adequate principal component analysis results, a combination of the following criteria (see table 5.14 on next page) must be met (Hair et al. 2014):

Table 5. 14 EFA Criteria

Criterion	Explanation
Latent Root (Eigenvalue)	The corresponding eigenvalue is a number that indicates how much variance there is in the data along that eigenvector (or principal component). In other words, a larger eigenvalue (>1) means that principal component explains a large amount of the variance in the data.
Scree Test	A scree plot shows the eigenvalues on the y-axis and the number of factors on the x-axis. It always displays a downward curve. The point where the slope of the curve is clearly levelling off the 'elbow' indicates the number of factors that should be generated by the analysis.
Percentage of Variance	A popular and intuitive index of goodness-of-fit in multivariate data analysis is the percentage of explained variance: the higher the percentage of variance a proposed model manages to explain, the more valid the model seems to be. Hair et al. (2014) suggest that a solution that accounts for >60% of the total variance in social sciences is considered good.
Priory Criterion	A simple criterion where the numbers of factors is known prior to undertaking the factor analysis. It is a particularly appropriate criterion if the purpose of the analysis is to replicate another research finding by extracting the same number of factors.

Source: Adopted from Haier et al. (2014)

After the factor extraction, determining the degree to which the variables load onto these factors becomes possible and can be conducted through factor rotation methods (Field, 2009). In EFA, rotating factors is essential because, even though clusters of variables may be obvious in the correlation matrix without factor rotation, they are unlikely to be identified by the initial factor extraction methods (Schmitt, 2011). In most cases, the initial factor solution does not provide an adequate interpretation, since most variables will have high loadings on the most important factors and small loadings on the other factors (Field, 2009; Hair, 2010). Therefore, a factor rotation is conducted to achieve a simpler and more meaningful solution. Because researchers often choose rotation criteria based on the presence or absence of inter-factor correlations (e.g., oblique or orthogonal), it is important that they become more acquainted with the different rotation methods.

The rotation methods are either orthogonal or oblique (Tabachnick and Fidell, 2014). Orthogonal rotation methods assume that the factors in the analysis are uncorrelated (Brown, 2009). Four orthogonal rotation techniques are equamax, orthomax, quartimax and varimax. In contrast, oblique rotation methods assume that the factors are correlated (Brown, 2009). The latest version of SPSS offers five rotation methods: varimax, direct oblimin, quartimax, equamax and promax, in that order. Three of those are orthogonal (varimax, quartimax and equimax), and two are oblique (direct oblimin and promax). However, the simplest and most commonly used rotation technique is the varimax orthogonal rotation (Tabachnick and Fidell, 2014). In addition, a rotation method is often arbitrarily based on how frequently it appears in the literature, which is generally the orthogonal varimax criterion (Schmitt, 2011; Tabachnick and Fidell, 2014; Brown, 2009). This study thus used the varimax rotation method to generate the final constructs.

After the factors have been rotated, specific criteria are employed to justify the significance of the factor loadings, thus ensuring a meaningful correlation between the variable and the factor (Hair, 2010; Tabachnick and Fidell, 2014). To ensure that the variables in each factor had practical significance, the recommended cut-off factor loading of 0.60 was used (Hair et al., 2014). The results of the EFA are presented next.

5.7.2 EFA Results

The EFA employed for the purpose of data reduction involved the elimination of any unrelated items and ensured the hypothesised grouping of the study variables. Since the measurement scales in the study were comprised mainly of individual items that had been previously used and validated in different studies in a technology acceptance context, the role of EFA was to confirm the groupings made by the researcher of the several measurement items into seven variables, and to find solutions to cases where such confirmation was not possible.

The principal component analysis (PCA) was run with eigenvalues exceeding 1 and a maximum of 25 iterations for convergence. Table 5.15 shows these results together with the total explained variance. This resulted in the identification and confirmation of eight components, which accounted for 83.46% of total variance in the dataset. The first 8-factor solution emerged from PCA when applying Kaiser's criterion 'eigenvalue-greater-than-one' rule. It is also clear that the first factor contributed 17.30% alone, while the remaining nine factors fluctuated in their contribution, from 15.88% for the second factor to only 5.34% for factor number 8.

Table 5. 15 Percentage of Total Variance Explained

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.885	17.309	17.309	5.885	17.309	17.309
2	5.402	15.887	33.196	5.402	15.887	33.196
3	3.832	11.270	44.466	3.832	11.270	44.466
4	3.513	10.332	54.797	3.513	10.332	54.797
5	2.973	8.743	63.540	2.973	8.743	63.540
6	2.801	8.238	71.778	2.801	8.238	71.778
7	2.154	6.334	78.112	2.154	6.334	78.112
8	1.819	5.349	83.461	1.819	5.349	83.461
9	.787	2.315	85.776			
10	.644	1.894	87.670			
11	.558	1.641	89.311			
12	.435	1.280	90.591			
13	.394	1.157	91.749			
14	.366	1.076	92.825			
15	.304	.895	93.720			
16	.266	.782	94.503			
17	.258	.759	95.261			
18	.228	.670	95.932			
19	.213	.627	96.559			
20	.190	.560	97.119			
21	.142	.417	97.536			
22	.138	.406	97.942			
23	.129	.380	98.322			

24	.118	.347	98.669			
25	.083	.246	98.915			
26	.072	.210	99.125			
27	.056	.164	99.289			
28	.054	.160	99.449			
29	.046	.136	99.585			
30	.040	.118	99.702			
31	.035	.104	99.807			
32	.025	.073	99.880			
33	.022	.064	99.944			
34	.019	.056	100.000			
Extraction Method: Principal Component Analysis.						

Accordingly, Kieffer (1999) asserts that it is important to examine more than one factor retention method, since different retention methods may generate conflicting results. Therefore, a scree plot was also used to determine the final number of constructs. According to William et al. (2010), inspection and interpretation of a scree plot involves two steps:

1. Draw a straight line through the smaller eigenvalues where a departure from this line occurs. This point highlights where the debris or break occurs. (If the scree is messy and difficult to interpret, additional manipulation of data and extraction should be undertaken.)

2. The point above this debris or break (not including the break itself) indicates the number of factors to be retained.

An inspection of Cattell’s scree test plot (see Figure 5.2) also reveals a clear break after the 7th component and confirms the Kaiser’s criterion result. In addition, the factors on the curve of the plot line prove the accuracy of the earlier ‘eigenvalue greater-than-one’ rule.

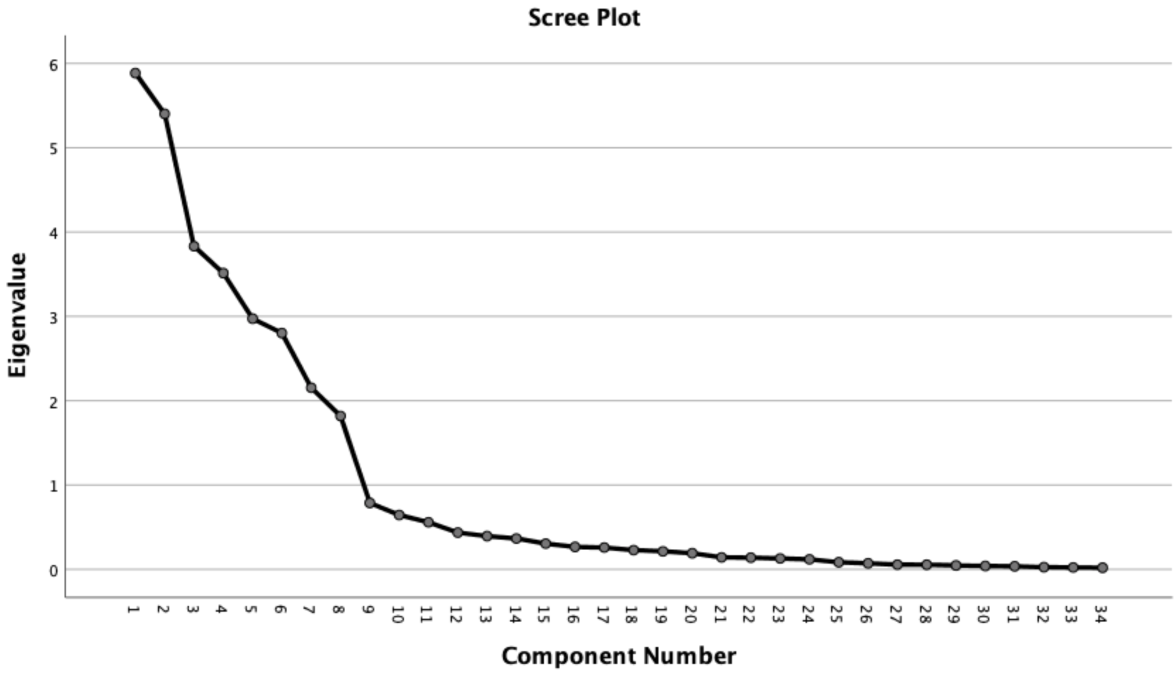

Figure 5. 2 Scree Plot Result

After factors have been extracted, it is essential to identify to what degree variables load on them by rotation technique. PCA/EFA literature defines rotation as performing arithmetic to obtain a new set of factor loadings (Jennrich, 2006; Yamamoto and Jennrich, 2013). Rotation is thus important for improving the interpretability and scientific utility of the solution. Moreover, it is used to maximise the significant correlations between factors and variables and minimise weak ones. Similarly, it is commonly used to rotate the factors to formulate a better solution that is more interpretable (Kieffer, 1999). Different techniques can be used to develop factors from variables, but the rotation method is the most important to arrange them in a more meaningful order (Field, 2006). There are two major rotation strategies available for researchers: orthogonal and oblique rotation (Kieffer, 1999; Field, 2006). However, the most commonly used method is varimax rotation of orthogonal techniques. Since, in many situations, it is unnatural for factors to be orthogonal to one another, a number of oblique rotation methods have been developed (Yamamoto and Jennrich, 2013). However, Tabachnick and Fidell (2014) assert that different methods of extraction give similar results with a suitable dataset; in addition, different methods of rotation tend to provide similar results if the correlations pattern of the data is objectively clear.

Employing varimax as one of the orthogonal rotation strategies has several advantages. First, the factors are inherently easier to interpret and remain perfectly uncorrelated with one another. Secondly, according to Kieffer (1999), the factor structure matrix and the factor pattern matrix are equivalent; therefore, only one matrix of association has to be estimated. This means that the solution is more parsimonious and thus, in theory, is more replicable. However, orthogonal rotation of factor solutions may oversimplify the relationships among the factors and the variables, and may not represent these relationships accurately (Kieffer, 1999). Nevertheless, in studies related to social sciences, varimax orthogonal techniques are most commonly used for rotation (Alexander and Colgate, 2000). Therefore, the researcher decided to use the varimax rotation technique for this study. The varimax rotation technique was developed by Kaiser (1960); it produces factors that have large pattern/structure coefficients for a small number of variables or very low pattern/structure coefficients with the other group of variables (Kieffer, 1999). According to Hair et al. (2014), the purpose of varimax rotation is to maximise the variance of factor loading by highering the high loadings for each factor and lowering the small ones.

Tabachnick and Fidell (2014) suggest that if the factor loadings cut-offs from +0.50 or greater are considered highly significant and can be used for further analysis. Principal component analysis revealed that 34 of 35 items had factor loadings of more than 0.60 in eight components. However, some components had cross loadings or only had one item loaded. In addition, one item, TC5, did not load at all. Thus, the problematic item/variable was identified and excluded from the rotation process. After removing the problematic item (TC5), a clean rotated component matrix with high loadings and fewer items (34 items) was achieved, as shown in the following Table 5.16.

Table 5. 16 EFA Final Matrix after Rotation

Items Loaded	Factors (F) Extracted							
	F1	F2	F3	F4	F5	F6	F7	F8
PU3	.914							
PU6	.910							
PU2	.875							
Pu4	.867							
PU5	.861							
PU1	.845							
PEU3		.896						
PEU6		.885						
PEU1		.873						
PEU4		.853						
PEU2		.842						
PEU5		.839						
TC1			.965					
TC4			.958					
TC3			.925					
TC2			.866					
PFC2				.929				
PFC1				.926				
PFC3				.909				
PFC4				.893				
TM2					.949			
TM1					.941			
TM4					.909			
TM3					.855			
CP1						.948		
CP3						.943		
CP2						.871		
CP4						.855		
FS3							.922	
FS1							.904	
FS2							.892	
GR3								.896
GR2								.892
GR1								.880
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalisation.								
a. Rotation converged in 6 iterations.								

The result of the final matrix (see the above table, Table 5.16) shows that 34 items loaded in eight factors were subject to the further analysis. In addition, the initial grouping of those retained eight factors was also supported by these findings. Following confirmation of the study-hypothesised latent variables by the EFA using varimax-rotated 8-factor solution, the next logical step was to employ confirmatory factor analysis (CFA) in order to validate the underlying structure of the main constructs in the study, examine the reliability of the measurement scales, and assess the factorial validity of the theoretical constructs. The next section thus explains the CFA process and results.

5.8 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) is used to test and confirm a specified relationship by applying a multivariate technique. CFA is the opposite of exploratory factor analysis (EFA) as the CFA measurement model is used to evaluate the model fit and test the convergent and discriminant validity of each construct. Each construct is allowed to correlate freely with other constructs but without specifying causal relationships between the constructs (latent variables). Confirmatory factor analysis provides a range of information that is useful in assessing the overall model fit and testing the convergent and discriminant validity of the scales. These tests will be described further in the next sections.

Using the results of exploratory factor analysis, CFA was employed in order to validate the underlying structure of the main constructs in the study, examine the reliability of the measurement scales, and assess the factorial validity of the theoretical constructs. This study used AMOS 26 software to create the measurement model shown in Figure 5.3 below based on the EFA findings.

