The Influence of Risks on the Cost Overrun of ICT Network Projects

تأثير مخاطر تجاوز التكلفة على مشاريع تقنية المعلومات والاتصالات

by

HAMAD KHALIFA SUWAIDAN AL NAUIMI

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ABSTRACT

As the internet is becoming an increasingly inescapable part of our lives, which is being facilitated through a number of disruptive technologies, it has become mandatory for the government sector to operate in such a technologically advanced environment. The implementation of Information and Communications Technology (ICT) helps governments become more effective, accessible and accountable. It is expected that the use of ICT by a government in its processes and services can help in streamlining services which are more responsive, encourage wider public participation and also result in cost-effective services at every government level. Thus, the focus of this research was the identification of risk factors for the implementation of ICT networks in the UAE and development of a conceptual framework that would help to implement ICT networks in spite of these risk factors. With respect to this focus, the aim of the study was *'To study those factors which influence the adoption and implementation of ICT networks in the UAE and lead to cost over-runs'*. After conducting a thorough literature review, a quantitative analysis was carried out by conducting a survey of 209 professionals who were related to the field of information technology or communication and were associated with ICT projects in different capacities.

Using the Statistical Package for Social Science (SPSS) in Microsoft Excel, data was gathered and the findings were analyzed, which helped to develop a unique framework and reach vital conclusions. The main risk factors that were identified were Planning and Development, People and Management, Operations, Technology and Hardware. Furthermore, under each of these risk factors, additional factors were identified which became a part of the framework. The researcher also identified the various cost over-run factors that could hamper the ICT adoption process. Characteristics of ICT project implementation which include barriers, benefits and risks from multiple points of view were identified during the course of research. Within the literature review and data analysis, a number of barriers which make it difficult for implementation of ICT components in public organizations were identified; this included governmental and organizational policies.

One of the novel contributions made by this research is fact that risk management, its factors, cost over-runs and its factors have not been studied in the adoption and implementation stage of ICT

network projects previously. This research has expanded the existing literature by documenting and clustering ICT network project risks into themes and clusters and has developed a scale (risk statements) for measuring such risks. Further, the research has advanced the ICT network projects by identifying the most likely risks that will contribute to over-run of these projects within the UAE context. The results from this study will help to develop a conceptual framework that will help in the strategic management of risk and cost over-run in ICT network projects.

ملخص

في ظل ثورة تكنولوجيا المعلومات والاتصــالات وتزايد اســتخدام الشــبكة الدولية للمعلومات واتســاع رقعة هذا الاســتخدام بما ينطوي عليه من مخاطر مدمرة نتيجة لإســاءة اســتخدام الشــبكة، وجب على القطاع الحكومي الاســتفادة من هذه الشــبكة في تطوير الخدمات المقدمة للمجتمع كماً ونوعاً وتبســيط الإجراءات على المتعاملين في ظل مجتمع تقنية المعلومات فأصــــبح للحكومات دور فعال في هذا المجال مع مراعاة المساءلة القانونية للإستخدتم الخاطئ والذي من شأنه الإضرار بالمصلحة العامة.

وبناءً على ما تقدم تتمثل إشكالية هذا البحث حول تحديد عوامل الخطر لتنفيذ مشاريع شبكات تكنولوجيا المعلومات والاتصالات في دولة الإمارات العربية المتحدة وتطوير إطار مفاهيمي من شأنه أن يساعد على تنفيذ مشـــاريع شـــبكات تكنولوجيا المعلومات والاتصــــالات على الرغم من عوامل الخطر هذه. وينتج عن هذه الإشــــكالية أن الهدف من البحث هو "دراســــة العوامل التي تؤثر على اعتماد وتنفيذ مشاريع شبكات تكنولوجيا المعلومات والاتصالات في دولة الإمارات العربية المتحدة والتي تؤدي إلى تجاوز التكاليف". و بعد إجراء مراجعة شاملة للدراسات السابقة في هذا المجال أجرى الباحث تحليلاً كميًا شـــملت على عدد 209 مختصـــاً في مجال تكنولوجيا المعلومات أو الاتصـــالات وكانوا قائمين بمشاريع تكنولوجيا المعلومات والاتصالات بكفاءات متنوعة.

وتم استخدام برنامج التحليل الإحصائي (SPSS) وبرنامج (Microsoft Excel)، في جمع البيانات وتحليلها والوصــول لاســتخلاص نتائج حيوية ســاهمت في تطوير إطار عمل فريد. وتشــمل عوامل الخطر الرئيســية التي حددها الباحث على عدد أربع محاور وهي كالتالي: التخطيط والتطوير، والناس والإدارة، والعمليات، والتكنولوجيا والأجهزة، مع مراعاة أن كلاً منها تنطوي على عوامل فرعية اندمجت في إطار هذه الدراسة.

كما حدد الباحث العوامل المختلفة لتجاوز التكلفة التي قد تعرقل عملية اعتماد واســـتخدام تكنولوجيا المعلومات والاتصالات. وتم تحديد خصائص تنفيذ مشروع تكنولوجيا المعلومات والاتصالات والتي تشـــمل العقبات والفوائد والمخاطر من وجهات نظر متعددة خلال مســـار الدراســـة. كما توجب على الباحث أيضًا دراسة إدارة التغيير، وهو مفهوم مهم؛ حيث أن هذا الجانب من تبني مشاريع تكنولوجيا المعلومات والاتصالات لم يشمله بالكامل في هذه الدراسة. في إطار مراجعة الدراسات السابقة وتحليل البيانات، تمكن الباحث من تحديد عدد من العقبات التي جعلت من الصعب توظيف مكونات تكنولوجيا المعلومات والاتصالات في القطاع الحكومي، بما في ذلك السياسات الحكومية والتنظيمية.

وقد واجه الباحث أثناء إعداد هذه الدراســـة عدة صـــعوبات منها: الحصـــول على المعلومات المتعلقة بمؤسسات القطاع الحكومي، بالإضافة الى صعوبة التواصل مع الموظفين في تلك المؤسسات، وطول

إجراءات الحصول على الموافقات من السلطات المختصة. ومن أبرز توصيات هذه الدراسة التعمق في دراسة هذا الموضوع من منظور إداري، ووضع وتحديد مبادئ توجيهية أكثر عملية و فاعلية تستند إلى الدراسة لاعتماد مشاريع شبكات تكنولوجيا المعلومات والاتصالات كأداة في العمل الحكومي، وإجراء المزيد من البحوث بشأن دور إدارة التغيير في تنفيذ مشاريع شبكات تكنولوجيا المعلومات والاتصالات. وبناءً عليه يمكن الاستفادة من هذه الدراسة والإطار المطور من قبل الأكاديميين والباحثين والمنفذين على حد سواء لتمكين تنفيذ مشاريع شبكة تكنولوجيا المعلومات والاتصالات بسهولة وتبنيها.

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ANN	Artificial Neural Network
CPU	Central Processing Unit
GCC	Gulf Cooperation Council
ICT	Information and Communications Technology
IT	Information Technology
KPI	Key Performance Indicators
MLP	Multi-layer Perceptron
OECD	Organization for Economic Co-operation and Development
OP	Operation
OPO	Operations Overrun
PD	Planning and Development
PDO	Planning and Development Overrun
PID	Project Initiation Document
PM	People/Management
PMO	People and Management Overrun
TH	Technology and Hardware
THO	Technology and Hardware Overrun
UAE	United Arab Emirates

1 INTRODUCTION TO THE RESEARCH

1.1 Introduction

As the internet is becoming an increasingly inescapable part of our lives, which is being facilitated through a number of disruptive technologies, it has become mandatory for the government sector to operate in such a technologically advanced environment. In this new landscape, the UAE government has identified the need to adapt and therefore has undertaken the process of transforming all its official processes into technologically-charged online processes. The implementation of Information and Communications Technology (ICT) projects helps the government to transform into a more effective, accessible and answerable government (Farelo and Morris, 2006).

In the UAE, the ICT projects are being adopted with the intention of providing equal access to effective public delivery. In the UAE context, ICT projects are being viewed as the means through which the government is trying to provide premium services to its citizens, an integrated approach to governance where the government is able to fulfil the requirements of the people in a short time span.

This chapter presents the background to the thesis and explains the motivations driving this research. The chapter also introduces the study aims, objectives and research questions. Also, the chapter presents a basic introduction to the research, the theoretical background, the purpose of the research, its problem statement, and the research aim and objectives. A theoretical literature review and justification of the significance of the research are then outlined within the chapter.

1.2 Theoretical Background

Dekkers and Forselius (2007) have defined an ICT project as a project that is focused on the development and installation of a new software product. In contrast, ICT network projects (sometimes these projects are termed ICT infrastructure physical assets) are associated with the infrastructure required to connect computers, data loggers, printers, switches, telecommunications, severs, cabling, data rooms, etc., for exchanging data., i.e., communication (see Fig 1.1) (Dordal, 2018). Networks are physical assets that deliver information systems, which, in turn, host databases and software (i.e. ICT). This research is aimed at investigating the cost overrun of the latter projects not the former.

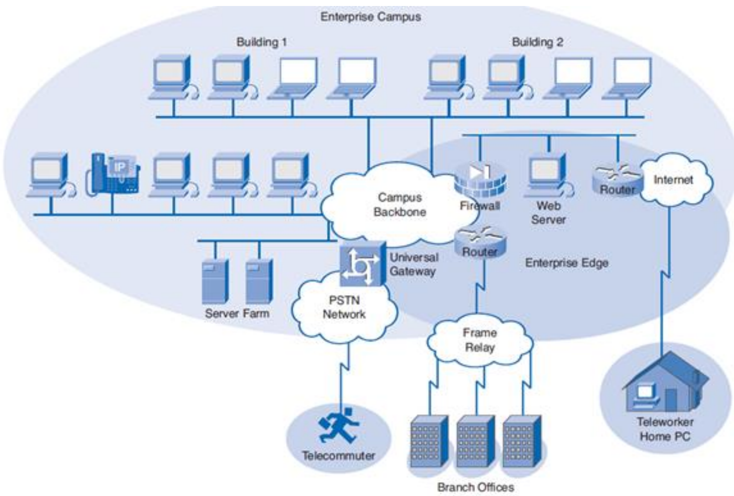

Figure 1.1 ICT network project components (Cisco, 2018)

Many ICT are termed hybrid projects, which include multiple sub-projects that are handled separately but within the scope of ICT. One of the major differences between an ICT project and a normal project is the fact that ICT projects are not discernible until their adoption and implementation is complete. There are five main stages of an ICT project (Pade, Mallinson and Sewry, 2008):

- Concept
- Development
- Adoption
- Implementation
- Post-implementation review

However, ICT network projects have the following specific characteristics

- Network development lifecycle
- Network analysis and design
- Logical network design

- Physical network design
- Network implementation
- Technology analysis

From the above stages, the adoption and implementation stages are the most difficult to execute because changes need to be bought about throughout the organization. These changes include replacing old systems with new ones and building the right infrastructure to implement ICT network projects. Furthermore, it also requires training for the workforce in order to adapt to the new changes. This thus causes a major increase in costing and thus these aspects have been studied in detail in the present research to understand their impact on cost overrun.

Cost overrun is defined as the amount by which the actual cost of a project exceeds the budget that was planned and estimated prior to the beginning of the project, after due diligence (Taylor, 2015). When a project overruns, it is usually measured according to the daily burn rate for the project; for example, if a day’s labour and other associated costs for an ICT project are AED 1,000/day, then two weeks of delay would lead to an increase of AED 10,000 from the planned budget.