Latent variables are shown as ovals and observed variables as rectangles. Two-headed connections indicate covariance between constructs and one-headed connectors indicate a causal path from a construct to an indicator. The diagram also shows how the errors influence each question, but do not influence the latent variable(s). SEM provides numerical estimates for each of the parameters (arrows) in the model to indicate the strength of the relationships.

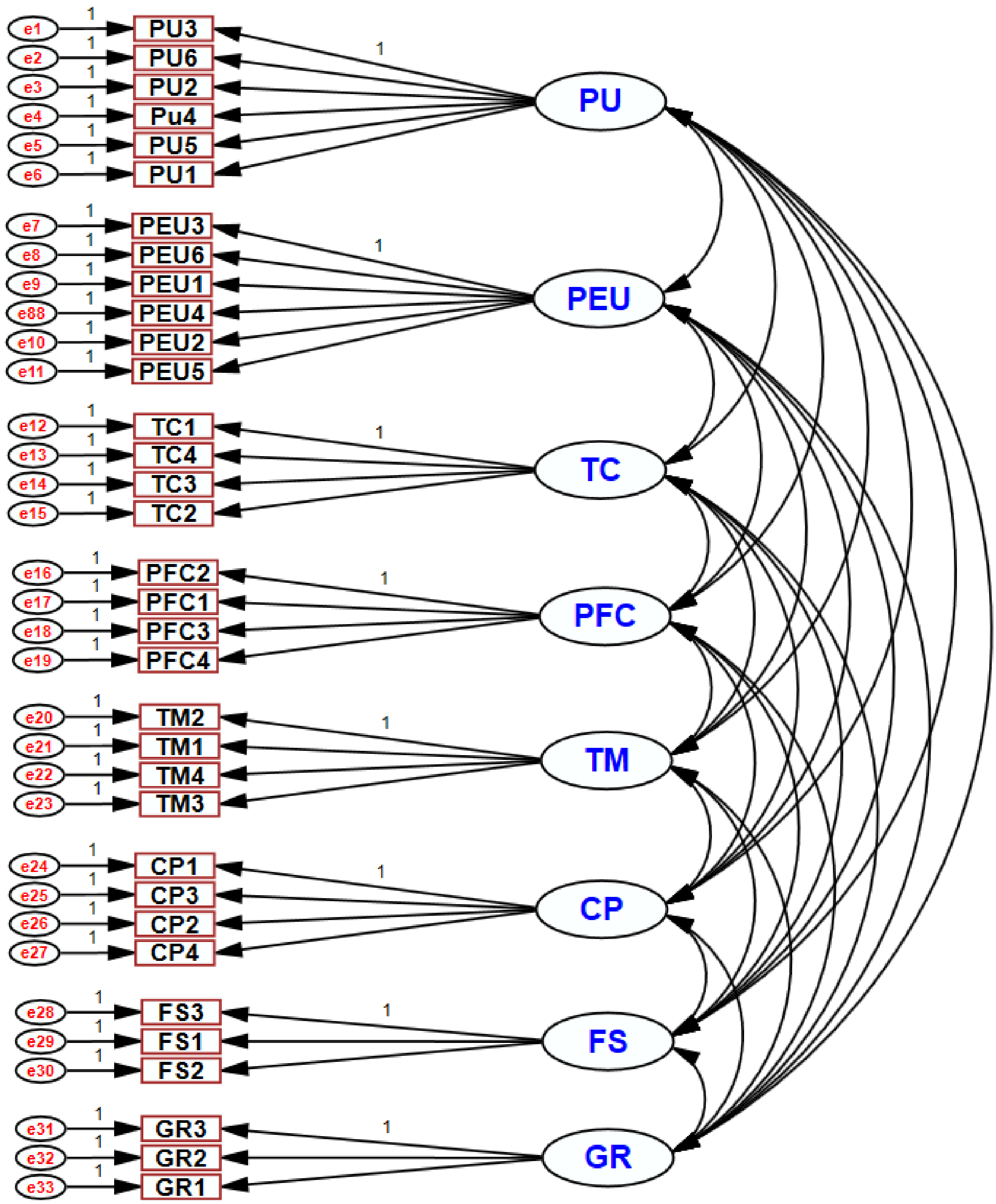

Figure 5. 3 Original CFA Model Based on EFA Results

5.8.1 Assessing Overall Fit (CFA)

The measurement model in this study was evaluated using the Maximum Likelihood estimation techniques. The CFA technique has the ability to find how well any factor represents the data. This can be done by examining the model fit indices. In general, if the fit indices prove to be good, the model is consistently accepted. However, instead of rejecting fit indices that are not good, a model with unsatisfactory fit indices will be modified until it reaches acceptable fit indices. In order to decide whether or not the model adequately represents the set of causal relationships, each of the measurement and structural models was subjected to the assessment of overall model fit. AMOS, however, generates 25 different goodness-of-fit measures and the choice of which to report is a matter of dispute among methodologists. Hair et al. (2006) recommend reporting chi-squared statistics in addition to another absolute index such as RMSEA and an incremental index such as CFI. They also recommended reporting the goodness-of-fit index (GFI) and the adjusted goodness-of-fit index (AGFI). Therefore, the fit indices used to assess model fit in this study were:

Chi-square (x^2), which is one of the most basic indices of absolute fit indices that include, in general, the degree of freedom (df) value and (p-value) (Kline, 2012).

Comparative fit index (CFI) is also a commonly used measurement model fit index, where ranges between 0 and 1 with higher values indicate better fit. Values less than .90 are not usually associated with a model that fits well (Byrne, 2001; Hair et al., 2006; Kline, 2010).

Root mean square error of approximation (RMSEA) takes into account the error of approximation in the population. Generally, values less than 0.05 indicate good fit and values as high as .08 represent reasonable errors of approximation in the population (Byrne, 2001).

The goodness-of-fit index (GFI) was developed by Jöreskog and Sörbom (1984) for Maximum Likelihood estimation. A GFI closer to 1 indicates a better fit. Values more than .80 are usually associated with a model that fits well (Byrne, 2001; Hair et al., 2006; Kline, 2010).

The adjusted goodness-of-fit index (AGFI) takes into account the degrees of freedom available for testing the model. An AGFI greater than 0.9 indicates a good fit (Holmes-Smith, 2000).

Model comparison indices (also known as incremental indices) compare the fit of a given model to the fit of another baseline model that assumes uncorrelated measurement variables, where all factor loading scores are fixed to 1 and all error values are fixed to 0. Examples of incremental indices include Comparative Fit Index (CFI), Normed Fit Index (NFI) and Non-Normed Fit Index (NNFI), which is also known as the Tucker-Lewis Index (TLI) (Schermelleh-Engel et al., 2003; Kenny, 2011; Byrne, 2013). Based on the above discussion, this study used the following ‘Rules of Thumb’ criteria for an acceptable model fit (see Table 5.17 below).

Table 5. 17 Model Fit Thresholds

Goodness-of-Fit Measure	**Model Fit Thresholds**	**References**
RMSEA	<0.10	Byrne (2001)
GFI	>0.8	Hu and Bentler (1999)
AGFI	>0.8	Etezadi-Amoli and Farhoomand (1996)
RMR	<0.05	Hair et al. (2010)
NFI	>0.9	Kline (2010); Lau (2011)
TLI	>0.9	Hair et al. (2010)
CFI	>0.8	Kline (2010); Hair et al. (2010)
Degrees of Freedom	≤ 3	Hair et al. (2010)
P-value	>0.05	Kline (2010); Lau (2011)

Subsequently, to test the measurement model, CFA through AMOS 26 was conducted using the Maximum Likelihood (ML) method, which is the most widely used method for parameter estimation (Schermelleh-Engel et al., 2003). Figure 5.4 below shows the output path diagram of the CFA first run and is followed by the overall goodness-of-fit statistics in Table 5.18. The full model-fit summary for the first run of CFA appears in Appendix 3 on page 213.

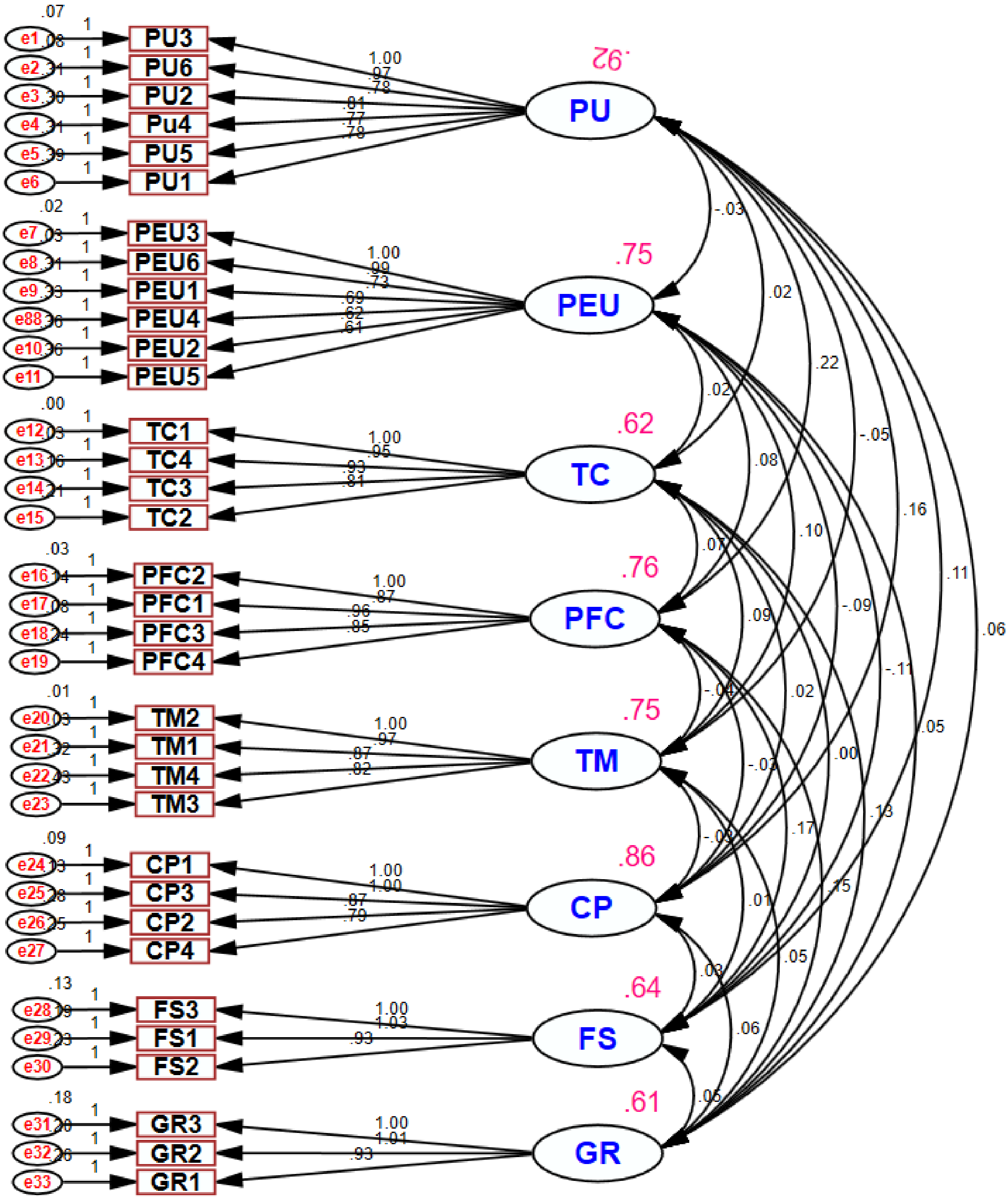

Figure 5. 4 CFA First Run Output Diagram

It can be seen from the following table, Table 5.18, that, while some fit indices indicated a satisfactory level of model adequacy, others showed the opposite, i.e., unsatisfactory results. Therefore, the unacceptable values such as values of AGFI and RMR suggested that there was room for further model adjustments in order to achieve a good model.

Table 5. 18 Model Fit Outcome (First Run)

Goodness-of-Fit Measure	Model Fit Thresholds	Model Actual Measures	Results	References
RMSEA	<0.10	0.124	Unacceptable	Byrne (2001)
GFI	>0.8	0.706	Unacceptable	Hu and Bentler (1999)
AGFI	>0.8	0.649	Unacceptable	Etezadi-Amoli and Farhoomand (1996)
RMR	<0.05	0.042	Acceptable	Hair et al. (2010)
NFI	>0.9	0.783	Unacceptable	Kline (2010); Lau (2011)
TLI	>0.9	0.790	Unacceptable	Hair et al. (2010)
CFI	>0.8	0.813	Acceptable	Kline (2010); Hair et al. (2010)
Degrees of Freedom	≤ 3	5.647	Unacceptable	Hair et al. (2010)
P-value	<0.05	0.05	Acceptable	Kline (2010); Lau (2011)

5.8.2 The Measurement Model Enhancement

To improve the measurement model goodness-of-fit, several modifications were introduced to the first-run model shown in Figure 5-10. The modifications and adjustments were based on the following guidelines provided by Hooper et al. (2008), Hair et al. (2010) and Byrne (2013). According to these experts, in order to improve the model-fit, a common practice in this regard is to correlate parameter errors that are part of the same factor. Therefore, in line with the advice from the experts, 18 different parameter errors were corelated to improve the overall model fit. The following figure presents the CFA model second run model output diagram which shows that different parameter errors are covaried.

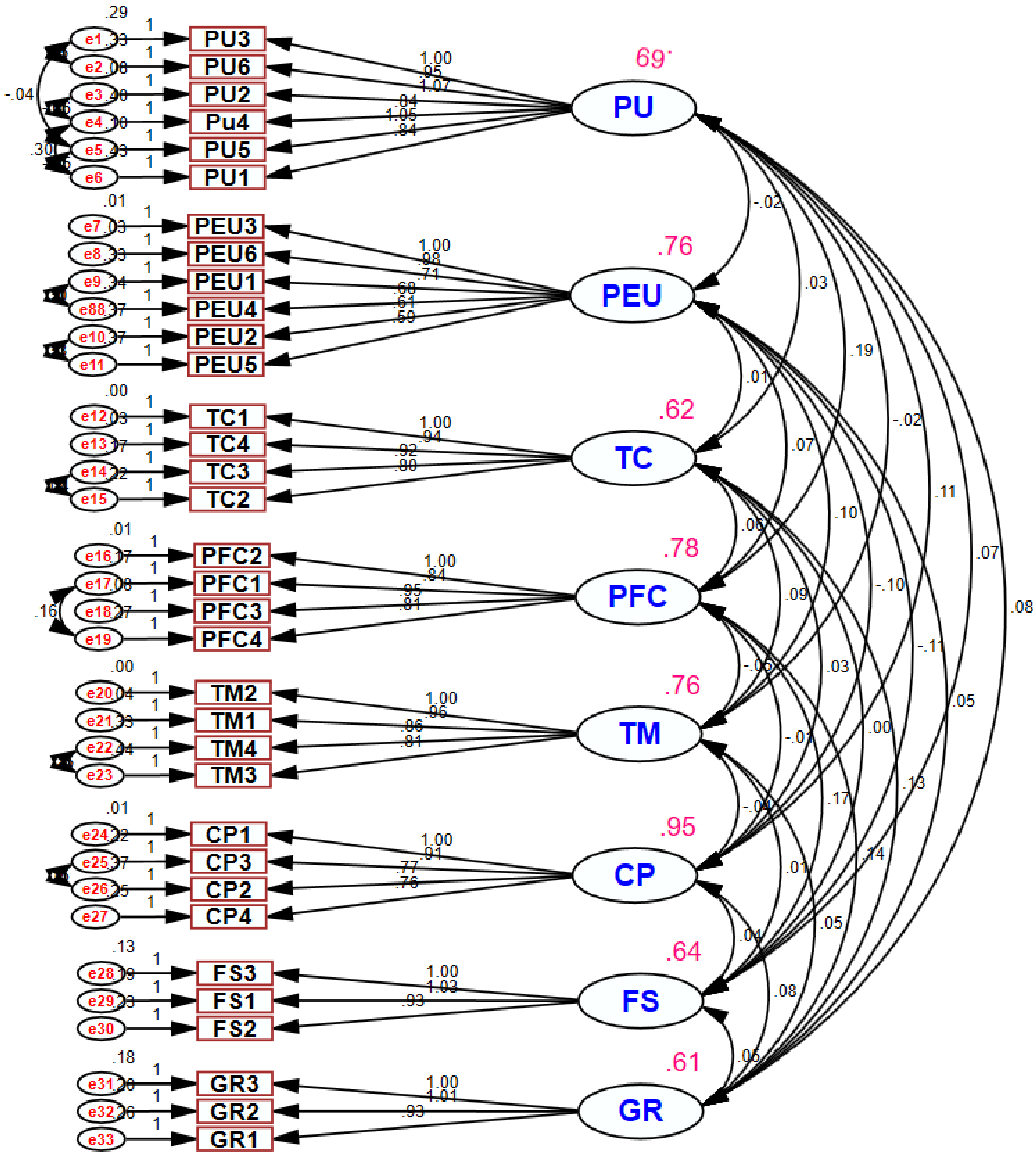

Figure 5. 5 CFA Output Path Diagram (Second Run)

It can be seen from the following Table 5.19 that introduction of the above-mentioned modifications finally improved the overall goodness-of-fit of the model to an acceptable level. Therefore, since the revised model was confirmed to fit the empirical data adequately, it was decided that no further modification was necessary.

Table 5. 19 Model Fit Results for CFA

Goodness-of-Fit Measure	Model Fit Thresholds	Model Actual Measures	Results	References
RMSEA	<0.10	0.124	Acceptable	Byrne (2001)
GFI	>0.8	0.867	Acceptable	Hu and Bentler (1999)
AGFI	>0.8	0.837	Acceptable	Etezadi-Amoli and Farhoomand (1996)
RMR	<0.05	0.038	Acceptable	Hair et al. (2010)
NFI	>0.9	0.935	Acceptable	Kline (2010); Lau (2011)
TLI	>0.9	0.968	Acceptable	Hair et al. (2010)
CFI	>0.8	0.972	Acceptable	Kline (2010); Hair et al. (2010)
Degrees of Freedom	≤ 3	1.717	Acceptable	Hair et al. (2010)
P-value	<0.05	0.05	Acceptable	Kline (2010); Lau (2011)

According to Steiger and Lind (1980), RMSEA is used to measure the discrepancy per degree of freedom, and CFI is identified as a steady descriptive fit (Gerbing and Anderson, 1992). The CFI, GFI and TLI are mainly used to compare the absolute fit of a specified model to the absolute fit of the independent model. Based on these criteria and the conditions explained in Table 5.19, the CFA model showed a good model fit. Once a good model fit is achieved, the next logical step is to ensure the validity of the measurement model, which is discussed next.

5.8.3 Convergent Validity

Convergent validity means that the indicators (items) of a certain construct should converge or share a high proportion of variance in common (Hair et al., 2010). Anderson and Gerbing (1988) suggested Construct reliability (CR) and Average variance extracted (AVE) values to evaluate convergent validity empirically.

Construct reliability (CR)

Construct reliability is also an indicator of convergent validity. The rule of thumb is the reliability estimates should be .07 or above to show good reliability. In addition, 0.70 is considered the minimum threshold for construct reliability; however, this rule is not applicable to exploratory research. A construct with high reliability means that internal consistency exists and indicates that all used measures consistently represent the same latent construct.

Average variance extracted (AVE)

Variance extracted from the item is the square of standardised factor loading that represents how much variation in an item is explained by the latent factor. In CFA, the average variance extracted (AVE) is a summary indicator of convergence. AVE is calculated as the mean variance extracted for the items loading on a construct (Fornell and Larcker, 1981). Average variance extracted (AVE) of 0.5 or higher is considered a good rule of thumb to suggest adequate convergence (Hair et al., 2010).

Table 5. 20 Convergent Validity of CFA Model

Serial No	Construct	CR	AVE
1	Perceived Usefulness	0.934	0.706
2	Perceived Ease of Use	0.912	0.640
3	Technology Competence	0.954	0.840
4	Perceived Financial Cost	0.949	0.823
5	Top Management	0.933	0.779
6	Competitive Pressure	0.928	0.764
7	Firm’s Size	0.911	0.774
8	Government Regulations	0.892	0.734

As shown in Table 5.20 above, CR values are greater than the recommended 0.7 and AVE values are higher than the threshold value of 0.5, which confirmed the convergent validity of the measurement model.

5.8.4 Discriminant Validity

Discriminant validity is the extent to which a construct is truly distinct from other constructs. Thus, high discriminant validity provides evidence that a construct is unique and captures some phenomena other measures do not. Hair et al. (2010) and Anderson and Gerbing (1988) suggested a rigorous test to assess discriminant validity. They suggest discriminant validity can be confirmed if the maximum shared variance (MSV) is lower than AVE (Hair et al., 2011; Fornell and Larcker, 1981). As shown in the following table 5.21, AVE values are higher than MSVs, which further confirmed the discriminant validity of each construct.

Table 5. 21 Discriminant Validity CFA Model Based on AVE and MSV

Constructs	AVE	MSV	AVE > MSV
Perceived Usefulness	0.706	0.068	Accepted
Perceived Ease of Use	0.640	0.118	Accepted
Technology Competence	0.840	0.073	Accepted
Perceived Financial Cost	0.823	0.167	Accepted
Top Management	0.779	0.065	Accepted
Competitive Pressure	0.764	0.165	Accepted
Firm’s Size	0.774	0.167	Accepted
Government Regulations	0.734	0.237	Accepted

5.9 Path Model (Structural Equation Model)

The structural model is used to conceptually represent the structural relationships between constructs. Usually, it is depicted by a visual diagram (Hair et al., 2010). The structural model links the hypothesised model’s constructs with a set of one or more dependence relationships. According to Hair et al. (2010), the structural model is useful to demonstrate the interrelationships of variables between constructs. The structural parameter estimate (path model) is the empirical representation of the structural relationship between any two constructs.

Evaluating the validity of the structural model is considered as the last stage of the decision process. It works by conducting a comparison between the CFA model fit and the structural model fit. This comparison helps to determine the degree to which the specified relationships in the structural model decrease model fit compared to the CFA model. According to Byrne (2010) and Hair et al. (2011), SEM is used to test the hypotheses and causal effect of independent variables (IVs) on dependent variables (DVs). Therefore, in order to determine the relationships between the constructs of the hypothesised conceptual framework (see Figure 3.2 on page **Error! Bookmark not defined.**), SEM was applied. In this study, the SEM procedure followed the two-step approach suggested by Hair et al. (2011): firstly, specifying and assessing the measurement model in order to establish the validity and then examining the structural model to assess the relationships between the constructs (Hair et al., 2006). Both steps required an assessment of the model fit indices and parameter estimates, which were based the similar procedures and criteria to those used in the CFA analysis in the previous section.

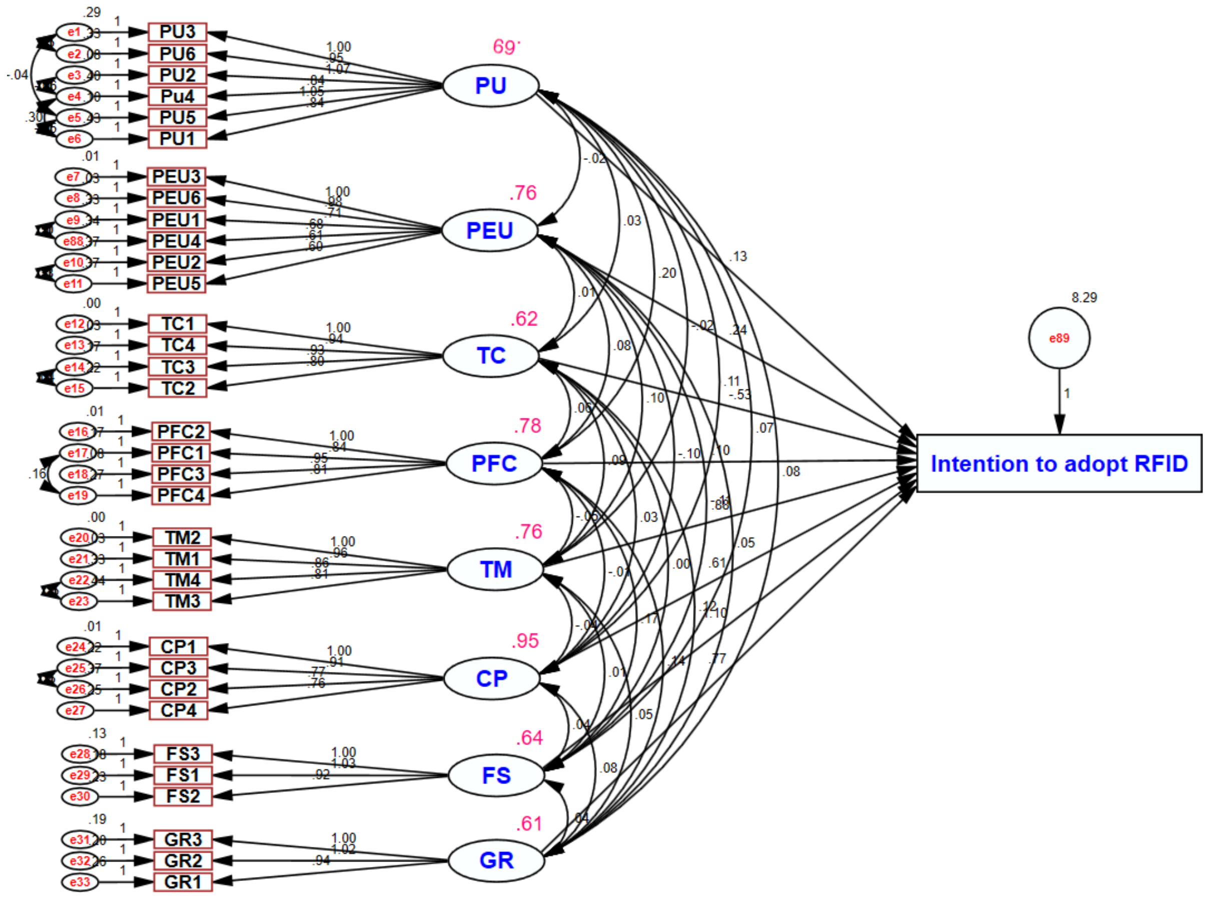

Figure 5. 6 Structural Equation Model

The results of the structural model assessment were evaluated against the criteria listed in Table 5.17 and are presented in the above figure. The fit indices show that the hypothesised structural model provided a good fit with the data. The absolute fit measures and the incremental fit measures indicate goodness-of-fit of the model; particularly, values of CFI and GFI are well above the recommended value, i.e., 0.9. The detailed structural model output summary is provided in the appendix 5 on page 217.

5.10 Hypotheses Outcomes

Having successfully validated the structural model's goodness-of-fit to the data, the next step was to examine the research hypotheses using path measurement coefficients (regression weight estimates and critical ratios) from the SEM analysis performed with AMOS 25. Table 5.22 summarises these results.