Risk and risk factors lead to delays in the project, which in turn leads to cost overruns. Risk in a project is defined as an uncertain event or an occurrence which has an impact or a negative effect on one of the project objectives, and may cause delays in project completion (Flyvbjerg and Budzier, 2011). Risk management thus aims to identify those risk factors and ensure that they are minimized so that the ICT project is on schedule. There is a strong relationship between risk factors, delays and cost overruns. When risks occur, they lead to project delays, project delays in turn lead to cost overruns, and cost overruns lead to difficulty in implementation and adoption of ICT infrastructure (Taylor, 2015). In the present research, the focus is on understanding the relationship between these elements in order to determine how it leads to delays and improper adoption of ICT network infrastructure. Existing literature mainly addresses risks and cost overrun in ICT projects (i.e., information systems projects), whereas the risks and cost overrun of ICT network projects (as defined previously) are not investigated. Thus, this research aims to expand the existing literature by documenting and clustering ICT network project risks into themes and clusters and develop a scale (risk statements) for measuring such risks. Further, the research is intending to advance the knowledge on ICT network projects by identifying the most likely risks that will contribute to overrun of these projects within the UAE context.

The increase in urbanization along with an increased awareness about sustainability has caused an increase in investments that will help to transform cities and countries into smart cities and countries with information and communications technology network projects and develop new ones that are equipped equally. However, it is also important to note that the scale of this challenge is huge and therefore simply putting in investment will not help. It is vital to provide new solutions that fulfil the needs of urban residents in a viable, socially inclusive and sustainable manner (Pade, 2007). Urban cities are growing at an exponential rate and therefore it is important that the technologies are up to date. Furthermore, ICT infrastructure-enabled cities also drive the need for efficient resource and asset management. The transformation of the government and by extension the city is fuelled by technological advancements. The implementation of an Information and Communications Technology infrastructure helps the government to transform into a more effective, accessible and accountable government (Farelo and Morris, 2006).

Njoki (2016) believes a major role is played by ICT infrastructure with respect to the flow of knowledge and information between citizens and the government, which totally overhauls the way in which citizens and government interact. According to the United Nations Development Programme (2014), it is a challenge for countries to create as well as develop a system of governance which is focused on promotion, support and sustaining human development. In the UAE, huge ICT infrastructure investments are targeted at improving the governance processes. Certain guiding principles have been identified by various researchers that will help the UAE government to successfully adopt ICT infrastructure components within its governance framework (Njoki, 2016; Farelo and Morris, 2006; Nijkamp and Cohen-Blankshtain, 2013). These principles include (Minto-Coy, Bailey and Thakur, 2015):

- Develop government services that are citizen focused in their approach. Services should be developed in a manner that eases the processes not just for the government but also for the citizens.

- Government services should be developed that are easily accessible to the masses. Services should be delivered electronically via the internet, digital TV, mobile phones or call centres. The mode should be decided by the masses, based on their preferences.
- The new services that are designed making use of ICT infrastructure components should be easy to use so that they are available to all.
- ICT infrastructure policies should be designed and adopted to ensure that they are coherent as well as compatible to ensure maximization of the government's rich information and knowledge resources.

It is expected that the government's use of an ICT infrastructure in its processes and services can help in streamlining services which are more responsive, encourage wider public participation and also result in cost-effective services at every government level. In terms of complexity, it ranges from the basic access to information and data to redesigning of processes. While the aligning of old processes with new technologies might prove to be a major issue, it is imperative that proper training is provided to the staff so that they are able to adapt themselves to the new technologies. While the need for the UAE government to adopt ICT infrastructure systems is important for the future of the country, the fact remains that the adoption is not easy and is laden with many hurdles. These hurdles may be in the form of financial issues, technological factors and the people factor. These factors may cause deliberate delays in the implementation and adoption of ICT network/infrastructure projects leading to cost overrun.

The research thus seeks to identify these factors and develop a conceptual framework which can be utilized by future academicians as well as policy makers for the implementation of ICT network projects in the UAE, after overcoming the hurdles. This would help to have a better understanding of the various factors and characteristics such as the drivers, barriers and cost overrun factors that influence the ICT infrastructure implementation and adoption process. This research also enables the identification and ranking of these factors which impact the adoption and implementation of ICT network projects in the UAE.

By mapping the framework, implementers and decision makers will be able to have a more holistic view of all those factors that influence the implementation of ICT network projects. This will also enable them to plan effectively for the change that will be caused as a result of implementation of

ICT components within the organization and figure out the risk factors that may have an impact on the ICT projects.

1.3 Focus of the Research

The focus of this research is the identification of risk factors for the implementation of ICT network projects in the UAE and development of a conceptual framework that will help to implement ICT infrastructure projects in spite of these risk factors. Firstly, the research aims to document conceptual ICT network project risk and how it influences project implementation in the UAE. The research noted that all the definitions of ICT network projects are different to the ICT notion reported in the literature. It is important to note that all these definitions do not restrict ICT to merely software, instead telecommunication and associated equipment such as printers, mobile phones and scanners also form part of the ICT infrastructure. Rouse (2005) and Skryabin et al. (2015) have noted that the term ICT is applicable to software as well as hardware. The ICT term is rather a general term that is used to achieve specific organizational outcomes. This research asserts that ICT network projects do differ in their characteristics, as pointed previously.

Next, it is important to gauge the UAE's readiness in order to understand where the country stands with its ability to adopt the ICT infrastructure systems. E-readiness refers to the government's ability to assimilate the information communications technologies that are being implemented and take advantages of these technologies for enhancing as well as improving the administrative functions of the departments (DesAutels, Berthon and Chakrabarti, 2016). It is vital to understand that ICT infrastructure adoption will bring with itself a revolution in terms of accessing and redistribution of information and data (Minto-Coy, Bailey and Thakur, 2015. Therefore, it is extremely important that the government be ready to handle these changes effectively, such that there is no disruption in services and there is smooth adoption. Upon research, it has been established that the UAE is ready to adopt new hardware technologies as it continues to be the hub of technological revolution in the GCC.

The fact that the UAE has adopted many new technological systems within its sphere clearly indicates that it will be an easier phase for the country to shift to ICT components entirely for government services (Halaweh, 2018). While e-readiness is determined, one cannot ignore the fact that, in the UAE, there is no solid infrastructure or distribution of resources that would aid in the adoption of e-services (Halaweh, 2018); it has been researched that there is an imbalance in the availability and allocation of ICT resources. There is a general lack of in-depth analysis with respect to the resources and finances that can be utilized for the development of ICT network projects. It is thus vital that more studies and research are carried out in the area of risk management so that the projects are delivered within optimum resources. In the opinion of Tapscott (1995), the development of an ICT infrastructure leads to a paradigm shift, wherein there is an introduction of an age of invention, such that it causes a reinvention of organizations, businesses and government. Thus, it becomes important for the government to identify those factors that affect the development and operation of these projects. These factors may be drivers whose absence may lead to failure of the ICT infrastructure projects or they may be enablers which help in the process of implementation and operation of these vital assets.

In the absence of well-documented risk factors, there can be major issues in the operation and implementation of ICT network projects. Therefore, the research has chosen to concentrate on identifying these risk factors and understanding their impact on the development, implementation and operation of ICT processes. Furthermore, the research also aims to extract and evaluate these risks based on established studies. In the UAE, there is a general lack of addressing these risk factors and thus the researcher is of the opinion that implementation of ICT infrastructure projects in the UAE public sector can be entangled with many issues and barriers. One of the important risk factors that is largely absent from the available literature about ICT network project implementation is the risks associated with cost overrun that is experienced during the implementation process. Cost overruns have plagued the ICT infrastructure systems industry for a long time, even after the industry had acquired in-depth knowledge about project management. Project management is based on three core principles also known as the Iron Triangle: schedule, cost and benefits. According to Anthopoulos et al. (2013), ICT network projects tend to deviate by more than 10% from their original initial cost estimates.

This therefore poses a major risk as ICT network projects can be left incomplete in cases of high cost overruns. This is not an ideal scenario. Researchers have identified risk factors collectively which could cause major cost over-runs in general projects and thus it is vital that delay and cost overrun risks are identified specifically for ICT network projects. These risks can be controlled and reduced by making use of proper project performance monitoring and control systems which help to integrate the key activities of the various project phases. Thus, this research investigates risk factors and enables experts to refer to these risks during the adoption, implementation and operation of ICT network projects in the UAE. This research will extract, document and evaluate risk factors for likelihood on ICT network projects in the UAE.

1.4 Context: ICT Network Projects in the UAE

In terms of ICT readiness, the UAE is considered to be a pioneer with respect to infrastructure and connectivity (Ahmed and Abdalla Alfaki, 2013). This indicates that the development of ICT infrastructure is more important in the UAE compared to other Arab nations. The ICT infrastructure is closely linked to social as well as economic development and therefore there is a furore within the government sector to improve ICT infrastructures. In order to do so, it is advised that the government undertakes steps to enhance connectivity through better broadband access, connecting major services and making ICT infrastructure available to the masses.

Businesses in the UAE, along with the government, have recognized the vital role that an ICT infrastructure plays in meeting people, policy and business objectives. Therefore, a large number of investments are directed towards ICT infrastructure systems that helps in designing smarter cities which offer a better quality of life to the residents and better business processes to the industries in the country (Nijkamp and Cohen-Blankshtain, 2013). And it is not only the residents and businesses that stand to benefit from ICT infrastructure, even the government can benefit tremendously from ICT network projects as they are able to meet their objectives in an easier and more cost-effective manner.

In the UAE, the ICT network projects are being developed with the intention of providing equal access to effective public delivery. Furthermore, in the opinion of Kaba and Said (2014), an ICT infrastructure helps to improve communication as well as the exchange of knowledge and information, which is a necessity for the development process, thus helping the UAE to reach its developmental goals (Minto-Coy, Bailey and Thakur, 2015). Since ICT is pervasive in its nature, it has an impact on the full range of human activity, enabling wealth creation and poverty alleviation in the UAE. ICT infrastructure systems are therefore indispensable for scaling up.

1.5 Problem Statement

Past researchers have identified several challenges in the implementation of general ICT projects within any nations, especially those which are yet to adopt technology in their processes. However, ICT infrastructure systems represent many opportunities for the introduction of significant changes within a country. The rapid penetration of technology within the population has resulted in many improvements with respect to personal lives as well as professional lives. The UAE government wishes to extend this positive impact in the governance and is thus looking to expand ICT infrastructure systems that would make the processes and services faster and more reliable (Halaweh, 2018).

While the idea of adopting ICT services into the governmental services is a positive one, the road is fraught with many challenges when it comes to the development, implementation and operation of ICT network projects. One of the risk factors that is to be studied is the fact that the technology is evolving rapidly, and public sector organizations are not able to keep up with these changes (Rana et al., 2015). ICT network components that they adopt may quickly become obsolete. The future policy impacts are difficult to gauge, and, whilst public sector organizations often develop new systems that are based on new technologies, these technologies may or may not be tested for their stability, and thus those systems that are built on such unknown technologies tend to be more susceptible to failure. Thus, in the opinion of Weiss and Anderson (2004), the failure of risk can be reduced considerably by making use of well-established risk approaches along with businesses processes must be aligned with these ICT systems. Furthermore, it is also advised that citizens of a country have expectations from the services provided and thus it is important that the government provides a seamless service to the citizens. However, in order to do so, there are a number of challenges that need to be identified and navigated by the government to ensure that a seamless service that is secure in every way is provided to the citizens. ICT infrastructure systems should be targeted towards presenting the users with coherent and integrated government information packages. However, it is well documented that generally infrastructure projects have a history of multitudes of problems. Cost overruns, delays, change of scope, lack of specification, failed procurement, or unavailability of private financing are very common. The majority of these problems are due to a lack of professional, forward-looking risk management (Flyvbjerg and Budzier, 2011). Thus, as reported widely in the literature, large ICT infrastructure projects suffer from significant undermanagement of risk in practically all stages of the value chain. These projects suffer from poor risk assessment and risk allocation, leading, in most cases, to destroying a significant share of their benefit realization value Chatzipoulidis (2015). Thus, this research is targeted towards addressing risk problems and challenges that the government faces with respect to the implementation and operation of ICT infrastructure projects.