Table 5. 22 Path Analysis Outcomes

Independent Variable	path	Dependent Variable	Estimate	S.E.	C.R.	p
Perceived Usefulness	⟵	**Intention to adopt RFID**	.125	.216	.579	.563
Perceived Ease of Use	⟵	**Intention to adopt RFID**	.239	.202	1.179	.238
Technology Competence	⟵	**Intention to adopt RFID**	-.527	.221	-2.38	.017
Perceived Financial Cost	⟵	**Intention to adopt RFID**	.096	.212	.455	.649
Top Management	⟵	**Intention to adopt RFID**	.878	.199	4.412	***
Competitive Pressure	⟵	**Intention to adopt RFID**	.613	.178	3.447	***
Firm's Size	⟵	**Intention to adopt RFID**	1.100	.233	4.715	***

Government Regulations	⟵	**Intention to adopt RFID**	.770	.243	3.176	.001

Note: *** represents $p < 0.001$

In line with the advice from Hair et al. (2010), who state that a significant relationship is considered if the p value is less than 0.05, five of the eight variables were found to have a significant and positive relationship with DV (Intention to adopt RFID). Thus, the results of the hypotheses which were developed and portrayed in chapter 3 (see figure 3.2 on page 76) are discussed in detail below.

Hypothesis H1 Results

H1: Perceived Usefulness positively influences employees' RFID adoption.

This hypothesis tested the impact of PU on DV (intention to adopt RFID) in the context of the ADNOC UAE. As shown in parameter estimates in Table 5.22, the results revealed unsupported values for hypothesis H1. The estimated regression weight and critical ratio for the causal path between the two constructs PU on DV are .125 and .579 respectively, while the p value illustrates an insignificant influence at a level of $p > 0.05$. Therefore, hypothesis H1 that PU has a statistically significant relationship to DV, is rejected. That is, any increase employees perceived usefulness may not influence their decision to adopt RFID within ADNOC UAE.

Hypothesis H2 Results

H2: Perceived ease of use (PEU) positively influences employees' RFID adoption.

This hypothesis tested the impact of PEU on employees' intention to adopt RFID in the context of the ADNOC UAE. As shown in parameter estimates in Table 5.22, the results revealed unsupported values for hypothesis H2. The estimated regression weight and critical ratio for the causal path between the two constructs and the p value illustrates insignificant influence at a level of $p > 0.05$. Therefore, hypothesis H2 that PEU has a statistically significant relationship to employees' intention to adopt RFID is rejected. That is, any increase in peoples perceived ease of use may not influence their decision to accept and adopt RFID within ADNOC UAE.

Hypothesis H3 Results

H3: Technology Competence (TC) positively influences employees' RFID adoption.

This hypothesis tested the impact of TC on DV in the context of the ADNOC UAE. As shown in parameter estimates in Table 5.22, the results revealed supported values for hypothesis H3. The estimated regression weight and critical ratio for the causal path between the two constructs, and particularly the p value, indicates a significant relationship at a level of $p < 0.05$. Therefore, hypothesis H3 in the context of ADNOC UAE is accepted.

Hypothesis H4 Results

H4: TOP Management (TM) support positively influences employees' RFID adoption.

This hypothesis tested the impact of TM support on employees' positive attitude towards adoption of RFID in the context of ADNOC UAE. As shown in parameter estimates in Table 5.22, the results revealed supported values for hypothesis H4. The estimated regression weight and critical ratio for the causal path between the two constructs TM and dependent variable (DV) are 0.878 and 4.412 respectively, while the p value illustrates significant influence at a level of $p < 0.05$. This infers that TM has positive influence on people's decision to accept change. Therefore, hypothesis H4 is accepted.

Hypothesis H5 Results

H5: Perceived Financial Cost (PFC) positively influences employees' RFID adoption.

This hypothesis tested the impact of employees' Perceived Financial Cost on their intention to adopt RFID in context of ADNOC UAE. As shown in parameter estimates in Table 5.22, the results revealed supported values for hypothesis H5. The estimated regression weight and critical ratio for the causal path between the two constructs, and the p value shows an insignificant relationship at a level of $p > 0.05$. Thus, hypothesis H5 is rejected. The logical explanation of the surprising result is discussed in detail in the next chapter.

Hypothesis H6 Results

H6: Firm's Size (FS) positively influences employees' RFID adoption.

This hypothesis tested the impact of FS on employees' intention to adopt RFID within context of the ADNOC UAE. As shown in parameter estimates in Table 5.22, the results revealed supported values for hypothesis H6. The estimated regression weight and critical ratio for the causal path between the two constructs FS on DV are 1.10 and 4.715 respectively, while the p value shows a highly significant relationship at a level of $p < 0.05$. Thus, hypothesis H6 is accepted.

Hypothesis H7 Results

H7: Competitive Pressure (CP) positively influences employees' RFID adoption.

This hypothesis tested the impact of competitive pressure (CP) on DV in the context of the ADNOC UAE. As shown in parameter estimates in Table 5.22, the results revealed supported values for hypothesis H7. The estimated regression weight and critical ratio for the causal path between the two constructs, and particularly the p value, indicates a significant relationship at a level of $p < 0.05$. Therefore, hypothesis H7 in the context of ADNOC UAE is accepted.

Hypothesis H8 Results

H7: Government Regulations (GR) positively influences employees' RFID adoption.

This hypothesis tested the impact of Government Regulations (GR) on employees' intention to adopt RFID in the context of the ADNOC UAE. As shown in parameter estimates in Table 5.22, the results revealed supported values for hypothesis H7. The estimated regression weight and critical ratio for the causal path between the two constructs, and particularly the p value, indicates a significant relationship at a level of $p < 0.05$. Therefore, hypothesis H8 in the context of ADNOC UAE is accepted.

5.11 Analysis of Variance (ANOVA)

In order to analyse the relationships between demographic variables such as respondents' positions, ranks, qualification, age and work experience in ADNOC UAE, and the dependent variable (RFID adoption), the one-way analysis of variance

(ANOVA) was conducted. The main purpose of using one-way ANOVA is to determine whether there are any statistically significant differences between the means of the above-mentioned groups.

According to Hair et al. (2010), there is a statistically significant difference between groups if the p value is less than 0.05. However, the ANOVA results suggest that, among the above-mentioned demographic groups, no group appeared to have a significant difference ($p<0.05$) in response to DV (RFID adoption). The output of ANOVA results for the groups is presented below.

5.12 Summary

This chapter presented the findings of the survey data analysis. The survey was conducted to examine the employees' intention to adopt RFID being implemented in the ADNOC UAE. Several sections were used to show the survey findings. The analysis started by describing the respondents' profile and the survey descriptive statistics. The results of the exploratory factor analysis (EFA) show that nearly all the items loaded above 0.60, which is more than the minimum recommended threshold (Pallant, 2013). In addition, items that did not load or had cross loadings were excluded from the analysis to improve the reliability. This test used principal component analysis (PCA) with the varimax rotation method to verify constructs' validity (Pallant, 2010).

In addition, the reliability test confirmed the internal consistency of the used constructs and showed that all the Cronbach's alpha values were above the recommended minimum threshold (0.70). Then, the study model was tested using structural equation modelling (SEM). Once acceptable model fit was achieved, SEM was used to test the inferred relationship of independent factors on dependent factor. Five out of the eight hypotheses were accepted. The results of significant relationships between constructs were mostly in line with the theoretical expectation. However, data analysis showed a few surprising results, which are discussed in detail in the next chapter. In the final section, one-way analysis of variance (ANOVA) was used to determine whether there were any statistically significant differences between the means' demographic groups such as age, qualification and rank. The next chapter will discuss the findings of the quantitative data in detail.

Chapter 6: Discussion

6.1 Introduction

This chapter features a discussion of the findings emerging from the hypotheses testing that were presented within previous chapter, along with a comparison of those findings with the literature reviewed within Chapter 2 and Chapter 3. The findings are interpreted within this chapter to enable the thesis aim to be fulfilled, that is, for the advancement of knowledge and understanding of change adoption through acquiring the awareness of key determinants that have an impact on peoples' decision to accept or reject change. within the oil and gas sector of the UAE. This aim is achieved through meeting the research objectives outlined within Chapter 1.

The structure of this chapter is as follows. First, the summary of data collection process and scale refinement procedure is summarised. Secondly, the findings of all key determinants are reviewed and compared with previous research findings. Finally, the final research model is presented that portrays the hypotheses results.

6.2 Research Population and Survey Instrument

This study attracted 301 responses from key organisational informants, constituting a response sample that provided a substantive representation of the total population of Abu Dhabi National Oil Company (ADNOC) in the UAE oil and gas sector, as shown in Table 5.2 in Chapter 5. The summary of the respondents' demographics (see Table 5.2 on page 112) supports the fact that all three criteria of relevance, qualification and experience of respondents were met, and that the data was obtained from highly dependable professionals. Similarly, the participants' demographics show a balanced representation of employees (by age, gender and experience). Therefore, precondition of sampling such as drawing a sample that represents the whole survey population as suggested by Millar and Dillman (2011) was satisfactorily met.

Another important consideration was the validity of the survey instrument used in this study. According to Field (2006), when a scale is adapted and applied to a specific culture and region, it is necessary to assess the relevance of the context of the scale to achieve the validity of inferences. Therefore, the instrument was revised further through a pilot study with quality practitioners and academics from the same context and background as the target sample population, to ensure that the questionnaire was relevant, comprehensive, understandable and valid. The survey instrument was modified based on their input. The survey was administered online and answers to TOE-related questions were mandatory. As a result, there was no missing data found. Values of scales were fixed and thus there was no chance of outliers in the data. Finally, the reliability and validity of the adapted scales were assessed through construct validity, internal consistency of items (Cronbach alpha) and constructs' explanatory power, which is an essential condition for further theory testing and development (Field, 2009; Hair, 2010). Convergent and discriminant validly in section 5.8 were further used to ensure the reliability and validity of the constructs and items. Both the measurement model and the structural model were assessed using exploratory and confirmatory factor analysis (see sections 5.7 and 5.8). All the steps mentioned above demonstrate the validity of the survey instrument, construct validity, and salience of the data collected. Therefore, the few unexpected results that were observed can be considered to be realistic and based on fact. The dimensionality of all eight constructs was consistent with those reported in the literature and presented in the preliminary conceptual framework (Figure 3.2).

As mentioned earlier, this chapter discusses the findings presented in Chapter 5 and systematically reviews how this research has addressed the three research questions formulated in Chapter 1. The first research question, 'to investigate the key factors that may influence employees' adoption for change', was answered effectively in chapters 2 and 3. Table 3.1 and Figure 3.2 demonstrate the critical success factors which were derived from the review of the relevant literature. These factors have been found to affect the acceptance, adoption, readiness for and implementation of change in different developing and Arab countries over the years (see for example: Srivastava and Teo, 2007; Harfoushi et al. (2016); Bernerth et al. (2007); Van der Voet et al., (2016); Thi et al., 2014; Mathew et al. (2014) and Pudjianto and Hangjung, 2009). Hence, based on the contextual similarities, these factors were theoretically assumed to have an influence on recent change (RFID adoption) being implemented in the UAE's oil and gas organisation (ADNOC).

To answer research questions 2 and 3, and to examine the influence of these factors on employees' intention to adopt RFID within the research context (ADNOC), the latest version of the SPSS software was employed to analyse the quantitative data that was obtained from the online survey. This chapter thus mainly provides a discussion about research questions 2 and 3, which is presented in the next sections.

6.3 Research Question 2

How do known factors influence RFID adoption and what are the most key factors to consider when implementing RFID in ADNOC UAE?

Once the first research objective (identification of key determinants of change adoption) was achieved, the next logical step was to investigate the impact of these determinants (Technology-Organisational-Environmental factors) on employees' adoption of change. In order to answer research question 2, research hypotheses were tested using inferential analysis, as discussed below.

6.3.1 Perceived Usefulness Positively Influences Employees' RFID Adoption (H1)

Strong agreement was found among respondents towards the usefulness of RFID in terms of effort and timesaving as well as enhancing their overall operational and logistic activities. These results may suggest that, when compared to traditional operational and logistic methods, RFID was perceived as more useful and more beneficial for the respondents.

It was also found that the six observable variables used to measure the PU construct were loaded highly on factor one and were highly correlated with each other. Moreover, factor one alone explains 17.30% of the total variance in the data. Additionally, CFA results revealed the PU construct to have a high composite reliability coefficient and a high level of construct validity (convergent and discriminant). Regarding the influence of PU on RFID adoption, the preliminary research model anticipated that PU would have a positive influence on RFID adoption. Therefore, hypothesis H1 was formulated and further tested by structural equation modelling (SEM). The results of testing this hypothesis revealed that the causal path between the two constructs was insignificant at a level of $p=0.563$. Consequently, this result provided no support for the hypothesis, leading to acceptance of the alternate hypothesis, which states that PU does not positively influence RFID adoption in the context of ADNOC.

These results differ from the findings of prior research. For example, Reddy et al. (2020), Venkatesh and Davis (2000) and Wong et al. (2021) propose PU as an important determinant of technology acceptance. Similarly, Sagnier et al. (2020) found a significant effect of perceived usefulness on intention to use and adopt technology, suggesting that users must consider new technology such as RFID to be useful to intend to use it.

As mentioned in the previous sections, perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance his or her job performance. Thus, the literature related to change management and organisational development often emphasises the importance of people's perceived usefulness. In the context of ADNOC UAE, although employees showed agreement with the usefulness associated with adoption of RFID, surprisingly, no significant relationship was found between PU and employees' intention to adopt RFID. One possible justification could be employees' level of satisfaction with the existing system. The existing systems such as barcodes have been very useful in the past and, more importantly, employees of ADNOC are more familiar with the existing systems. Thus, despite their awareness regarding the advantages associated with the RFID, they still prefer the existing systems.

In practical terms, these results provide managers with information about the successful planning and implementation of RFID. For example, ADNOC can focus on promoting the usefulness and benefits associated with the RFID adoption and implementation to gain competitive advantage and improve organisational performance.

6.3.2 Perceived Ease of Use (PEU) Positively Influences Employees' RFID Adoption (H2)

The mean score results of the six observable items used to measure PEU revealed that respondents agreed that RFID-related systems are easy to understand, learn and use. EFA results also revealed that these measurement items were exclusively loaded on factor two and were highly correlated to each other. Factor two alone explains

15.88% of the total variance in the data. Additionally, the CFA results for PEU showed a high composite reliability as well as a high level of construct validity.