1.6 Significance of the Study

In the UAE, there is considerable exposure to information technology and other technological processes. However, there is little penetration of ICT systems in the UAE government (Halaweh, 2018). While it has been successful in establishing e-services, the penetration is not wholesome or complete. The main reason for this lack of penetration is due to many challenges and risk factors that have made it difficult to provide a seamless experience to the masses. Even for many processes which are already using ICT systems, there are certain challenges and issues which are to be addressed by the government. In the past there has been little or no research with respect to ICT implementation in the UAE context. Therefore, the author is looking to address this gap in the study and ensure that the challenges and risk factors are addressed so that the research can help future implementers and policy makers along with academicians to easily implement ICT systems and components in the governmental processes.

This research is set to augment our understanding of the risks that contribute to the cost overrun of ICT network projects.

> *The thesis will focus in particular on extracting and classifying a set of risks that are deemed to contribute to cost overruns. The study aims to offer an innovative way of clustering the ICT project risks. The originality of the research is also in its methodology. The research aims to explore the use of ANN (Artificial Neural Network) to map ICT project risks to cost overrun outcomes.*

1.7 Aims and Objectives of the Study

As has been discussed earlier, the UAE is gearing up to adopt ICT projects and components into the government services. Therefore, the aim of this study is:

To investigate risk factors that influence the adoption and implementation of ICT network projects in the UAE and lead to cost overruns.

In order to fully achieve this aim, there are a number of objectives for the study to fulfil during the course of this research. These objectives are to:

- Identify the various risk factors that play a vital role in the implementation of the ICT projects and their adoption.
- Evaluate which of these risk factors contribute to cost overrun in order to successfully implement ICT projects in the UAE.

1.8 Research Questions

The following research questions were developed to achieve the above objectives:

1. What are the components influencing the delivery of ICT (Information Communications Technology) networking projects in the UAE?
2. What is the association between risks and cost overrun of ICT networking projects in the UAE?
3. What are the success factors that might encourage successful enactment and implementation of new opportunities, ideas and technology that can add value to the ICT networking project in the UAE?

1.9 Research Hypotheses

The following hypothesis is identified based on the literature review to support the fulfilment of the research questions:

Hypothesis: *Planning and Development, Technology/Hardware, Operation and People/Management risks have a significant influence on overrun cost of ICT network projects.*

H1 – Planning and Development has a significant influence on overrun cost of ICT network projects

H2 –Technology/Hardware has a significant influence on overrun cost of ICT network projects

H3 – Operation has a significant influence on overrun cost of ICT network projects

H4 – People/Management risks have a significant influence on overrun cost of ICT network projects

1.10 Methodology Outline

In this section, the research aims to present an understanding of the methodology that has been utilized for this study. This is just an outline of the methodology; the details are presented in later chapters. The research reports an analysis of the survey of professionals who are related to the field of information technology or communication and are associated with ICT projects in different capacities. For the purpose of this study, the research chose to carry out quantitative analysis which involved a survey of 209 participants. The survey included closed-ended questions that helped to understand the various challenges that are faced by businesses in implementing ICT projects in the UAE.

The survey included questions in the major fields of Planning and Development, People and Management, Operations, and Technology and Hardware. This survey was carried out after an in-depth literature review that helped to identify the above-mentioned major fields that presented risk factors. The literature review helped to gain more insight into the risk factors that affect the ICT implementation. This approach is in line with the research approach adopted by other researchers in the area of ICT implementation and its challenges. Weerakkody et al. (2015), Kaba and Said (2014), and Touray, Salminen and Mursu (2013) have all utilized this approach for their research.

They have conducted similar literature reviews regarding the risk factors for ICT network projects and produced lists of a number of factors. The current researcher therefore has used a similar approach and has also identified many of the risk factors identified by the previous researchers, those overlapping the factors, and further reinforcing their validity. Apart from the risk factors that were identified in the literature review, identification of additional factors through a research study that involved surveying 209 participants, brainstorming and conducting informal discussions with other relevant personnel was attempted. These risk factors have not been studied previously and thus they add to the literature. Moreover, in the present study, a relationship has been established between risk factors, delays and cost overruns in ICT projects. The topic of cost overrun and ICT network projects (as defined above) has not been explored extensively in the past literature and the researcher thus aims to add to the literature in this area. The survey questionnaire was circulated electronically to all the participants, who belonged to public or private companies and were in roles that were associated with ICT network project implementation or adoption or even development. The respondents approached were across a variety of job functions to ensure that all aspects were covered.

After the respondents returned their responses, the researcher transferred them into a proper tabling and formatting program. For the purpose of this study, the research utilized the Statistical Package for Social Science (SPSS) in Microsoft Excel so that relevant statistical data could be extracted. The statistical findings that were gathered helped to develop an overall understanding and a relevant conceptual framework. Based on the same, a number of conclusions were drawn that are presented in later chapters.

1.11 Outline of the Thesis

In this section the researcher will present an outline of the research to understand how the research was carried out and the considerations behind the same.

Chapter 1: In this chapter, a presentation of the basic introduction to the research, the purpose of the research, its aim and objectives is made. A theoretical literature review and justification of the significance of the research are then outlined within the chapter.

Chapter 2: In this chapter, a thorough and in-depth literature review is carried out that is targeted towards understanding the various risk factors which pose a challenge to the implementation of ICT projects. The focus was to elaborate on the various factors in a manner that helps future researchers as well as implementers to bring about the necessary changes.

Chapter 3: In this chapter, based on the literature review and the survey that was administered, the researcher has developed a conceptual framework which identifies the various risk factors, their effects on the ICT implementation and a framework that will help to overcome these challenges. This framework is a useful tool for governmental entities, implementers, managers, and leaders and decision makers to use to apply the necessary changes in the ICT project implementation and it will also help to increase the understanding of the factors that play an important role in the decision-making process.

Chapter 4: This chapter identifies the various methodologies that can be adopted for reviewing risk factors. The researcher provides a justification for choosing quantitative analysis for the purpose of this study, and the survey method is explained.

Chapter 5: In this chapter, the research presents the results of the survey that was carried out with an emphasis on the risk factors identified through this survey.

Chapter 6: This chapter presents the results of the neural project in which an analysis of the findings derived from the neural project analysis applying a multi-layer perceptron is presented. The aim is to study the Influence of Risks on the Cost Overrun of ICT Projects effect of four types of overrun adoption of implementation of ICT.

Chapter 7: In this chapter, the results for the regression analysis are presented, and multiple regression analysis results are presented and interpreted post-verification of the underlying assumption. It examines the hypothesis developed between the independent and dependent variables, thereby supporting the research in meeting its aim and objectives.

Chapter 8: The research presents an important discussion based on the received responses and thus identifies the main risk factors. Inputs are taken from the findings of chapters 4, 5 and 6.

Chapter 9: This chapter presents a summary and conclusion of the study, with research contribution and recommendations for future research.

2 LITERATURE REVIEW

2.1 Introduction

With the advent of an increasingly pervasive internet, which is being facilitated through several disruptive technologies, it has become mandatory for the government sector to operate in such a technologically advanced environment. In this new landscape, the UAE government has identified the need to adapt and therefore has undertaken the process of transforming all its official processes into technologically-charged online processes. The implementation of Information and Communications Technology (ICT) will help the government to transform into a more effective, accessible and accountable government (Farelo and Morris, 2006). In the UAE, ICT projects are being adopted with the intention of providing equal access to effective public delivery. In the context of the UAE, ICT is being viewed as the means through which the government is trying to provide premium services to its citizens, an integrated approach to governance where the government is able to fulfil the requirements of the people in a short time span.

The research aims to identify the meaning of ICT, its definition, its background and how it is applicable in the UAE context. Furthermore, the research also enumerates the various benefits of ICT projects and how they can help in the achievement of organizational goals and objectives. Furthermore, the research also presents the various drivers for success and the factors or the barriers to the successful implementation of ICT projects. For ease of understanding, the risk factors are divided into four major categories, namely: Planning and Development, People and Management, Operations, and Technology and Hardware. With respect to the implementation of ICT projects in the UAE, the government needs to identify the complex issues that will have an impact on the implementation process. Cost overruns have plagued the ICT systems industry for a long time, even after the acquisition of in-depth knowledge about project management. The research further identifies the various factors which lead to cost overruns and delays in ICT project implementation.

By identifying these factors, it is possible to avoid the delays which ultimately lead to cost overruns. It is vital to study these factors in detail and ensure that they do not cause any hindrances. After the implementation process has been completed, it is imperative that ICT implementers and the top management take note of all these various factors and ensure that they do not pose any threat to the complete adoption of the ICT projects, and this is also considered in this chapter. The researcher then presents the conclusion to the chapter. This chapter has helped the researcher to identify the main factors which act as risk factors in the implementation of ICT projects. This in turn has been important for the formation of the conceptual framework that the researcher presents in the ensuing chapters. According to the information from the literature review and the results of the interviews, the researcher was able to formulate a justifiable conceptual framework for the implementation of ICT projects in the UAE.

2.1.1 Research Gap

Previous studies have extensively discussed the various risk factors that are experienced in the implementation of software ICT projects. However, as asserted before, information technology projects do differ significantly from ICT physical hardware assets. Thus, the risks factors associated with ICT physical assets (networks) are also different in nature. This research is set to add to the understanding of the risks that contribute to the cost overrun of ICT network projects. There is also a lack of studies that have documented, classified and evaluated risk factors related to ICT network projects and there with cost overruns. With this research, the aim is to fill this gap and present a well-developed piece of research that helps to understand the impact of risk and cost overrun on the implementation and operation of successful ICT network projects.

2.2 Theoretical Background of ICT

2.2.1 Definition of ICT

Information and communications technology (ICT) consists of the vital infrastructure and components that are required for modern computing. There is no universal definition of ICT since it is an umbrella term and it constitutes all the devices, applications, networking components and systems which, when combined together, allow organizations and people to interact and conduct business globally (Rouse, 2005). On the other hand, in the opinion of Njoki (2016), defining ICT as Computer Science and Engineering would be a narrow perspective. Njoki (2016) further states that such a narrow definition of the term also leads to major implications for ICT research. The OECD (2012) has defined ICT as "*the production (goods and services) of a candidate industry that must primarily be intended to fulfil (or enable) the function of information processing and* *communication by electronic means, including transmission and display"*. It has been noted that ICT is often used synonymously with IT (Information Technology); however, in terms of the components and digital technologies that come under it, ICT is broader and there is a more exhaustive list than for IT. Furthermore, the list of components is not exhaustive; it is growing continuously. ICT does not just include components, it also includes the application of these components (Kumar, 2017).

Kumar (2017) states that it is this which presents the real power and potential of ICT. Blurton (1999) defines ICT as an assortment of technology-based tools and resources which are utilized to create, communicate, store and disseminate information. The technologies used for this purpose include computers, telephony, and radio and television. In recent years there has been much interest in identifying the use of ICT to leverage the efficiency and effectiveness of processes in organizations. Barrantes (2007) goes on to describe ICT as the study, development, design, implementation and management of computer-based information systems. While it is synonymous with computer-based networks it also includes other information distribution technologies such as telephones, televisions and radio. In a similar definition, Daintith (2009) stated that ICT is a branch of engineering, which deals with the use of telecommunication equipment as well as computers for storage, retrieval, transmission and manipulation of data.