In this study, 'Perceived ease of use' was hypothesised to positively influence employees' positive attitude towards RFID adoption. As summarised in Table 5.22, the parameter-estimate results for hypothesis H2 (path coefficient = 0.239, critical ratio = .202) did not support the significant relationship between Perceived ease of use (PEU) and the dependent variable (RFID adoption). The p value of 0.23 was more than the recommended value of 0.05; hence, the hypothesis was not supported and was rejected (i.e., PEU showed no significant relationship with RFID adoption).

In the technology acceptance literature, perceived ease of use refers to the degree to which a person believes that using a particular system will be free of effort. Several works have shown that perceived usefulness is the strongest predictor of intention to use. For example, in the context of banks, Wang et al. (2003) reported that, among other factors, PEU had the greatest positive impact on intention to use new IT applications in Taiwan. Similarly, Sagnier et al. (2020) found a significant effect of PEU on intention to use and adopt technology, suggesting that users must consider new technology such as RFID to be easier to use to adopt it. In the same vein, Reddy et al. (2020) claimed that the actual use of technology depends on the person's intention to use it, which is influenced by the perceived ease of use. Prior research also shows that, if employees have a positive attitude towards the ease of use of new technology, then they will have the intention to adopt the new system (Shroff et al., 2011; Wong et al., 2021; Wang et al., 2003; Chan and Lu, 2004; Gefen, 2003; Venkatesh and Davis, 2000).

According to the previous findings, it can be concluded that, the more the new technology is perceived to be easy and free of effort, the more the chance it will be considered useful by the employees. However, in ADNOC UAE, the current study found a surprising result: i.e., no significant relationship was found between PEU and employees' intention to adopt RFID. Whilst ADNOC employees perceive RFID as less difficult to use, people in general are often reluctant to leave their comfort zone (Yilmaz and Kılıçoğlu, 2013). Another possible reason for this surprising result could be the employees' level of satisfaction and comfort with the existing systems.

Generally, less complex and more easy-to-use services are those not requiring much mental and physical effort; however, RFID being a unique technology may be perceived as difficult to use. Practically speaking, it is important for ADNOC's senior management to take special care about communicating the usefulness and ease of use of RFID systems. Therefore, in designing and promoting RFID systems, top managers should emphasise the ease of use of this technology in performing daily tasks. In other words, the challenge for any RFID application design would be to make it as easy to use as possible in terms of features and the level of skills needed to perform particular tasks. Moreover, perceived risk has been found to decrease employees' intent to use new technology (Featherman et al., 2010). During pre-purchase evaluations, a new system that appears to be easy to learn, understand and use should alleviate people's uncertainty and overall risk. Therefore, top managers of ADNOC must take steps to reduce perceived risks associated with the new technology (RFID) if there are any.

6.3.3 Technology Competence (TC) Positively Influences Employees' RFID Adoption (H3)

The third factor found to influence the DV (RFID adoption) is the technology competence. TC is a variable that can be used to enhance the quality and timeliness of organisational intelligence and decision making, thus promoting organisational development (Dewett and Jones, 2001). The collapsed mean score for the four observable variables used to measure the TC factor was 3.63 (greater than the scale midpoint of 3), reflecting agreement among respondents on this factor's variables. This result shows that most survey participants (66.6% of the sample) described their personal and organisational level of technology competence as being either good or excellent; hence, they are able to learn new technologies quickly and with less training. Many researchers have emphasised the need to have the necessary knowledge and competence in order to use and adopt new technology effectively (Ma et al., 2005). The oil and gas sector has not been isolated from digitalisation. In this sector, organisations, as well as individuals, need new skills and competence to cope with changing and increasingly digital work (Vehko et al., 2019).

The EFA result table (Table 5.16 on page 133) exhibited that all four observable variables related to the TC construct were loaded on factor three and were highly correlated with each other. Moreover, factor three (TC) alone explains 11.27% of the total variance in the data and reliability (α=0.85) is adequate (Table 5.1). Additionally, CFA results confirmed that the TC construct has a high composite reliability coefficient and a high level of construct validity (convergent, discriminant and nomological). Regarding the influence of TC on the RFID adoption, the preliminary research framework (Figure 3.2) anticipated that TC would have a significant positive influence on 'intention to adopt RFID' within ADNOC UAE. The results of path measurement coefficients (Table 5.22) revealed that the causal path between the TC construct and DV was significant at a level of $p< 0.05$. As the Beta value was positive, these results imply that technology competence positively influences employees' intentions to adopt RFID within the context of ADNOC UAE.

These results are consistent with findings from prior studies. For example, research by Lian et al. (2014) concluded that the staff's technological capabilities and/or competencies will also impact on an organisation when adopting an innovative technology. If the staff have sufficient knowledge and the needed skills to adopt RFID, that organisation will certainly have more confidence throughout the process. Similarly, in the context of the education sector, Yuen et al. (2003) found that successful adoption and implementation of new technology requires the readiness of the technical infrastructure and most of the staff must be trained to be technically competent. It has been repeatedly proved in practice that technical competence is the key issue which should be taken into consideration seriously to decrease the probability of technology adoption failure (Xia et al., 2019). In the context of ADNOC, it is thus required to have a clear picture about the possible difficulties and obstacles ahead in the way of RFID adoption, which will lead to a full understanding and preparation of the required technical competences and circumstances supporting the application process. Moreover, technical competence and adequate IT infrastructure offer the potential to dramatically improve the way in which people communicate and collaborate within the organisation – presumably aiding greater participation, involvement and motivation in difficult times of change (Chao and Yang, 2007; Ngai et al., 2007). In summary, the presence of a well-developed technical infrastructure is critical for RFID adoption and employment of efficient service delivery. Therefore, ADNOC needs to have a technical infrastructure and technical competence that are capable of supporting and enabling the execution of change (innovation).

6.3.4 Top Management Support (TM) Positively Influences Employees' RFID Adoption (H4)

Commitment and support to innovation by top management is a vital factor that is proved to be important in technology adoption (Soltani et al., 2007). Similarly, lack of commitment and support to quality by top management was found to be a significant innovation implementation barrier in previous studies such as Bhattacharya and Wamba (2015), Khanh, (2014) and Soltani et al. (2007).

The collapsed mean score for the four observable variables used to measure the TM factor was 3.61 (greater than the scale midpoint of 3), reflecting agreement among respondents on this factor's variables. This result shows that most survey participants (67% of sample) considered that TM commitment and support was available to implement RFID application. The EFA table (Table 5.16) exhibited that all four observable variables related to the TM construct were loaded on factor five and were highly correlated with each other. Moreover, the TM construct alone explains 8.74% of the total variance in the data (see Table 5.15 on page 129). Additionally, CFA results confirmed that the TM construct has a high composite reliability coefficient and a high level of construct validity (convergent and discriminant). Regarding the influence of TM on the DV, the preliminary research framework (Figure 3.2) anticipated that TM would have a significant positive influence on 'intention to adopt RFID'. The results of path measurement coefficients (Table 5-22) revealed that the causal path between the TM construct and the DV was significant at a level of $p< 0.001$. As the Beta value was positive, these results imply that top management's support positively influences employees' intentions to adopt new systems in ADNOC UAE.

The findings complement literature asserting that knowledgeable and committed top management is behind many successful change/innovation implementation projects (Ireland and Hitt, 1999; Carpenter et al., 2004; Boyne et al., 2011). Conversely, whenever there was a lack of top management's ability and support, the process of change was inhibited. A more similar study by Shaar and Khattab (2015) that used

SEM to examine the relationship between top management and change also indicated that top management positively affects change and innovation. Furthermore, top management support results in appropriate funds and resources for each innovation project, which are required to implement new technologies successfully. Therefore, a vital role of top management has always been to back employees, aid them with problem solving, create harmonious interactions and cooperation among various job functions, encourage bottom-up idea generation and incentives, and guide unit managers to champion innovation by sending out clear and consistent signals that lay a clear foundation (Hsu et al., 2019). In summary, supportive relationships lead to more positive employee attitudes towards change (Kirrane et al., 2017), which in turn helps employees to proceed effectively with the tasks of change (Abdolvand et al., 2008; Rusly et al., 2012).

Current research suggests that top management support is a key driver for overcoming obstacles and enhancing a firm's technological ability to successfully adopt or implement new technologies such as RFID. Therefore, a moderating view suggests that the openness of technology adoption is inherently valuable to the extent that top management support facilitates its effect on innovation. In practical terms, ADNOC may foster their top management's positive intention to support RFID adoption by pre-planned support activities, such as allocating sufficient new service resources and qualified support technicians.

6.3.5 Perceived Financial Cost (PFC) Positively Influences Employees' RFID Adoption (H5)

Costs associated with RFID implementation include costs of hardware and software, and time and costs required for setup, running and training (Verma and Bhattacharyya, 2016). They also include the security and privacy of data. PFC was identified by EFA results as the fourth factor among those influencing RFID adoption in ADNOC UAE. Costs included the expense of acquiring RFID-related equipment such as active and passive RFID devices, scanners, computers, tablets and new IT interface. Four items, PFC1, PFC2, PFC3 and PFC4, were used to measure this construct; the average mean score for these four items being 3.49, thus revealing that respondents considered the financial costs of using RFID in ADNOC to be within acceptable levels. Indeed, they believed that using these services would save them additional costs associated with other, traditional ways of doing things. CFA confirmed these results and provided statistical evidence of internal consistency and construct validity of the PFC construct.

The influence of PFC on intention was tested through hypothesis H5, PFC being proposed to impact positively upon RFID adoption, as reported in several technology acceptance studies (Wu and Wang, 2005; Li and Visich, 2006; Reyes et al., 2016; Tung et al., 2008). The review of the technology adoption literature suggests that the better resource availability and financial flexibility of larger firms often lead to increased adoption of integrated systems (Kumar et al., 2018). The hypothesis testing results revealed that H5 was rejected ($p = 0.649 > 0.05$); hence, PFC was not found to be a significant predictor of behavioural intention towards RFID adoption in ADNOC. The most likely justification for this contradiction with previous studies is the precise UAE context. For example, the UAE is a rich country and the oil and gas sector in particular has ample financial resources. Thus, financial cost associated with the new technology has minimum effect on people's decision to accept/reject change. Therefore, the research sample did not perceive costs associated with RFID to affect their intentions; rather, they were considered insignificant. Interestingly, investigating the adoption of new technology in Malaysia, Tan et al. (2010) also found that PFC had an insignificant effect on customers' intentions to adopt new technology, an outcome they explained by reference to the youthfulness of their sample (21-30 years old). This age group is believed to be more concerned with social image than cost. Similarly, research by Kumar et al. (2018) concluded that increased financial risk resulting from a higher setup price was attributed as the main deterrent for the initial adoption of new technology in traditional systems. Overall, it could be concluded that PFC does not contribute directly to the adoption behaviour of ADNOC employees in the UAE.

6.3.6 Firm's Size (FS) Positively Influences Employees' RFID Adoption (H6)

Firm size has been examined by several researchers in the field of innovation and has been considered to be a top indicator of organisational complexity (Salah et al., 2020). Even though a negative relationship has been revealed by some researchers between firm size and technology adoption, a positive relationship has been supported by the majority of studies in different contexts, such as e-commerce, mobile reservation systems, e-marketing, and IT innovations, as well as adoption of ICTs (Lee and Jung, 2016; Wang et al., 2010; Brown and Russell, 2007; Yunan et al., 2019).

In the current study, FS was found to be an important predictor of customer intentions to adopt RFID in ADNOC UAE. The EFA results revealed that three measurement items (FS1, FS2, and FS3) measured the FS construct. These results, construct validity and composite reliability, were all subsequently confirmed by CFA. The mean scores for these items were 3.36, 3.51 and 3.40, respectively, indicating that most respondents perceived FS to be compatible for implementing large-scale change, i.e., adopting RFID.

As expected, the testing of hypothesis H6 using SEM revealed that FS significantly influenced employees' behavioural intentions to adopt RFID ($p < 0.001$). In more practical terms, it was found that most respondents believe that ADNOC, being a bigger firm, is more likely to adopt high-priced RFID technology successfully compared with smaller firms. According to Salah et al. (2020), in smaller organisations, innovation is expected to be promoted by the availability of cross-functional cooperation; however, large firms have a higher likelihood to adopt new technology like RFID.

Literature dedicated to the innovation management and organisational development field indicates that the successful adoption of technologies largely depends on firm size. For example, in the context of Nigeria, Otali et al. (2020) concluded that firm size had a significant influence on the level of adoption of sustainability practices among construction firms. Smaller companies are generally less aware of newer technologies such as RFID and do not have enough time and financial resources to learn about and invest in them (Yunan et al., 2019; Darnall et al., 2010). Moreover, the big firms like ADNOC are also more able to absorb the impact of any innovation adoption failure.

6.3.7 Competitive Pressure (CP) Positively Influences Employees' RFID Adoption (H7)

Competitive pressure is defined as the extent of a competitive atmosphere within the industry in which companies operate (Sin et al., 2016). Organisations are likely to adopt innovation due to intense competition in this competitive environment. The majority of the empirical studies proved that higher innovative adoption possibility is related to higher competitive pressure. For instance, Zhu et al. (2003) investigated electronic business adoption by European companies and concluded that the adopters are under higher competitive pressure than the non-adopters. Moreover, in the same year, Lertwongsatien et al. (2003) also reviewed e-commerce adoption among small and medium enterprises, this time in Thailand, and found that e-commerce adopters are more likely to adopt innovative systems in intense competitive surroundings.

In the current study, competitive pressure was hypothesised to have a positive influence on people's behavioural intentions towards using RFID services in ADNOC UAE (hypothesis H7), and the parameter estimate results in this connection indicated that it was indeed statistically significant. This finding suggests that employees of ADNOC generally believe that adopting RFID is essential to compete and grow. Although the research findings are aligned with those of most previous studies, however, this finding is primarily not supported by research completed by Chang (2006) in Taiwan, which illustrated that environmental context (competitive pressure) did not considerably contribute to the model for predicting the extent of e-commerce adoption from the entire series of predictors, which is possibly due to the difference in culture and civilisation. Furthermore, this finding is also not verified by a former study under the TOE model that found that external competitive pressure is not significant to e-business adoption (Suhaiza et al., 2008).

In the context of innovative technology, competitive pressure corresponds to the degree of pressure felt by an organisation from its competitors, being recognised as an important driver in the adoption of innovation (Cruz-Jesus et al., 2019). Previous studies related to organisational development literature found that there is a tendency that the intensity with which firms compete with their competitors in the market positively affects their strategic business policies, such as it influences managers' investment decisions, or their innovation efforts, or in creating the firm's innovation strategy (Abdullah and Yaakub, 2014; Ferguson and Olfert, 2016). Therefore, it can be seen that financial and competitive pressure are positively related to technology adoption. The results of the current study highlight the importance of competitive pressure as an important determinant of technology adoption in the oil and gas sector, building on earlier contributions that emphasised the importance of change and innovation management. In addition, the study concluded that, the more competitive pressure ADNOC perceives, the more likely the firm and its employees will be convinced to adopt RFID.

6.3.8 Government Regulations (GR) Positively Influences Employees' RFID Adoption (H8)

Government regulation in the IT context refers to the support provided by a government authority to encourage the assimilation of IT innovation by organisations (Zhu et al., 2006). GR was found to be an important predictor of employees' intention to adopt RFID in ADNOC UAE. The EFA results revealed that three measurement items (GR1, GR2 and GR3) measured the GR construct. These results were later confirmed by CFA, which also confirmed their construct validity and composite reliability. The average mean score for these items was 3.79, suggesting that most respondents believed that the UAE government has provided the necessary technical and legal infrastructure to ensure successful implementation of new technology such as RFID.

In the current research model, hypothesis H8 assumed that GR would positively influence behavioural intentions of ADNOC employees towards using RFID applications. SEM path analysis results (see Table 5.22) confirmed that GR had a significant positive influence on intention to use RFID in ADNOC UAE, and therefore the hypothesis was accepted (GR positively influences DV). This result suggests that a higher level of perceived GR would enhance employees' confidence and trust in RFID, and it provides credibility to RFID, which then encourages more employees to accept and adopt RFID systems.

This result is consistent with previous technology adoption studies. For example, Tan and Teo (2000) found that, the greater the extent of perceived GR for electronic commerce and its related applications, the more likely that e-commerce services would be adopted by Singaporean customers. They concluded that GR enhances the credibility and the feasibility of various electronic commerce applications, thus increasing the likelihood of their adoption by people. However, the researchers admit that the influence of GR on technology adoption behaviour may not apply in the case of developed countries, where the private sector tends to dominate the economy and the government role is limited, unlike the situation in most developing countries. The main aim of the government regulations is to protect users' privacy and provide security by enforcing attributes such as confidentiality, integrity, availability and accountability (Yimam and Fernandez, 2016). Another study, by Minifie (2014), showed that the creation of specific government regulation settings related to particular technology adoption will lead to the promotion of broader productivity, growth and innovation.

The impact of existing regulations can be critical in the adoption of new technologies; thus, government regulations can encourage businesses to or discourage them from adopting RFID (Ali and Osmanaj, 2020). In particular, RFID is in its infancy and has yet to gain significant consideration for policy regulation. The current study thus suggests that the government should develop specific regulations to encourage organisations to adopt and use RFID as a model within their systems. Moreover, when considering RFID applications, organisations are caught between their desire for cost savings and the acquisition of the latest technology platforms (Zhu et al., 2006; Ali and Osmanaj, 2020). Consequently, the government should create specific regulations to encourage and control the quality of services that RFID can provide to organisations. The government can also help private sector organisations by providing a better infrastructure for the internet-related applications in order to increase their competitiveness. Finally, the study confirms the premise that, to build trust and obtain a successful implementation of RFID, specific regulation is required to address the security and privacy of the RFID-based services.

6.4 Research Question 3

What is the level of validity of the proposed factors (technology, organisational and environmental) in Abu Dhabi in terms of employees' acceptance for technology-based change?

This section discusses how the study's findings have answered these questions related to the contextual model of technology adoption developed for the UAE oil and gas sector.

As explained in earlier sections, this study utilised empirical data, factor analysis, CFA and SEM to enhance the understanding of RFID adoption, by specifying a context-based technology adoption model that fits the reality in Arab countries, the purpose of which is to improve the chances of technology adoption and success in the Arab world. If leaders can predict change (innovation) uptake and identify predictors of success, they can focus resources on appropriate interventions and initiatives, thus driving the efficient utilisation of what are often scarce resources. Causal models, like the TOE framework, can help us to understand change/innovation and indicate how to intervene in the change process to enhance the chances of success (effectiveness).

Models are widespread across the social sciences and SEM has been widely applied in the field (Wong, 2013). However, they need to be representative (Frank, 2002), i.e., correspond with the system under study (isomorphic) and 'fit' the data collected. Thus, conceptual models are of limited use to change practitioners. The TOE-based SEM examined in this study produced a set of acceptable fit indices, indicating that the model is an acceptable fit with the empirical data and that the DV (intention to adopt RFID) is influenced significantly by several latent variables.

The SEM results (GFI, CFI, RMSEA and AIC) of the final eight-construct model with 43 variables represented a relatively better model fit compared to the original model with 44 variables. Therefore, the results of the current study advance understanding of the applicability of the TOE model in the UAE context. The findings did not support the influence of all the proposed factors presented in Chapter 3 (sections 3.3 and 3.4). Rather, the results showed that, among TOE-related factors, perceived usefulness, perceived ease of use and perceived financial cost have an ineffectual impact on DV (people's intention to adopt RFID), and thus their insignificant relationships are represented in the final model (see Figure 6.1) with red lines.

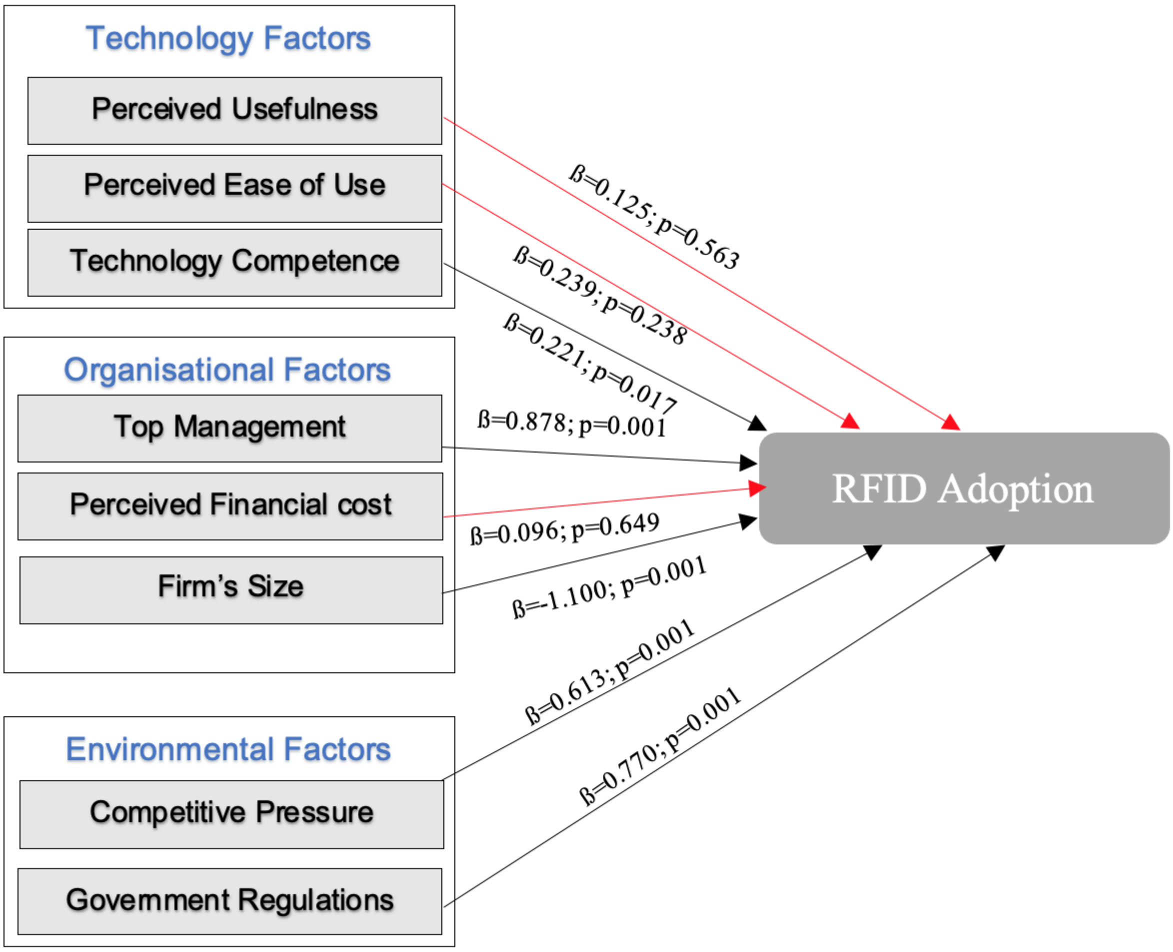

Figure 7. 1 Final RFID Adoption Model

According to the final research model, the intention to adopt RFID in ADNOC UAE is determined by five contextual factors, TC, TM, FS, CP and GR. Figure 7-1 illustrates the results of the aforementioned validated factors that affected the RFID adoption/implementation in ADNOC UAE. Squared multiple correlations obtained by SEM indicate that the explanatory power of the proposed model in this study (in respect of adoption) is shown as 80.1% (Table 5.20). The path statistics exhibited in Table 5.22 (standardised regression weight=.878, critical ratio=1.586 and p-value<0.001) revealed that 'Top Management Support' had the most impact on the adoption of RFID in ADNOC UAE. After top management, government regulations and competitive pressures were found to be the most influential factors. As discussed earlier, despite a few unexpected results, most of the results are very much aligned with the previous studies related to change management and organisational development literature. Overall, it could be concluded from the foregoing discussion that the model proposed in the current study provide a good understanding of factors that influence employees' intention to adopt/implement RFID in ADNOC UAE. This new insight into change adoption in Arab countries will be of use to those responsible for bringing about change in similar settings. Moreover, the final change adoption models can help organise thinking regarding where to focus attention when planning and implementing change; how to intervene and enhance change/innovation success.

6.5 Summary

This chapter reflected on the outcomes derived from the research hypotheses, as presented in Chapter 5, through the use of a structural equation model. First, there was discussion of the key determinants for RFID adoption within ADNOC UAE. As shown in the final change adoption model (see Figure 7.1), five of the eight hypothesised determinants within the preliminary research model were found to have a positive and significant influence on change readiness. The following key determinants were therefore integrated into the final version of the model: Technology Competence, Top Management, Competitive Pressure, Firm's Size and Government Regulations. Three determinants, Perceived Usefulness, Perceived Ease of Use and Perceived Financial Cost, were found to have no significant impact on RFID adoption. In the final model, insignificant relationship paths are highlighted as red lines. Moreover, based on the Beta values presented in the final model, it can be seen that top management, government regulations and competitive pressures are the most influential factors for employees' decision to accept/reject new technology.

The revised (final) model presented in this chapter (Figure 7.1) is a novel contribution as it can be used by academics and researchers to understand key determinants affecting people's positive attitude towards change, i.e., change readiness and change adoption. The final model also holds practical implications as it provides a tool for policy makers to understand different factors affecting employees' decision to adopt change, particularly technology-based change.

In the following chapter, the thesis is drawn to a final conclusion, the contributions made by the study are outlined, recommendations based on the findings are discussed, and the limitations of the study are presented. Some directions for future research are also offered.

Chapter 7: Conclusion

7.1 Introduction

In this chapter, the author briefly summarises the findings of the research. Issues that emerge from the main findings of the study are presented. The research implications are discussed from theoretical and practical perspectives. First, the theoretical contributions of the thesis, particularly in terms of the gap in the RFID implementation has been discussed. Second, the practical/managerial implications of the study's findings are described. This is followed by a discussion of the methodological and theoretical limitations of the research. Finally, some possible directions for future research are recommended.

7.2 Research Summary

While RFID has been regarded an important technology that can provide strategic and operational advantages, it has yet to see significant rates of adoption in the oil and gas industry. Hence, it is necessary to understand what determines RFID successful adoption in the oil and gas industry. Based on the TOE theoretical framework, this study developed and validated a research model to examine the influence of key contextual factors on RFID adoption in the oil and gas sector of the UAE. The study applied a quantitative method with a positivist approach in which an online survey questionnaire was used to obtain quantitative data to test the stated hypotheses. The data for this study was obtained from ADNOC UAE. The sample consisted of 301 usable responses. The SEM (Structural Equation Modelling) technique was used to test the hypothesised relationships using analysis of moment structure (AMOS) software.

The use of technology to support business processes for success and growth has been widely studied by scholars. Many studies have shown a positive correlation between employing technology and improved business processes. In recent times, RFID is one of the most promising information system technologies for supply chain application in the oil and gas industry today and in the future. Its potential to increase the transparency in supply chains and thus to advance the control of logistics, manufacturing, distribution, delivery, and reverse-logistics processes is one of the biggest advantages within the industry. However, adoption and deployment of the technology does not come over night – neither in automotive, nor in any other industry.