Definition	Focus	Source
ICT is an umbrella term and it constitutes all the devices, applications, networking components and systems which, when combined together, allow organizations and people to interact and conduct business globally.	Devices for interaction	Rouse (2005)
The production (goods and services) of a candidate industry that must primarily be intended to fulfil (or enable) the function of information processing and communication by electronic means, including transmission and display.	Information processing	OECD (2012)
ICT is often used synonymously with IT (Information Technology); however, in terms of components and digital	Use and application of components	Kumar

technologies that come under it, ICT is broader and there is a more exhaustive list than for IT. Furthermore, the list of components is not just exhaustive; it is growing continuously. ICT does not just include components, it also includes the application of these components.		(2017)
Assortment of technology-based tools and resources which are utilized to create, communicate, store and disseminate information.	Technology tools and resources	Blurton (1999)
The study, development, design, implementation and management of computer-based information systems. While it is synonymous with computer-based networks, it also includes other information distribution technologies such as telephones, televisions and radio.	Computer-based information systems	Barrantes (2007)
ICT is a branch of engineering, which deals with the use of telecommunication equipment as well as computers for storage, retrieval, transmission and manipulation of data.	Branch of engineering, use of computer and telecommunication equipment	Daintith (2009)

Table 2.1: Definitions of ICT

Thus, after reviewing all the definitions, it can be seen that all the definitions of ICT share a similar notion, wherein information is generated and shared. Furthermore, these definitions also assert that the information must be electronic or digital. It is however important to note that all these definitions have not restricted ICT to merely computers; instead, telecommunication and associated equipment such as printers, mobile phones and scanners also form part of the ICT systems. Rouse (2005) and Skryabin et al. (2015) have noted that the term ICT is applicable to software as well as hardware. The ICT term is rather a general term that is used to achieve specific organizational outcomes.

The definitions clearly bring out the importance of technology, which forms the main component of ICT projects. Therefore, in order to be able to implement ICT projects, it is also important that the nation is ready to inculcate the technology component in the framework for ICT implementation. In the case where technological advances in the nation are absent, the economy will not be able to implement the ICT projects successfully.

2.2. Success of ICT Projects

In order to achieve maximum benefits from the ICT implementation it is best to achieve all the success factors and avoid all the failure factors. However, that is not possible and thus, in such a situation, an action plan to increase the chances of success is required. Clockwork (2004) suggests an effective framework for the implementation of ICT projects by the government:

- Examination of the e-readiness of the nation (UAE).
- Identify the major themes and prioritize them accordingly.
- Development of an action plan.
- Apply the action plan to the target demography.
- Implement vital solutions.

The last leg of this framework calls for implementation of solutions; however, the key factor in this phase is to ensure that the organization is well ready to take in the new technologies and for the corresponding changes. Clockwork (2004) has further suggested certain best practices in ICT that were developed after studying other successful ICT project implementations. These include:

- It is vital that the complex environment of the ICT program evolution is not underestimated as ICT projects have a major technology focus.
- Government should select those ICT projects which demonstrate the capability of benefiting the target audience chiefly.
- The government staff must be given the necessary skills training in order to anticipate the changes that will accompany the ICT projects.
- Identify the right technologies that are needed for the various departments of the government and ensure interoperability.
- Identify the organizational process that fits the technology addition to the systems.
- A strong program and project management to develop as well as implement ICT solutions after the adoption of the ICT project systems within the organization.

2.3 Factors Affecting Implementation of ICT in Governmental Outfits

Due to the emergence of ICT, it has become possible to increase the efficiency and effectiveness of processes of internal administration in governmental organizations. Furthermore, thanks to the emergence of ICT, many crucial governmental services have now been shifted from physical offices to online portals for the ease of the masses, which can be accessed from anywhere using a computer and internet. While the benefits of ICT in government remain undisputed, there are many factors which do not allow for its successful implementation. In the opinion of Tapscott (1995), the application of ICT in government leads to a shift in paradigm, wherein there is the introduction of an age of invention, such that it causes a reinvention of organizations, businesses and government. Furthermore, Ndou (2004) suggests that the traditional paradigm constituted departmentalization, internal bureaucracy, and hierarchical control and management that is stringent on rules.

This is now being replaced with knowledge-based, competitive requirements such as innovation, flexibility, vertical and horizontal integration, customer services and a customer-driven strategy and external collaboration; all which is supported by ICT (Homburg, 2018). According to Bannister and Connolly (2014), governments across the globe have not only identified the importance of ICT, but have also engaged in the process of implementing a number of different ICT applications. Worldwide, there is an increase not only in investment in ICT reinvention but also with respect to initiatives to increase its visibility. Furthermore, in the opinion of the OECD (2012), the increase in information infrastructures will only stimulate economic growth as is evident in western countries which have adopted complete ICT solutions. ICT adoption will also increase productivity, improve quality of life and create more jobs (Cordella and Tempini, 2015).

2.3.1 ICT Performance Evaluation

In order to evaluate the potential, value and efficiency of ICT projects, qualitative or/and quantitative methods need to be deployed by organizations. Project performance cannot be evaluated prior to the successful implementation of the ICT project (Tapscott 1995). Post-implementation only, ICT projects can be termed as good or bad. For this research study, the main points of focus and analysis are the technical and operational aspects of ICT infrastructure design and implementation.

Conducting evaluations and assessments of ICT projects – across all phases – could pose a problem, and occasionally the reviews can be very subjective in nature (Heeks 2002; Ndou 2004; Irani 2002), yet there is no standard procedure that can be universally applied to all scenarios (Khalifa et al. 2004). To illustrate this, Currie (1995) presented several research case studies sourced from different parts of the developed world. Heeks (2002) on the other hand points out that there is no problem if the evaluation of ICT projects is subjective, and it could be based on situational factors such as time, etc. That said, it only asserts that the rate of success or failure of an ICT project can be gauged and determined after thorough evaluation.

2.3.2 ICT Success and Failure

Research data compiled from the recent past reveals that project planning and overall management of ICT-based undertakings have been rather poor in developed countries (Heeks 2002). Careful study of the failure causes disclosed that availability or absence of other reasons played a critical role in determining whether an ICT project would be successful or it would fail. First, the output variables are subjected to analysis. The variables are advantages and benefits that are expected to be acquired if the project initiative is a success. This step is crucial as it helps establish goal clarity for ICT projects. The determined goals are a crucial component in the aforementioned project planning phase. Classification of ICT projects is established based on the goals achieved. Furthermore, a thorough review of the reasons behind project failure is carried out so that related variables can be detected.

2.2.1.1 Output Variables

Although a number of benefits can be achieved by means of ICT, according to Malmodin et al. (2014), ICT is a means to an end and is not the end in itself. Thus, the true value of ICT is in its ability to help the government find solutions. The justification of ICT is possible only when there are benefits associated with it. Some of the major benefits of adopting ICT include (Eze et al. 2013):

- Higher quality of service delivery: It is vital that the core element of adoption of ICT should be customer focus. Successful services can be built with an in-depth understanding of the requirements of the users. This means that it should not the customers' responsibility to understand the complex structures of government in order to be able to interact and communicate with that government. ICT also enables a government to be a unified organization in itself, and provides seamless online services to the customers (Cordella and Tempini, 2015).

- Policy outcomes: Stakeholders are able to share ideas and information on particular specific policy outcomes. Use of online information can help to boost the use of educational and training programmes while it may also enable governments across the Emirates to share information to facilitate environmental policies (Kaba and Said, 2014) – although it is important to note that this kind of sharing of information also increases privacy issues and thus it is vital to study the potential trade-offs.

- Contribution to reform: The UAE is facing an issue with public management modernization and reform of the same. Development and adoption of ICT means there should be continuous reform (Kaba and Said, 2014). ICT has helped to underpin reform in a number of areas such as easy information sharing, transparency and accountability, and in highlighting internal inconsistencies (Delport, Von Solms and Gerber, 2016). Decision-making processes within the government become more transparent due to information sharing, thus making the government more accountable.

- Improved efficiency: Mass processing tasks and public administration operation's efficiency can be improved greatly by the adoption of ICTs. Internet-based applications can be utilized for data collection and transmission, and provide the necessary infrastructure for information dissemination and communication with the masses (Delport, Von Solms and Gerber, 2016). In the case of future efficiencies, these can be achieved through greater data and information sharing between the various regional governments.

- Better and increased access to information: ICT adoption is considered to greatly help in the reduction of corruption while also increasing trust and openness in the government (Cordella and Tempini, 2015). This therefore enables to achieve economic policy objectives. Furthermore, it also leads to decreased spending due to effective programmes, efficiency in business productivity due to simplification of administrative tasks and enhanced government information (Osborne and Brown, 2013). ICT plays a huge role in the free flow of information and knowledge between citizens and the government, thus transforming the manner in which the government and its citizens interact. According to the United Nations Development Programme (2014), it is a challenge for countries to create as well as develop a system of governance which is concentrated on promoting, supporting and sustaining human development.

- Advanced technology access: ICT is a tool to transform the government to be more citizen-centric by making use of technology. Technology is utilized to change the manner in which the government works and deals with information and how officials interact with the citizens (Delport, Von Solms and Gerber, 2016). Furthermore, technology can be utilized to split-up the government into accessible departments, which requires partnerships between the government and the private sector (Bannister and Connolly, 2014). However, it is vital to note that, for the successful adoption of ICT and for its success, it is imperative that there is continuous feedback as well as input by the customers – who are the citizens of the nation. For an ICT-enabled government to work, their ideas and suggestions are important.

- Helps build trust: One of the fundamentals of good governance is trust between government and citizens (Osborne and Brown, 2013). ICT helps in building this trust by engaging the public in the policy processes and promoting an open government. This also enables to prevent corruption. ICT can also be harnessed to help citizens talk constructively about the various public issues and assess the implications of the application of technology to the policy process.

ICT is considered an element of the government's modernization programme. However, in the opinion of Skryabin et al. (2015), merely adding computers will not modernize or improve the old government processes. Similarly, making complex procedures will decrease efficiency and focusing entirely on automation will not help in making government officials more service-oriented. Instead, leaders need to think about harnessing technology to achieve the objectives of reform and ICT is a tool that will bring about this reform (Osborne and Brown, 2013). Integration of technology is important to truly achieve the benefits of ICT.

Perceived Benefits	Description	Source
Higher quality of service delivery	ICT enables a government to be a unified organization in itself, and provides seamless online services to the customers.	Cordella and Tempini (2015).
Policy outcomes	Stakeholders are able to share ideas and information on particular specific policy outcomes. Use of online information can help to boost the use of educational and training programs while it may also enable governments across the Emirates to share information to facilitate environmental policies.	Kaba and Said (2014)
Contribution to reform	Development and adoption of ICT means there should be continuous reform. ICT has helped to underpin reform in a number of areas such as easy information sharing, transparency and accountability, and in highlighting internal inconsistencies.	Kaba and Said (2014); Delport, Von Solms and Gerber (2016)
Improved efficiency	Mass processing tasks and public administration operation's efficiency can be improved greatly by the adoption of ICTs.	Delport, Von Solms and Gerber (2016)
Better and increased access to information	ICT adoption is considered to greatly help in the reduction of corruption while also increasing trust and openness in the government. This therefore enables to achieve economic policy objectives.	Cordella and Tempini (2015).
Advanced technology access	ICT is a tool to transform the government to be more citizen-centric by making use of technology. Technology is utilized to change the manner in which the government works and deals with information and how officials interact with the citizens.	Bannister and Connolly (2014); Delport, Von Solms and Gerber (2016)
Helps build trust	One of the fundamentals of good governance is trust between government and citizens. ICT helps in building this trust by engaging the public in the policy processes and promoting an open government.	Osborne and Brown (2013)

Table 2.2: Benefits of ICT in Government

2.2.2 Drivers for Success

Those occurrences whose existence or absence affects the success of an ICT project are known as drivers. When these factors are absent, it can lead to failure in the implementation and adoption of ICT. Some of these drivers include (Avgerou, 2010):

- Governmental support.
- Vision and strategy.
- Donor support (external).
- Consumer expectations.
- Globalization and technological change.

Similarly, along with drivers, there are certain enablers, which are nothing but active elements that are present in society which help in overcoming barriers. These enablers include:

- Good practices.
- Effective project management.
- Change management.

Drivers

Governmental Support: The UAE government is intent on utilizing the full potential of ICT in order to benefit the community, while leveraging the country's position as a technological hub. In order to harness the potentials of ICT, governmental support is imperative. The government must adopt strategies and initiatives that promote the adoption of ICT (Avgerou, 2010). Strategic implementation of ICT is important to achieve the global modernization standards. In order to do so, many new changes will have to be adopted and implemented that would help in bringing about a technological revolution within the UAE government structure. In Figure 2.1, the Government ICT Strategy is proposed which has been developed based on recommendations of Kaba and Said (2014).

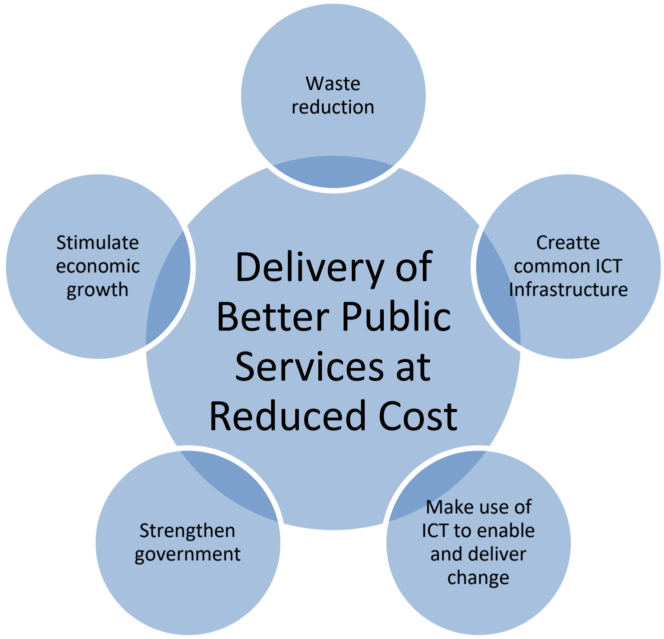

Figure 2.1: Delivery of better public services at reduced cost

In order to deliver the above strategy, it is vital that the government establishes a delivery process that will help in achieving the ICT strategy. The delivery approach must be unique in its standing and have the various departments working in line with each other in order to deliver the elements of the strategy and achieve its objectives (Anderson et al., 2015). According to Rodrigues, Sarabdeen and Balasubramanian (2016), the commitments of the strategy are rather challenging: the requirement to reduce the operational costs while delivering superior public services requires that there is efficiency in all the various government departments, such that they are able to work collectively in an effective manner. The delivery approach can be basically divided into short-term and long-term goals; all focused towards increasing the efficiency of the current ICT operations.

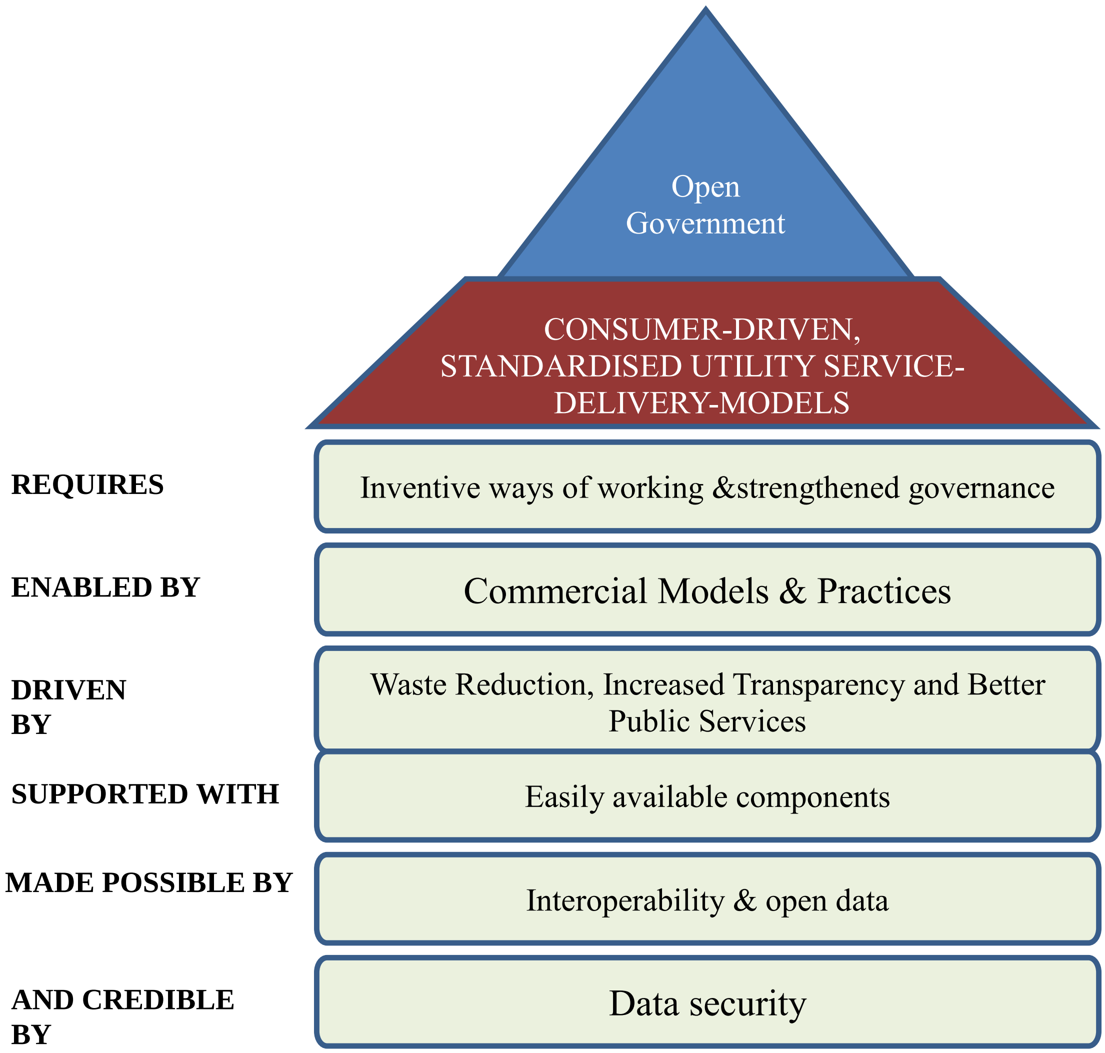

Figure 2.2: ICT Delivery Approach

The main component of the long-term goals is standardization. Having a suite of open standards will enable the government to move away from using expensive systems to re-use of solutions that are 'off the shelf' (Blind, Gauch and Hawkins, 2010). Furthermore, it is anticipated that standardization will also help to bring about a shift to a commodity approach of procuring ICT services. This will help the government in exercising greater flexibility. In order to achieve the goals, it is vital that the government is able to build the trust of citizens and assure them about the security of the data and that their information will be safeguarded at every point.

Vision and Strategy: One of the key enablers of ICT adoption is the vision and strategy of government. Government must proactively respond to the ICT needs of governance. To do so, it is important to implement flexible as well as agile systems and infrastructures that can ease dealings with citizen as well as businesses (Jegede, 2002). It is however important that the ICT systems implemented by the government are connected as well as aligned to the citizens' requirements as well as the businesses' processes (Botnariuc and Fat, 2011). In order to develop a vision, there is a set of core principles and policies which should be addressed by the government. These include (Botnariuc and Fat, 2011):

- ICT strategy is developed and maintained in line with the IT strategy, government's vision and key stakeholders' requirements.
- The services delivered are of low cost but maintain quality standards.
- ICT as a function is compliant with industry standards.
- Security features are applicable and are up to date.
- Helps in business growth.
- Flexible service delivery to users.
- Budgets are developed for new and improved services.

It is vital that the government is aware of the key technologies, trends and challenges, and monitors them to ensure that it will be able to respond to ensuing changes effectively (Cordella and Tempini, 2015). In order to do so, the ICT vision must be developed as depicted in Figure 2.3 to help in easy adoption and implementation.

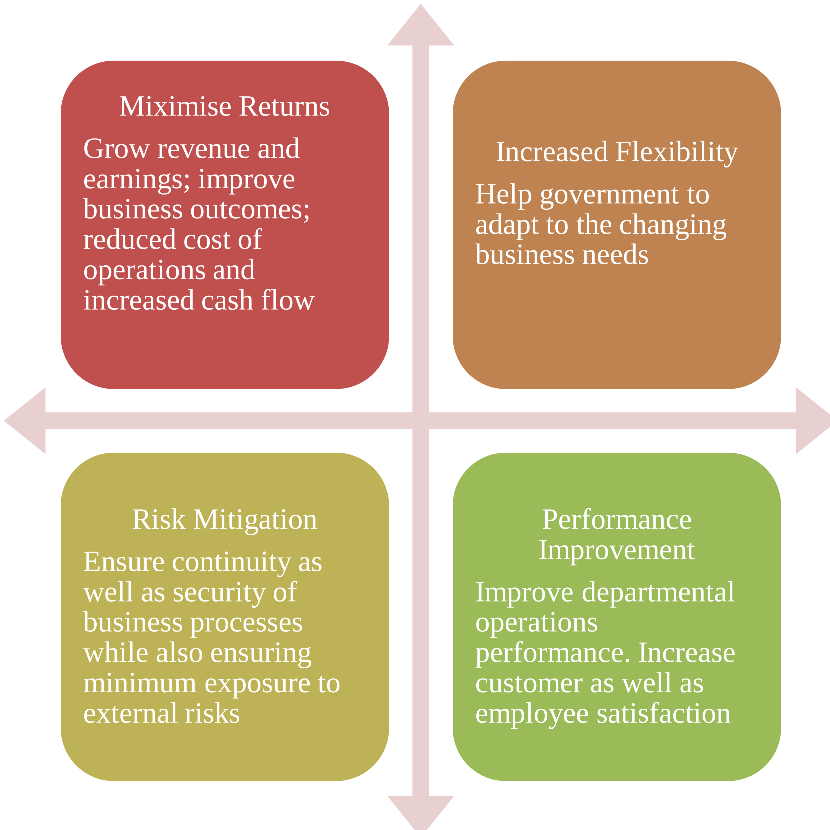

Figure 2.3: ICT vision

There are certain ICT demands from different sectors which when fulfilled can help integrate ICT into the government sphere. These demands are categorized as follows (Andersson, Vimarlund and Timpka, 2002):

- Business Demands: These demands include management information systems which primarily consist of the internal sources of information, business transformation and efficiency initiatives (Qader, Hassan and Saeed, 2017).

- Information Technology Demand: Every department within the government is responsible for crafting, authenticating and maintaining ICT disaster recovery as well as business continuity plans to mitigate any losses caused due to ICT disruptions (García-Muñiz and Vicente, 2014). In case of disruptions, all agencies should be able to function cohesively. Additionally, departments must identify all deliverables that are their responsibility, prioritizing the outcomes and recognizing the key dependencies as well as the dependencies which might lead to organizational/departmental failure (Adu, 2014). Furthermore, the implementation of ICT must add value for money by cost reduction, as was discussed in the ICT strategy.

- Demand from Within the Organization: ICT infrastructures are dependent on certain central functions such as operations, management of services and quality maintenance (Taylor, 2015). This is achieved via communication networks integrated with other vital systems such as Clouds, Virtual Networks and Smart Grids (Delport, 2017). However, these systems are under security threat due to disruptions, outages and security breaches. Thus, the government must identify the vulnerabilities and create a robust and reliable network. It will form a part of the core regulations, compliance and governance framework of ICT (Gatautis, 2015).