Main reason is peoples' resistance to adopt new technologies. Against this background, this contribution identifies the significant factors that facilitate the adoption of RFID in the oil and gas industry within UAE. One of the most established approaches in studying change adoption entails identifying contingency factors that can affect adoption decisions in organisations. Starting from a general literature review of prior research on the diffusion of innovations and a closer look at the diffusion of information system and technology-based innovations in particular, we have identified a number of factors that are responsible for the low rate of technology diffusion by organisations. Then, the factors belonging to the class of technology characteristics, organizational characteristics, and environmental characteristics were further analysed in order to extract such factors that have an impact on the diffusion of RFID technology in oil and gas sector. Subsequently, we found that Technology Competence, Top Management, Competitive Pressure, Firm's Size and Government Regulations showed significant and positive relationship with employees' intention to adopt RFID. However, perceived usefulness, perceived ease of use and perceived financial cost were found to have no significant effect on employees' willingness to adopt RFID. Thus, practitioners, solution and technology providers, and oil and gas sector may become able to address these factors directly to bring RFID projects to a success.

The results of the analysis of various studies in various sectors correspond to the findings of research conducted in the field of diffusion of innovations in general and – more focussed – the diffusion of IS innovations. In contrast to other studies on technology diffusion, the perceived financial cost was found to be the least important in the ADNOC UAE context. The reason for this seems to be that the adoption and diffusion of RFID is still in an early stage and therefore basic implementation issues must be solved first. Moreover, UAE in general, and oil and gas sector in particular, have ample financial resources and thus employees are less bothered about the financial costs associated with the implementation of new technologies such as RFID. Compared with prior RFID adoption research, this study empirically uses a large and representative sample which consists of several RFID decision makers in the UAE oil and gas industry. Thus, the findings of this study are valuable and provide several important implications for RFID adoption research and practice.

7.3 Research Contributions

The findings highlighted in the previous section have made a novel contribution to the theoretical knowledge in the field of innovation management, technology diffusion and organisational development particularly in the oil and gas sector. The outcome of the key determinants and development of technology adoption models also make a constructive contribution to both academic research and practice. These contributions are discussed in the following sections.

7.3.1 Theoretical Contributions

In relation to the theoretical contributions, there are five different aspects worthy of consideration as follows:

Firstly, organisational development, change management and Information Systems literature shows scarcity of empirical research regarding the determinants of technology adoption in the Arab World. This study examined the viability of the proposed research model in explaining employees' behaviour in Arab settings by taking UAE as an example. Thus, the results of present research contribute to the existing body of knowledge by filling this important gap by taking on a theory-based empirical investigation of the influencing factors of technology adoption in the context of Arab World. Consequently, key contribution relates to the fact that this study brings empirical evidence from a relatively new cultural context, considering that most of the technology-based change studies have taken place in the western world.

Secondly, given that the theoretical model was based on literature developed mainly in western contexts (such as the U.S., Europe and Japan), the test of the theoretical model in the context of UAE firm has also provided a good opportunity for the researcher to evaluate the applicability of TOE theory in a different, non-western national context.

Thirdly, this study has also developed and initially validated a scale to measure technology-organisational-environmental (TOE) related factors based on the synthesis of prior work that can be used by practitioners and researchers in their effort to advance the theory and practice of the TOE approach.

Fourthly, it was one of the key objectives of this research to develop a TOE model (or revised model) of technology adoption, this study has contributed a new dimension to our understanding of factors affecting the adoption/implementation of RFID. It thus provides future researchers with a wider and deeper understanding of these factors that can inform the development of more effective and empirically grounded models for RFID implementation that explicitly take account of organisational culture and RFID implementation barriers.

Fifthly, the global perception of the RFID technology, its worldwide reach and its use by many multinational organisations, there was found to be hardly any research attempts to study RFID implementation issues in the context of developing countries. In addition to that, there was a lack of studies that would deal with the RFID implementation related issues in oil and gas sector. The work in this thesis has made a new contribution to the field of RFID implementation with a focus on supporting RFID's effective implementation in developing countries particularly in the oil and gas sector. In addition, many of the previous RFID related studies simply focus on the technology itself, often disregarding broader societal, organisational, cultural, and environmental factors that often determine how a new technology is adopted. Thus, those studies have fallen short of drawing important conclusions that can be applied in practice. This study fills that gap by adding new perspectives to the study of determinants of RFID adoption by investigating key factors of RFID adoption across technological, organisational, and environmental contexts, including investigating administrative, regulatory, and cultural aspects of RFID adoption.

Finally, this study empirically verifies and supports the applicability of the TOE framework in understanding business IT adoption (i.e., RFID). The TOE framework provides a good starting point for analysing and considering suitable factors that can influence business innovation-adoption decisions. Moreover, compared with prior RFID adoption research, this study empirically uses a large and representative sample which consists of several RFID decision makers in the oil and gas industry. Thus, the findings of this study are valuable, and the novelty of this research is based on the development of comprehensive theoretical framework that examines the factors that influence the employee attitudes to accept/reject new technology such as RFID.

7.3.2 Practical Contributions

The examination of factors that influence employees to adopt new technology is an important endeavour. Eventually, innovation and introduction of new technology affects individual attitudes and behaviours because of moving form a known to unknown situation. The findings of this study have thus several practical implications; however, few important implications for managers and policy makers are as follow:
Firstly, our research findings will help enterprises in the oil and gas sector to develop a stronger understanding of factors that shape RFID adoption. By making enterprises more aware of how much various factors affect RFID adoption, our findings can help enterprises make more appropriate and rational decisions, thus facilitating RFID adoption in the oil and gas industry.

Secondly, the conceptual framework and survey instrument tested and validated in this study, will help oil and gas sector of UAE to identify the appropriate emphasis on RFID implementation based on their organisational culture and subsequently identify critical success factors for RFID implementation. The Research will benefit organisations who have not been able to implement RFID effectively, or who are in the process of planning the introduction of the RFID approach. Furthermore, it is reasonable to propose that the conceptual framework and survey instrument can be used in any organisational environment in any country or region. Therefore, it is envisaged that this study will help enhance the success rate of RFID implementation on a large scale.

Thirdly, key findings of the study offer practitioners practical insights or guidelines towards understanding and pinpointing which aspects of their corporate culture affect their adoption, implementation, and benefits of RFID. This will enable that have adopted RFID or those seeking to adopt RFID in aligning their internal characteristics and capabilities with RFID implementation requirements and procedures.

Overall, this thesis provides insights and acts as a useful reference to help managers to understand how RFID should be implemented along with the activities and issues that need to be considered in implementing RFID systems. Managers find it difficult to make decisions on the implementation of RFID systems due to a lack of knowledge about RFID technology. Unfamiliarity with the system leads to creating unrealistic expectations and erroneous perceptions about the benefits that an RFID system can deliver. With contributions from this study, organisations would be able to assess the factors that drive them towards adoption and weight them against perceived costs. Organisations will also have a better understanding on how their internal characteristics influence the deployment of RFID and benefits derived therefrom. This will help them to understand how to make a success of each phase of RFID implementation and to be able to realistically manage their expectations.

7.4 Research Limitations

The study findings contribute to the literature on information management systems, organisational behaviour, organisational development, and change/innovation management. Despite the promising results, some limitations of the study are noted that could be addressed in future research. For example, since the sample is based on only one country, it may not be sufficient to generalise to the entire population of the manufacturing industry in the world. Furthermore, because the sampling frame of our study was the oil and gas sector in the ADNOC UAE, the firm might have more resources and capabilities to be able to afford RFID investments and risks. For this reason, the RFID adoption rate in our sample may be higher than the RFID adoption rate in other businesses. Thus, caution needs to be exercised in generalising our findings to the entire industry population in UAE or other countries. Samples from different nations or industries should be collected to validate or refine our model.

Another limitation of this research is that the current research did not consider the phases of technology adoption. In future research, researcher could examine the differences in employee attitudes and behaviours depending on how long the change process had taken.

In addition, Likert scales were employed in the measurement of the attitudes and perceptions of research participants. The measures were therefore subject to the statements' interpretation by the respondents, although a pilot study was conducted so that the problem could be minimised. Studies in the future need to account for potential issues in interpretation. Moreover, measurements using a Likert scale could result in response bias as participants may wish to avoid the scale extremes and may not always provide honest answers.

Finally, some hypotheses derived from the TOE model were found to be insignificant in influencing RFID adoption. However, this is not a serious limitation i.e., a theory or model does not necessarily hold in all circumstances. In order for the TOE model to be generalised to other contexts and to allow for new predictions, empirical studies must be continuously conducted to validate or revise this model. Besides, many other variables in the TOE model, such as security issues and legal concerns, may be potential determinants of RFID adoption. Future research may incorporate these variables into a predictive model to enhance our understanding of the causality and interrelationships between the predictors.

7.5 Recommendations for Future Researchers

As this is an original study integrating change management and technology adoption, there are areas out of the scope of this current study that will increase the explanatory power of the developed model. Therefore, to build on the findings achieved by this study, this section offers several suggestions and areas for future research.

Firstly, this study has focused on eight key determinants for the purposes of analysis and development of the model. Further research could extend such a study for the inclusion of additional technology adoption determinants, particularly more cultural related factors can be incorporated. Furthermore, a greater deal of attention and investigation could be focused on the external environmental aspects, and their role in the employees' willingness to adopt change. The addition of cultural and external factors would expand our understanding of the process of change adoption, and the contributions they make towards the improved organisational performance.

Secondly, future researcher could analyse which factors in a particular stage of diffusion are the most relevant ones for the use of RFID in the oil and gas industry. Thus, longitudinal study can be used by future researchers.

Thirdly, the framework could be tested in non-organisational settings like in the development of national policies and strategies, or in consumer settings where technology adoption is not mandatory.

Finally, to optimise the value of this research field to organisational practice, developing and testing the effectiveness of identified determinants on technology adoption should be a clear prerogative for future research.

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Appendix 1: Research Questionnaire

SURVEY QUESTIONNAIRE FOR ADNOC UAE EMPLOYEES

(Please confirm the following by ticking the box below)

☐ *I have read the information sheet provided and I am happy to participate. I understand that by completing and returning this questionnaire I am consenting to be part of the research study and for my data to be used as described.*

Part A – About You

Target Audience: ADNOC UAE EMPLOYEES

Please indicate your gender

Male ☐ Female ☐

Indicate your age group (years)

21 -- 25 ☐ 26 -- 30 ☐ 31 -- 35 ☐ 36 or Over ☐

Please indicate your level of education

High school ☐ Diploma Bachelor ☐

Masters ☐ Doctorate ☐

Other, please specify ……………….

Please indicate your total years of service (ADNOC UAE EMPLOYEES)

5 or Less ☐

6 – 10 ☐

11 – 15 ☐

16 – 25 ☐

Over 25 years ☐

☐

Prefer not to say

Part B – **Independent variables (critical factors related to technology adoption in ADNOC of UAE.)**

Section 1- Key Determinants of Technology Adoption					
Statements	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Perceived Usefulness (PU)					
PU1. Using the RFID system enhances the productivity of my daily activities.					
PU2. Using the RFID system makes it easier to do my day-to-day activities.					
PU3. Using the RFID system enables me to accomplish daily activities more quickly.					
PU4. Using the RFID system improves my performance of daily activities.					
PU5. Using the RFID system enhances my effectiveness of regular activities.					
PU6. Overall, I find the RFID system useful for my day-to-day activities.					
Perceived Ease of Use (PEU)					
PEU1. Learning to operate the RFID system is easy for me					
PEU2. I find it easy to get the RFID system to do what I want it to do.					
PEU3. My interaction with the RFID system is clear and understandable.					
PEU4. I find the RFID system to be flexible to interact.					
PEU5. It is easy for me to become skilful at using the online banking information system.					
PEU6. Overall, I find RFID system easy to use.					
Technology Competence (TC)					
TC1. The technology infrastructure of my company is available for supporting RFID-related applications.					
TC2. My company is dedicated to ensuring that employees are familiar with RFID-related technology.					

TC3. My company contains a high level of RFID-related knowledge.					
TC4. The technology infrastructure of my organisation is available for supporting RFID-related applications.					
Top Management Support (TM)					
TM1. My top management is likely to invest funds in RFID.					
TM2. My top management is willing to take risks involved in the adoption of the RFID.					
TM3. My top management is likely to be interested in adopting the RFID applications in order to gain competitive advantage.					
TM4. My top management is likely to consider the adoption of the RFID applications as strategically important.					
Statements Continued…	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Perceived Financial Cost (PFC)					
PFC1. Costs of needed equipment required to implement RFID are reasonable					
PFC2. Setup costs for RFID system are reasonable					
PFC3. Running Costs for RFID system are reasonable					
PFC4. Training costs for RFID system are reasonable.					
Firm's Size (FS)					
FS1. The capital of my company is high compared to the industry.					
FS2. The revenue of my company is high compared to the industry.					
FS3. The number of employees at my company is high compared to the industry.					
Government Regulations (GR)					
GR1. The government encourages and promotes the usage of RFID system.					
GR2. The internet infrastructures are sufficient for RFID system implementation.					
GR3. The government has adequate regulations and laws for RFID system.					

Part C: Dependent Variable (peoples’ intention to Adopt (IA) RFID**)**					
People’s intention to Adopt (IA)					
IA1. Given the chance I intend to use RFID technologies.					
IA2. Given the chance I plan to use RFID technologies.					
IA3. Overall, I think that using RFID is advantageous.					
IA4. Overall, I am in favour of using the RFID system.					