- Demand from Outside the Organization: With the implementation of ICT, there are many emerging business opportunities. The emergence of e-government provides the chance for the development of a legal framework that offers many business opportunities with private firms (Cordella and Tempini, 2015; Larson and Park, 2014). It will allow small and big firms to market various security-based services and thus strike up partnerships with the government (Taylor, 2015). However, with the emergence of new business opportunities, there will also be a rise in competition. Furthermore, there will be a rising need to adopt and manage new technologies.

Many of the above factors will overlap with different demands as depicted in Figure 2.4.

Donor Support (External): In order to bring affordable access to ICT, there is a need to collaborate with the external agencies, especially the private sector (Larson and Park, 2014). It has been noted by Gatautis et al. (2014) that private agencies provide services efficiently, especially in the telecommunications sector. The demand to provide more integrated and interactive information services can be fulfilled by private actors where in a seamless and unfailing service across the departments, agencies are provided that are compatible with each other and can be linked together (Nica, 2015). Such external investments play a pivotal role in the development and adoption of ICT projects.

Consumer Expectations: The widespread use of technology and internet has drastically increased consumer expectations. The consumers' cognition is altered, leading to them having enhanced expectations of governmental procedures (Nica, 2015). Simple practices such as purchases, renewals and service terminations are preferably carried out online (Mimbi and Bankole, 2016). Consumers are looking for easier solutions than visiting service centres to complete vital legal procedures. Thus, in an age where everything is web and mobile based, it is vital that the government establishes its own online portal for all major services.

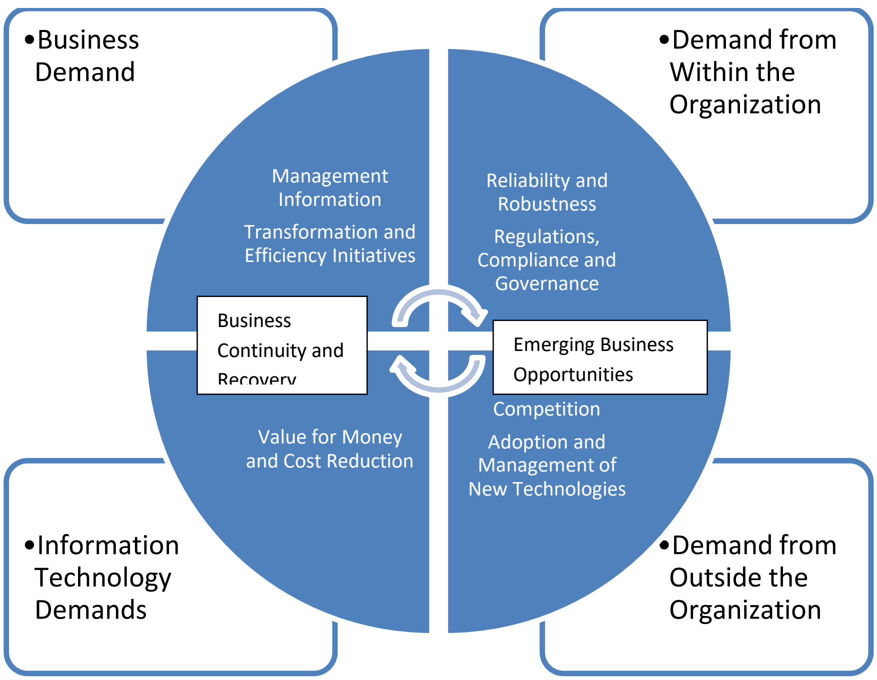

Figure 2.4: ICT Demands

Globalization and Technological Change: One of the driving factors of globalization is Information Technology (IT). Since the 1990s, there has been significant improvement in computer hardware and software and there has been a boom in internet use (Mimbi and Bankole, 2016). These changes have had an impact on the manner in which people communicate as well as on how they conduct their lives. Furthermore, they have also changed the manner in which people share information, data and opinions and carry out commercial transactions (Taylor, 2015). It is these technological changes that have driven efficient gains in the various sectors of the economy

(Faik and Walsham, 2013). IT is largely responsible for the innovative use of resources and the spread of new ideas across people and nations (Faik and Walsham, 2013). This globalization and technological change is one of the biggest drivers of ICT. In today's age, there is a growing realization that technology and innovation are the key to improving a nation's economy as well as the well-being of its citizens (Anderson et al., 2015. It is due to this reason that the government serves as a facilitator in helping consumers and businesses to adapt to the new economy's demands and opportunities. ICT, a major component of globalization, has many policy implications and should be studied and implemented in the UAE.

Enablers

Good Practices: ICT is emerging as an ideal delivery platform for public services in government organizations. ICT technologies help in the redesigning of vital government processes (Soto-Acosta et al., 2016). However, the persistent use of technology in ICT has resulted in a growing dependency on IT governance (Nica, 2015). This relates to the leadership, organizational structures and processes which ensure that ICT is able to sustain in a manner that is an extension of the vision and objectives of the organization. The best practices in ICT governance in the public sector are developed to improve as well as increase the accountability and transparency while reducing cost (Kettani and Moulin, 2014). Best practices are essential to increase efficiency as well as organize the resources for the growth of the country. To develop and implement ICT governance principles a number of process issues must be addressed. Some of the best practices in ICT governance include (Anderson et al., 2015):

- An enterprise-wise approach towards IT must be adopted.
- Commitment and accountability at the top level.
- A framework for IT controls.
- Gain trust externally as well as internally.
- Financial savings should be encouraged.
- Performance measurement and management.

Effective Project Management: According to a number of researchers, the main reason for the failure of ICT projects is poor project design and management (Guha and Chakrabarti, 2014). It is therefore vital that government leaders have a good understanding of the process of managing projects and also familiarize themselves with the tools that are available and may be used for increasing the project success rates (Too and Weaver, 2014). For effective management of projects, there are three vital elements of ICT Projects: people, technology and processes. It is therefore vital that these elements are defined, balanced and integrated for better project management and optimum performance (Guha and Chakrabarti, 2014).

Change Management: A key element of the successful adoption of ICT projects is change management. While the aim of the ICT strategy is to enable the government to deliver better services via citizen focus, citizen, industry and community collaboration, and better sharing of information, it brings about many changes in the work routine, processes and procedures (Cordella and Tempini, 2015). The government must acknowledge the importance of improving the ICT project management capabilities (Eze et al., 2013). For effective change management, it is essential that government agencies recognize ICT as a vital asset of operational, administrative and strategic importance (Khanh, 2014). The success of ICT is dependent on technological implementation, redesign of processes and management of changes in the organizational culture at the agencies. There are two sets of customers who are affected by ICT initiatives (Khanh, 2014):

- Internal: staff who are providing the necessary services for successful adoption and implementation of ICT services.
- External: Businesses and individual accessing the provided services.

Thus, change management entails successful management of these two groups. Some of the critical factors of change management include:

- Continued, strong engagement of stakeholders at every level.
- Executive endorsement.
- Clear objectives.
- Prioritizing of activities based on these objectives.
- Consolidation of gains and maintaining the momentum.
- Continuous improvement of processes.

It is vital to ask the staff how well the change is being managed and how confident they are that the change will help improve the organization's performance. It is the feedback that will help in identifying the right change management techniques.

Drivers for Success	Description	Sources
Governmental Support	The UAE government is intent on utilizing the full potential of ICT in order to benefit the community, while leveraging the country's position as a technological hub. In order to harness the potentials of ICT, governmental support is imperative. The government must adopt strategies and initiatives that promote the adoption of ICT. Strategic implementation of ICT is important to achieve the global modernization standards.	Avgerou (2010)
Vision and Strategy	One of the key enablers of ICT adoption is the vision and strategy of the government. The government must proactively respond to the ICT needs of governance. To do so, it is important to implement flexible as well as agile systems and infrastructures that can ease dealings with citizens as well as with businesses. In order to develop a vision, there is a set of core principles and policies which should be addressed by the government.	Jegede (2002)
Donor Support (External)	In order to bring affordable access to ICT, there is a need to collaborate with the external agencies, especially the private sector. It has been noted that private agencies provides services efficiently, especially in the telecommunications sector.	Larson and Park (2014); Gatautis et al. (2014)
Consumer Expectations	The widespread use of technology and internet has drastically increased consumer expectations. Consumers' cognition is altered, leading to enhancing their expectations of governmental procedures.	Nica (2015); Mimbi and Bankole (2016)
Globalization and Technological Change	Since the 1990s, there has been significant improvement in computer hardware and software and there has been a boom in internet use. These changes have had an impact on the manner in which people communicate as well as how they conduct their	Mimbi and Bankole (2016); Taylor (2015);

	lives. Furthermore, they have also changed the manner in which people share information, data and opinions and carry out commercial transactions. It is these technological changes that have driven efficient gains in the various sectors of the economy.	Faik and Walsham (2013)
Good Practices	The persistent use of technology in ICT has resulted in growing dependency on IT governance. This relates to the leadership, organizational structures and processes which ensure that ICT is able to sustain in a manner that is an extension of the vision and objectives of the organization. The best practices in ICT governance in the public sector are developed to improve as well as increase the accountability and transparency while reducing cost. Best practices are essential to increase efficiency as well as organize the resources for the growth of the country.	Soto-Acosta et al. (2016); Nica (2015); Kettani and Moulin (2014)
Effective Project Management	The main reason for the failure of ICT projects is due to poor project design and management. It is therefore vital that government leaders have a good understanding of the process of managing projects and also familiarize themselves with the tools that are available and may be used for increasing the project success rates.	Guha and Chakrabarti (2014); Too and Weaver, (2014)
Change Management	A key element of the successful adoption of ICT projects is change management. While the aim of the ICT strategy is to enable the government to deliver better services via citizen focus, citizen, industry and community collaboration, and better sharing of information, it brings about many changes in the work routine, processes and procedures. It is vital to ask the staff how well the change is being managed and how confident they are that the change will help to improve the organization's performance. It is the feedback that will help in identifying the right change management techniques.	Cordella and Tempini, (2015); Khanh (2014)

Table 2.3: Drivers for Success

2.2.3 Risk Factors for ICT Network Project Adoption, Implementation and Operation

Risk and risk factors lead to delays in the project which in turn leads to cost overruns. Risk in a project is defined as an uncertain event or an occurrence which has an impact or a negative effect on one of the project objectives, and may cause delays in project completion (Flyvbjerg and Budzier, 2011). Risk management thus aims to identify those risk factors and ensure that the risks are minimized so that the ICT infrastructure projects are on schedule. There is a strong relationship between risk factors, delays and cost overruns. When risks occur, it leads to project delays, project delays in turn lead to cost overruns, and cost overruns lead to difficulty in implementation and adoption of ICT infrastructure (Taylor, 2015). It thus becomes important to study the various risk factors associated with ICT infrastructure project adoption and implementation. Project managers need to develop project plans wherein risks have been accounted for, such that this helps to avoid delays. Additionally, it also becomes important for the project manager to develop a contingency plan in case they are faced with risks. Consequently, risk management should be the fundamental element of an organization's strategic management. Organizations must methodically address each identified risk with the aim of achieving sustained benefit under each phase of the ICT infrastructure project cycle. However, it is also important to note that risk identification should be a continuous process since each phase presents its own unique challenges and associated risks.