Appendix 2 Normality

	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PU1	301	3.8239	-.464	.140	-.663	.280
PU2	301	3.9502	-.436	.140	-.823	.280
PU3	301	3.9734	-.496	.140	-.859	.280
Pu4	301	3.8339	-.418	.140	-.629	.280
PU5	301	3.9435	-.361	.140	-.928	.280
PU6	301	3.9435	-.341	.140	-1.114	.280
PEU1	301	3.5515	-.596	.140	-.132	.280
PEU2	301	3.6146	-.734	.140	.647	.280
PEU3	301	3.4651	-.489	.140	-.772	.280
PEU4	301	3.5349	-.569	.140	-.107	.280
PEU5	301	3.6047	-.700	.140	.681	.280
PEU6	301	3.4485	-.432	.140	-.787	.280
TC1	301	3.6611	-1.031	.140	.343	.280
TC2	301	3.6777	-.850	.140	.261	.280
TC3	301	3.6346	-1.017	.140	.039	.280
TC4	301	3.6678	-.987	.140	.445	.280
TM1	301	3.5548	-.329	.140	-.563	.280
TM2	301	3.5714	-.419	.140	-.549	.280
TM3	301	3.6312	-.507	.140	-.753	.280
TM4	301	3.6146	-.430	.140	-.729	.280
PFC1	301	3.4784	-.197	.140	-.456	.280
PFC2	301	3.4983	-.165	.140	-.739	.280
PFC3	301	3.4950	-.072	.140	-.716	.280
PFC4	301	3.4086	-.142	.140	-.668	.280
FS1	301	3.3621	-.506	.140	-.680	.280
FS2	301	3.5116	-.755	.140	-.122	.280
FS3	301	3.4020	-.401	.140	-.764	.280
GR1	301	3.2990	-.483	.140	-1.071	.280
GR2	301	3.2326	-.345	.140	-.534	.280
GR3	301	3.3090	-.536	.140	-.707	.280
CP1	301	3.8140	-.413	.140	-.825	.280
CP2	301	3.8538	-.213	.140	-1.123	.280
CP3	301	3.9535	-.406	.140	-1.091	.280
CP4	301	3.8472	-.470	.140	-.444	.280
IA1	301	3.4784	-.468	.140	-.439	.280
IA2	301	3.4684	-.446	.140	-.474	.280
IA3	301	3.4718	-.432	.140	-.480	.280
IA4	301	3.4419	-.434	.140	-.590	.280
Valid N (listwise)	301					

Appendix 3 CFA first run output

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	96	2817.763	499	.000	5.647
Saturated model	595	.000	0		
Independence model	34	12957.122	561	.000	23.096

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.042	.706	.649	.592
Saturated model	.000	1.000		
Independence model	.214	.289	.246	.272

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.783	.756	.814	.790	.813
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.889	.696	.723
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	2318.763	2155.708	2489.249
Saturated model	.000	.000	.000
Independence model	12396.122	12028.926	12769.691

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	9.393	7.729	7.186	8.297
Saturated model	.000	.000	.000	.000
Independence model	43.190	41.320	40.096	42.566

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.124	.120	.129	.000
Independence model	.271	.267	.275	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	3009.763	3035.121	3365.646	3461.646
Saturated model	1190.000	1347.170	3395.731	3990.731
Independence model	13025.122	13034.103	13151.164	13185.164

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	10.033	9.489	10.601	10.117

Model	ECVI	LO 90	HI 90	MECVI
Saturated model	3.967	3.967	3.967	4.491
Independence model	43.417	42.193	44.662	43.447

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	59	62
Independence model	15	15

Appendix 4 CFA final output

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	107	837.841	488	.000	1.717
Saturated model	595	.000	0		
Independence model	34	12957.122	561	.000	23.096

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.038	.867	.837	.711
Saturated model	.000	1.000		
Independence model	.214	.289	.246	.272

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.935	.926	.972	.968	.972
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.870	.814	.845
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	349.841	273.576	433.971
Saturated model	.000	.000	.000
Independence model	12396.122	12028.926	12769.691

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	2.793	1.166	.912	1.447
Saturated model	.000	.000	.000	.000
Independence model	43.190	41.320	40.096	42.566

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.049	.043	.054	.622
Independence model	.271	.267	.275	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	1051.841	1080.105	1448.502	1555.502
Saturated model	1190.000	1347.170	3395.731	3990.731
Independence model	13025.122	13034.103	13151.164	13185.164

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	3.506	3.252	3.787	3.600

Model	ECVI	LO 90	HI 90	MECVI
Saturated model	3.967	3.967	3.967	4.491
Independence model	43.417	42.193	44.662	43.447

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	194	202
Independence model	15	15

Minimisation: .089
Miscellaneous: .849
Bootstrap: .000
Total: .938

Appendix 5 SEM Output

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	116	910.300	514	.000	1.771
Saturated model	630	.000	0		
Independence model	35	13101.714	595	.000	22.020

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.052	.859	.827	.701
Saturated model	.000	1.000		
Independence model	.236	.290	.249	.274

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.931	.920	.969	.963	.968
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.864	.804	.836
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	396.300	316.109	484.336
Saturated model	.000	.000	.000
Independence model	12506.714	12137.662	12882.145

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	3.034	1.321	1.054	1.614
Saturated model	.000	.000	.000	.000
Independence model	43.672	41.689	40.459	42.940

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.051	.045	.056	.409
Independence model	.265	.261	.269	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	1142.300	1173.936	1572.325	1688.325
Saturated model	1260.000	1431.818	3595.479	4225.479

Model	AIC	BCC	BIC	CAIC
Independence model	13171.714	13181.260	13301.463	13336.463

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	3.808	3.540	4.101	3.913
Saturated model	4.200	4.200	4.200	4.773
Independence model	43.906	42.676	45.157	43.938

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	188	195
Independence model	15	16

Minimisation: .088
Miscellaneous: .834
Bootstrap: .000
Total: .922

Appendix 6 Missing Data Analysis

	N	Missing		No. of Extremes[a]	
		Count	Percent	Low	High
PU1	301	0	.0	0	0
PU2	301	0	.0	0	0
PU3	301	0	.0	0	0
Pu4	301	0	.0	0	0
PU5	301	0	.0	0	0
PU6	301	0	.0	0	0
PEU1	301	0	.0	2	0
PEU2	301	0	.0	4	0
PEU3	301	0	.0	0	0
PEU4	301	0	.0	2	0
PEU5	301	0	.0	4	0
PEU6	301	0	.0	0	0
TC1	301	0	.0	0	0
TC2	301	0	.0	0	0
TC3	301	0	.0	0	0
TC4	301	0	.0	0	0
TM1	301	0	.0	0	0
TM2	301	0	.0	0	0
TM3	301	0	.0	0	0
TM4	301	0	.0	0	0
PFC1	301	0	.0	1	0
PFC2	301	0	.0	0	0
PFC3	301	0	.0	0	0
PFC4	301	0	.0	1	0
FS1	301	0	.0	5	0
FS2	301	0	.0	4	0
FS3	301	0	.0	1	0
GR1	301	0	.0	0	0
GR2	301	0	.0	8	0
GR3	301	0	.0	5	0
CP1	301	0	.0	0	0
CP2	301	0	.0	0	0
CP3	301	0	.0	0	0
CP4	301	0	.0	0	0
IA1	301	0	.0	1	0
IA2	301	0	.0	1	0
IA3	301	0	.0	1	0
IA4	301	0	.0	1	0

Appendix 7 Normality Test

Descriptive Statistics

	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PU1	301	3.8239	-.464	.140	-.663	.280
PU2	301	3.9502	-.436	.140	-.823	.280
PU3	301	3.9734	-.496	.140	-.859	.280
Pu4	301	3.8339	-.418	.140	-.629	.280
PU5	301	3.9435	-.361	.140	-.928	.280
PU6	301	3.9435	-.341	.140	-1.114	.280
PEU1	301	3.5515	-.596	.140	-.132	.280
PEU2	301	3.6146	-.734	.140	.647	.280
PEU3	301	3.4651	-.489	.140	-.772	.280
PEU4	301	3.5349	-.569	.140	-.107	.280
PEU5	301	3.6047	-.700	.140	.681	.280
PEU6	301	3.4485	-.432	.140	-.787	.280
TC1	301	3.6611	-1.031	.140	.343	.280
TC2	301	3.6777	-.850	.140	.261	.280
TC3	301	3.6346	-1.017	.140	.039	.280
TC4	301	3.6678	-.987	.140	.445	.280
TM1	301	3.5548	-.329	.140	-.563	.280
TM2	301	3.5714	-.419	.140	-.549	.280
TM3	301	3.6312	-.507	.140	-.753	.280
TM4	301	3.6146	-.430	.140	-.729	.280
PFC1	301	3.4784	-.197	.140	-.456	.280
PFC2	301	3.4983	-.165	.140	-.739	.280
PFC3	301	3.4950	-.072	.140	-.716	.280
PFC4	301	3.4086	-.142	.140	-.668	.280
FS1	301	3.3621	-.506	.140	-.680	.280
FS2	301	3.5116	-.755	.140	-.122	.280
FS3	301	3.4020	-.401	.140	-.764	.280
GR1	301	3.2990	-.483	.140	-1.071	.280
GR2	301	3.2326	-.345	.140	-.534	.280
GR3	301	3.3090	-.536	.140	-.707	.280
CP1	301	3.8140	-.413	.140	-.825	.280
CP2	301	3.8538	-.213	.140	-1.123	.280
CP3	301	3.9535	-.406	.140	-1.091	.280
CP4	301	3.8472	-.470	.140	-.444	.280
IA1	301	3.4784	-.468	.140	-.439	.280
IA2	301	3.4684	-.446	.140	-.474	.280
IA3	301	3.4718	-.432	.140	-.480	.280
IA4	301	3.4419	-.434	.140	-.590	.280
Valid N (listwise)	301					

Appendix 8 Recruitment Email for Research Participants

LIVERPOOL JOHN MOORES UNIVERSITY

Dear Sir / Madam

I am currently undertaking research as part of a PhD programme at Liverpool John Moores University.

As part of my PhD research, I have to conduct a questionnaire-based survey that aims to investigate the impact of contextual factors on employees' intention to accept/reject change. The main objective is to create a contextual model for ADNOC UAE.

This research is focused on the ADNOC employees who are facing the large-scale reform being implemented in the oil and gas sector of the UAE. Therefore, being an oil and gas sector employee, you are hereby invited to take part in this research.

Participation in the study is voluntary. If you do wish to participate, please take your time in reading the attached 'Participant Information Sheet' prior to completing the questionnaire.

You have seven days to complete the questionnaire and return it electronically (via email).

If you have any questions regarding this study, please do not hesitate to contact me using the details below.

Kind Regards

Ibrahim
PhD Researcher
Liverpool John Moores University

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Appendix 9: Participant Information Sheet

LIVERPOOL JOHN MOORES UNIVERSITY
PARTICIPANTS INFORMATION SHEET

Title of Project: A CRITICAL REVIEW OF CHANGE MANAGEMENT AND TECHNOLOGY ADOPTION FACTORS TO DRIVE ORGANISATIONAL PERFORMANCE: A STUDY OF THE ABU DHABI NATIONAL OIL COMPANY(ADNOC)
Name of Researcher: Ibrahim
School/Faculty: Liverpool Business School

Dear Participant

You are being invited to take part in the above research study. Before you decide it is important that you understand why the research is being done and what it involves. Please take time to read the following information. Ask us if there is anything that is not clear or if you would like more information. Take time to decide if you want to take part or not.

1. What is the purpose of the study?

The purpose of this research is to investigate the impact of contextual factors on employees' intention to accept/reject change. The main objective is to develop and test a change (reform) conceptual framework that explains how employees of ADNOC institutions of UAE develop their positive attitudes and behaviours regarding organisational change. The study will contribute to the knowledge in the field of change management and organisational development in the UAE.

2. Do I have to take part?

This questionnaire is intended for employees of the UAE ADNOC organisation. Also, the participation in this study is voluntary so it is up to you to decide whether to take part in the research or not. If you do wish to participate, you will be given this information sheet. You are still free to withdraw at any time and without giving a reason. You may withdraw your participation at any time during the study that will not affect your rights. Data cannot be withdrawn once the questionnaire has been completed and submitted. By completing the questionnaire, the participants will be consenting to be part of this research.

3. What will happen to me if I take part?

Your participation in the study is by being involved in filling the attached questionnaire that would serve as the primary source of data. It will take approximately 10-15 minutes to answer the questionnaire. Once completed, the questionnaire should be returned electronically within 10 working days.

The questionnaire relates to demographics, participant's attitude about the internal and external environmental factors which impact on employees' decision to accept or reject change.

The data collected will be solely for the research/academic purposes and your identity will be kept anonymous. Therefore, I can confirm that there will be no risks to you due to your participation. The data (completed questionnaires) will be transferred to the UK for further analysis and will be treated confidentially, stored securely in a locked cabinet at the university. Only the researcher and his supervisory team will have access to it. All personal information will be retained for a period of 5 years when it will then be destroyed.

4. Are there any risks / benefits involved?

There are no known or expected risks for involvement in this study. However, the results of the study will be shared with the research participants (on request as researcher email is provided). This investigation may provide leaders of change with information and guidance on how various factors can affect people's attitude towards change.

5. Will my taking part in the study be kept confidential?

Yes. The data collected will be solely for the academic use and will not be sold to any third party or so. The demographic data such as age, gender, course details and university details will only be used for the academic research purpose. All the questionnaires will be anonymised and no names will be used in the study itself or in any further publications. The data collected will be stored on the password-protected computers at LJM University, Liverpool UK. The access to these computers is only given to the researcher. The hard copies of the questionnaires will be kept securely in the locked cabinets. The data will be stored for the purpose of this study for next 5 years and thereafter the data will be destroyed.

This study has received ethical approval from LJMU's Research Ethics Committee

Thank you for your valuable assistance and your co-operation is highly appreciated.

Contact details:

Name of Researcher: Ibrahim
Email:

Name of Supervisor: Dr. Scott Foster
Email:

Address:

Liverpool Business School
Faculty of Business and Law
Liverpool John Moores University
Redmonds Building
Brownlow Hill
Liverpool, United Kingdom
L3 5UG

If you any concerns regarding your involvement in this research, please discuss these with the researcher in the first instance. If you wish to make a complaint, please contact researchethics@ljmu.ac.uk and your communication will be re-directed to an independent person as appropriate.