There are four important reasons why risk management is important in the ICT infrastructure project cycle and how each factor is connected to the others:

- Minimizing delays: One of the major reasons why risk management is vital is because project delivery time and project schedule are very important during the project cycle. When appropriate risks are identified and mitigation plans are undertaken, this helps to minimize delays.
- Cost reduction: When there is an occurrence of risk, it becomes pertinent to rearrange the resources, which causes delays as well as increase in cost. Furthermore, it also leads to wasting of human resources. Thus, the entire projects undergoes changes. To avoid such an increase in cost, risk management becomes important.
- Increasing return on investment: When a project is delayed or is over budget, this decreases the financial returns from the project while also losing competitive advantage.

Risk management thus provides the right means for organizations to ensure return on investment.

- Increasing opportunities: By conducting successful risk management and mitigating the expected risks, the project manager will be presented with more opportunities that would help the project output.

Due to the above reasons, risk management becomes imperative during the ICT infrastructure project cycle, especially during the adoption and implementation phases.

Risk factors are those occurrences that present constraints to the smooth adoption and implementation of ICT projects by the government. These factors may be considered as barriers as well as inhibitors, as identified by Heeks (2003) and Khaled (2003). Barriers are those factors that completely hinder the adoption and implementation of ICT projects; this leads to failure and thus the organization is not able to benefit from the ICT projects. Researchers have identified a number of such barriers:

- Financial constraints.
- Poor infrastructure.
- Lack of compatibility and integration.
- Lack of skilled personnel.
- Poor data systems.
- Leadership styles, culture and attitudes.

In the case of inhibitors, these are the factors which may not necessarily hinder the adoption process, but cause restrictions in the implementation, advancement and sustainability of the ICT projects. Some of the major inhibitors include:

- Technology and hardware.
- User needs and requirements.
- ICT policy adoption.
- Operational issues.

For the purpose of this study, the researcher has divided these risk factors into four main categories: Planning and Development, People and Management, Operations, and Technology and Hardware. Risk factors in each category are discussed to assess their impact on the adoption and implementation of ICT projects.

2.2.4 Planning and Development Risk Factors

These factors relate to the risks that are associated with the initializing, planning, developing and implementing of an ICT project and its associated processes. In the case of an ICT project, it is extremely important that the project scope be well defined; this includes development of a common understanding regarding what should be included in and what should be excluded from the project (Malik, Dhillon and Verma, 2014). It is imperative that all stakeholders have a good understanding of the scope of the project in order to be able to determine the budget and time frame (Anthopoulos et al., 2016). However, it is also vital to remember that the project scope tends to change as the project is being implemented; once the details become clearer, there tend to be more complexities which were not thought of earlier (Anthopoulos et al., 2016). Therefore, it is important that such changes are always accounted for before the start of the project adoption process. According to Davies and Harty (2013), some changes in the scope tend to cause problems when the perception of what was defined within the scope was different for everyone involved. While there are different ways to define the scope of an ICT project, it is best to define the perceived outcomes in order to garner the right results. Just as the scope is an integral part of ICT planning, the absence of a clear mandate regarding the goals and objectives of the project can also pose problems in the successful implementation of an ICT project. Mandate is nothing but a blueprint of the program and process of ICT; thus, having clarity is vital. A well-developed project charter will spell out the project scope, resource pool and resource requirements based on the objectives and bill of requirements (BoR) (Malik, Dhillon and Verma, 2014). This helps the project to be on-budget and on schedule.

While the ICT strategy may be in place, the absence of the right programs and process will not allow the strategy to be implemented successfully. Only being on schedule and on budget is not sufficient for the success of the project; it must also be in-sync with the business strategy (Ab Razak and Zakaria, 2015). In order to gain strategic advantage, it is important to execute ICT projects, however these strategic initiatives are rendered useless when it is not aligned with the business strategy. Furthermore, according to Gatautis et al., (2015), strategic alignment ensures that the ICT adoption will help the organization achieve its business goals. Weiss and Anderson (2004) suggest alignment of business strategies with ICT strategy is crucial for creating efficiency, reducing costs, improve customer relationships and create better business solutions. When there is lack of ICT strategy and business strategy alignment, it leads to increasing financial and opportunity losses (Ljungholm, 2015).

For any ICT project to be successful it is important that the core team/project management team is able to carry out essential risk assessment. Some of the potential risks associated with ICT project implementation include: the team members do not have the required computer and technical skills and thus they are not able to fulfil the project objectives, the infrastructure is not developed sufficiently to allow for ICT implementation, collaborative associations are not studied before implementation, and high cost of software and hardware (Guha and Chakrabarti, 2014). All these factors, if not considered and appropriate risk mitigation is not developed, can lead to project failure (Homburg, 2018). Human resource is an integral part of any organization and its management is concerned with the hiring, compensating and performance management of the workforce (Kettani and Moulin, 2014). The success of any ICT project is based on both the technology and the people component. Thus, it becomes essential to manage this component competently so that the implementation of ICT is smooth. ICT-related changes need to be adopted by the staff in an efficient manner; however, for them to do so, the management must provide the necessary training (Halachmi and Greiling, 2013). Only when there is complete adoption of the ICT systems within the organization can it lead to the successful adoption and implementation of the ICT projects. When there is failure to recruit and retain employees with the appropriate skills and knowledge, this results in failure of ICT project implementation (Sherwood, 2005). For the repeated and continuous application of technical specification, standards are developed. These standards are approved by a recognized national or international standardization body (Pesquer et al., 2015), and the successful adoption of these standards has major economic benefits:

- Interoperability and compatibility between the various products as well as elements of the project.
- Reduction in variety, thus enabling economies of scale in production.
- High-quality guarantee.
- Standard service description for easy use.

Thus, standards can be considered as a key tool in identifying the best products and services and enabling interoperability (Hanseth and Bygstad, 2015). During the procurement phase, many entities are involved and therefore it is important that the transition towards ICT is smooth. The budget and spending on digital technologies is large in ICT projects and therefore it is advisable to refer to the standards. Expenditure in ICT systems is mostly concentrated on the procurement of hardware, software, management digital platforms and mobile technology (Hanseth and Bygstad, 2015). It is vital that business managers ensure value for money for every expenditure. In the absence of strict vigilance, the project may go overbudget, resulting in decreased spending power at the later stages of the adoption and implementation process. This may lead to project failure. Therefore, there is a dire need to address the procurement policies, a risk factor that must be studied diligently by the management.

Stakeholders tend to measure the success of a project based on how well it was executed despite any constraints and limitations. It is therefore vital that a schedule be formulated which takes into account the changes that may occur during the implementation process (Ugwu and Kumaraswamy, 2007). A project schedule is a document that can be utilized for planning, executing, monitoring and communicating the delivery of the project scope to all the key stakeholders as well as to the workforce (Matavire et al., 2010).

The main aim of a project schedule in ICT projects is to represent the plan to deliver the project scope at a pre-determined time period. In consists of work elements that have the associated scheduled dates of when certain phases and milestones will be achieved (Weiss and Anderson, 2004). Apart from guiding the implementation process, the project schedule helps to communicate to the stakeholders the work elements and their expected completion dates or time periods. Furthermore, it is also a tool that helps to link the work elements to the resources (Matavire et al., 2010). Usually a project schedule consists of the start date, all work elements, milestones to be achieved, planned start and end date of the activities, and resource assignment. In the absence of such a project schedule, there tends to be much mismanagement, which is reflected as inadequate project management, thus hindering the implementation process of ICT projects (Matavire et al., 2010).

2.2.5 Technology and Hardware Risk Factors

Even after developing the important technology for ICT projects, there remains a huge gap between its applications. It has been observed that often the managers who manage the technological change must also serve as the implementer. In a usual scenario, a technical company develops the required technology and hands it over to the other organization, which may not have the right technological knowledge, but which is aware of the technology and its implementation (Skryabin et al., 2015). However, in practice, the user organization is often not able to comprehend the technology and there is a lack of correct communication. Thus, ideally the implementation manager must study the technology and its application before the handover to ensure a smooth transition (Meijer, 2015).

It is vital that a marketing perspective be adopted by implementation managers in order to identify the product and the user requirements along with preparing the user organization to receive the technology. It has been suggested by many researchers that it is advisable to involve users at the design phase itself as it helps to understand the product better, helps in its implementation and ensures a seamless transition while also boosting user satisfaction (Loukis et al., 2016). Having a tight communication loop allows users to provide the necessary feedback prior to the implementation process.

Many implementation efforts are unsuccessful in the case of ICT projects because the scope is underestimated and there is little or no preparation to receive the technology. According to Gichoya (2005), while the top management pours in all the resources to procure the best ICT technologies with the aim of improving processes, there is little resource addition in the case of implementation. In the opinion of Tearle (2003) and Yaacob et al. (2014), it is imperative that, for successful implementation, heavy investment should be made not just to procure the technology but also to train the user organization’s workforce regarding the right application techniques. Alkalbani et al. (2013) suggest that implementation managers must develop an iterative framework that will guide important decisions regarding how and from where information must be taken from those groups which will be affected by the new ICT technologies. In order to ensure information gathering is effective, Yaacob et al. (2014) suggest an effective framework routine:

- Observation of the current job routine: Frequent visits by the system engineer to the worksite, interviewing 10 employees each time to learn about their work operations.
- Pay attention to those work routines where users need to make decisions, seek information, which jobs should run first.
- Gather information regarding what part of their work is frustrating or rewarding. For many it could be the processes or for some it may be the high amount of paperwork, while flexibility may be a rewarding point.
- Identify their dependency on other workers or operations. This will enable the dependency level to be gauged and efficiency to be improved.

This framework cycle in Figure 2.5 below will enable system engineers to understand the dependency of the workforce on variables, and thus enable the design of an ICT system that helps to solve the major problems.

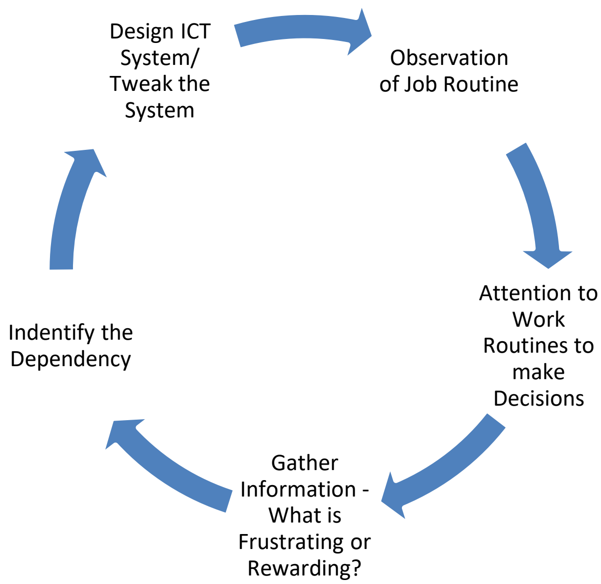

Figure 2.5: Framework Cycle for ICT System development

The transition to new technology can be challenging for organizations and therefore it is imperative that, prior to implementation, users are given the required training regarding the new technologies that are being introduced (Yaacob et al., 2014). Training helps in making an easy transition and readies the workforce for the new technology. Furthermore, it also helps to serve the customers better, thus ensuring customer satisfaction. Integration of new technologies with old technologies may be difficult to execute, but the absence of such an integration can result in ICT project implementation failure (Alkalbani et al., 2013).

2.2.6 Operational Risk Factors

Despite the robustness of ICT infrastructure, many networks tend to experience hardware and software downtimes and outages (Bekkers and Thaens, 2005). Some may last for a few hours while some may cause the shutting down of business activities for a day. This leads to mounting losses for the organization. While the IT department tries to deal with the downtime, it is the business organization that has to face the consequences (Bekkers and Thaens, 2005). These consequences may be loss of revenue, reputation damage and loss of productivity. According to Touray, Salminen and Mursu (2013), unplanned outages are majorly caused by ill-planned changes implemented prematurely in the organization. Additionally, misconfiguration caused due to reduced knowledge also leads to performance errors. Manual configuration errors can also lead to increased losses to the organization. This also leads to organizations having to spend a high percentage on application maintenance (Meijer, 2015). It is therefore necessary to address these configuration errors in order to negate the chance of ICT project implementation failure.

In Meijer's (2015) opinion, it is the responsibility of the implementation manager and the IT director and IT manager to solve issues relating to unplanned outages. While it is difficult to achieve 0% of downtime, minimizing the downtime is important since downtime largely results in cost overruns (Bekkers and Thaens, 2005). Additionally it also results in loss of customers and loyalty, employee time diverted from important tasks at hand to other IT-related tasks to get the system running again, overtime, lost data and emergency restoration fees. All these are added costs which the organization has to incur when operational factors cause downtime and outages. It also impacts significantly on the employees' productivity.

ICT infrastructures are even prone to instability due to disruptions or failing components (Shackleton et al., 2004). Rectifying the same would be complex due to issues regarding the availability of the old components. Furthermore, security vulnerabilities are profound when the systems are old or are unsupported by the vendors, which means that the components are no longer receiving the updated bug fixes and security patches (Kaba et al., 2014). Thus, such a system may not be apt for ICT infrastructure implementation. It is therefore suggested that the ICT infrastructure constitutes components that are not just up to date but are also effective in maintaining the security feature of the organization Meijer (2015).

ICT systems need to be connected to other systems which are already in operation. However, compatibility issues tend to crop up between systems while operations take a backseat (Shackleton et al., 2004). In a governmental ICT project, many organizations are involved and thus compatibility between all the networks proves to be especially challenging.

It is vital that the organization enlists the help of outside organizations to maintain and operate the ICT projects so that, if the system goes down, the professionals from the third-party organizations can provide resolutions quickly (Shackleton et al., 2004). High service levels are provided by experts who are able to identify the network and system issues quickly and are able to provide the necessary solutions. Third-party organizations also provide infrastructure monitoring and reporting services, which helps the organization to achieve high availability, credibility and reliability along with data security (Camarinha-Matos, Afsarmanesh, and Ollus, 2008). It is due to this reason that researchers such as Qader, Hassan and Saeed (2017) suggest enlisting such third-party organizations for operations maintenance of ICT projects. Some of the benefits associated with employing third-party service management contracts include (Camarinha-Matos, Afsarmanesh, and Ollus, 2008):

- Shorter maintenance periods.
- Operations working 24/7.
- Reduced pressure on the organization’s IT department.
- Lower operating costs.
- Financial resources being used efficiently for IT services.
- Clear ICT infrastructure that can be operated by the workforce easily.

Feasibility studies are an important part of ICT project implementation since transitioning from ICT policy to practical action can be complex and challenging (Bhatnagar, 2004). Keynote projects are usually multi-faceted and therefore any discrepancies may cause delay in the delivery of core policy aims. Furthermore, often, the ICT policy itself might require a detailed modification so that it can accommodate the regulatory and technical demands (Bekkers and Thaens, 2005).

Researchers therefore suggest undertaking an effective feasibility study before putting in resources for the adoption and implementation of ICT projects.

An ICT feasibility study will enable investment to be secured easily and also identify those issues which can pose major threats. In order to ensure that the operations are not halted, it is advisable to enlist the help of experts with extensive experience to conduct an ICT feasibility study of the organization (Bhatnagar, 2004. Such companies tend to appraise the project from various perspectives which include regulatory, economic and technical aspects. After appraisal, appropriate examples of best practice can be suggested that comply with the industry standards and regulatory standards. Based on the study, a roadmap can be created that ensures that the project is able to meet the targets.

Operation-related barriers can cause major delays in ICT implementation as well as adoption. In the context of UAE government projects, such delays can cause major losses in terms of data and time. When operations come under disruptions, the workforce is forced to seek solutions that cause unnecessary delays in processing vital procedures related to residents and visitors. This also leads to mistrust and a general negative attitude towards the functioning of the governmental departments. Therefore, it becomes imperative to enlist the help of third-party organizations who major in the maintenance if such ICT infrastructures. IT will be beneficial to the organization in the ways discussed above.

2.2.7 People and Management Risk Factors

In the past few years, the role of ICT has changed dramatically from being a back-office, support system to becoming a key function and the driving force of an organization. In order to achieve the goals and missions, it has become a strategic tool. Since ICT is responsible for managing transactions and achieving organizational goals by making use of the resources responsibly, organizations are becoming highly dependent on ICT projects.

Even in the public sector in the UAE, organizations are utilizing ICT projects to manage the various government procedures effectively while offering best services to the residents. Successful adoption and implementation of ICT projects is highly dependent on top management's capabilities and abilities. ICT governance, a subset of ICT infrastructure, is defined as the responsibility of the top management and it consists of the processes, structures and organizational structures needed to ensure that the organization's ICT is able to sustain during challenging situations and is an extension of the objectives and strategies of the organization (Nijkamp and Cohen-Blankshtain, 2013).

It is therefore important to formulate a valid ICT management framework that throws light on how decisions are made, the main people responsible for input, who is accountable for the ICT implementation process and how co-ordination is achieved with respect to ICT activities to ensure that the stakeholders have taken in the correct roles and responsibilities to manage the organization's resources and ICT activities (Balocco, Ciappini, and Rangone, 2013; De Vries, 2011). ICT governance, according to Balocco, Ciappini and Rangone (2013), is pivotal in providing the right direction for ICT endeavours and for ensuring that the ICT projects within the organization are able to meet the vital objectives:

- Alignment with the critical organizational mandate and objectives.
- Enabling the organization to identify opportunities and increase benefits.
- Using ICT resources responsibly.
- Appropriate management of ICT project-related risks.
- Better coherence with ICT project management methodologies and ICT systems.

ICT governance is thus an important factor that helps to generate business value from ICT infrastructures (Nijkamp and Cohen-Blankshtain, 2013). Furthermore, it is also a critical factor for the successful adoption and implementation of ICT projects as it ensures that there is alignment between ICT and the organization's resources, people factor, mandates and strategies (De Vries, 2011). Therefore, it is vital that the ICT governance mechanism should confirm that ICT strategies and direction are driven by business so that alignment of ICT projects with the business needs of the organization can be ensured. There are three important aspects of ICT governance (Bin-Abbas and Bakry, 2014):

- The right decisions to ensure appropriate use and management of ICT projects and systems at the organization.
- People responsible for taking these decisions.
- The manner in which these decisions will be implemented as well as monitored.

The central entity that executes the ICT governance framework is the top management, leaders and the business managers who provide the necessary guidance and direction regarding the implementation, adoption and application of ICT systems at an organization-wide level (De Vries, 2011). The top management is often supported by a technical committee that provides the necessary technical assistance and advice. Apart from these two major participants, the ICT governance committee also includes several task forces for the major ICT programs (Bin-Abbas and Bakry, 2014). Steering committees, work groups and project teams are all part of the ICT governance framework and are the people component that enables the smooth functioning of the ICT networks (Nijkamp and Cohen-Blankshtain, 2013).

Furthermore, along with these entities, many governmental organizations establish independent governance structures and committees for major, large-scale ICT projects. It is important to note that the corporate strategy of the organization forms an important part of the ICT governance framework (Bin-Abbas and Bakry, 2014). The ICT governance committee is an integral part of an organization that aims to implement and adopt the ICT networks accurately (Nijkamp and Cohen-Blankshtain, 2013). Given the rapidly changing technologies, and rising complexities of operating systems, it can be assumed that any decision has an ICT component. It is the duty of the ICT governance committee to not just ensure that the ICT elements are taken into consideration while taking any major decision but also to ensure close alignment of ICT with business (De Vries, 2011). It is imperative to raise awareness regarding ICT as an asset and an important tool for cost-effectiveness. This can be achieved only when an ICT governance structure is present: a forum where business managers are able to discuss their ICT requirements. Thus, an ICT governance committee is a useful vehicle for leveraging the ICT profile of an organization.

Ab Razak and Zakaria (2015) are of the opinion that there exist many inefficiencies in ICT governance committees. These include:

- Meetings not conducted regularly.
- Not all members participate in the meetings and usually other people are representing the elected members.
- Documentation is not strong as many documents do not contain vital information that was discussed in the meetings.

It is extremely important that there is effective communication between the members of the organization and ICT implementers, which includes the top management and the ICT governance committee members. This is vital if an organization is looking to tap into the full potentials of ICT. However, according to Bin-Abbas and Bakry (2014), such communication is severely lacking and inadequate. It has been noted that many within the workforce find it difficult to communicate with ICT technologies. Therefore, there is no alignment between the ICT projects, business communication and the workforce. This is one of the biggest risk factors affecting the implementation of ICT networks. Loukis et al. (2016) state that close communication and cooperation is a vital prerequisite of ICT project implementation, wherein there is input from business as well as ICT systems. This will enable a better flow of information, which is a critical success factor for ICT implementation.

Another vital aspect for the success of ICT implementation is information and data sharing (De Vries, 2011). It is vital that the ICT implementers, ICT governance committee and other top management personnel share vital information and data (Loukis et al., 2016). In the absence of such sharing, workforces are not able to fulfil their mandates, leading to difficulties in the adoption and implementation of ICT projects. It has been suggested by Loukis et al. (2016) that organizations should develop easy information and data sharing channels in order to ensure that all the important committees and personnel are on the same page, with the same agenda with respect to ICT project adoption and implementation.

In the absence of the above-discussed ICT governance framework, organizations lose direction with respect to the ICT implementation process, which leads to many complications such as misalignment of the project with the organization’s standards and policies, failure to achieve compatibility with the strategic business and IT direction of the organization, and mismanagement of organizational changes (De Vries, 2011). It is therefore imperative that, prior to their adoption and implementation, a valid ICT governance structure is formulated that is responsible for the accurate implementation of ICT systems. In this regard, researchers Balocco, Ciappini and Rangone (2013) along with Ab Razak and Zakaria (2015) offer the following recommendations, based on best practices, that will help in enhancing the effectiveness as well as efficiency of ICT governance:

- The executive heads of the organization must ensure that the ICT governance committee is comprised of the top management, business managers of the major departments. It should be chaired by an executive manager.
- The executive heads of the organization must ensure that the ICT governance committee convenes meetings regularly with full participation from the members along with adequate documentation in order to make use of the committee's work.
- The executive heads of the organization must ensure that the ICT governance committee's work and performance is reviewed regularly to ensure that all the grievances are being addressed.

After examining the factors that can lead to issues with the implementation of the ICT networks, it can be concluded that it is vital to study these factors in detail and ensure that they do not cause any hindrances. After the implementation process has been completed, it is imperative that ICT implementers and the top management take note of all these various factors and ensure that they do not pose any threat to the complete adoption of the ICT projects.

Factors	Description	Source
Planning and Development Risk Factors	• These factors relate to the risks that are associated with the initializing, planning, developing and implementing of ICT projects and their associated processes. In the case of ICT projects, it is extremely important that the project scope be well defined; this includes development of a common understanding regarding what should be included and what should be excluded from the project. It is imperative that all stakeholders have a good understanding of the scope of the project in order to be able to determine the budget and time frame. • While the ICT strategy may be in place, the absence of the right programs and process will not allow the strategy to be implemented successfully. • Human resource is an integral part of any organization and its management is concerned with the hiring,	

	compensating and performance management of the workforce. The success of any ICT project is based on the technology and the people component. Thus, it becomes essential to manage this component competently so that the implementation of ICT is smooth. • For the repeated and continuous application of technical specification, standards are developed. These standards are approved by a recognized national or international standardization body. Standards can be considered as a key tool in identifying the best products and services and enabling interoperability.	
Technology and Hardware Risk Factors	• Even after developing the important technology for an ICT project, there remains a huge gap between its applications. It has been observed that often the managers who manage the technological change must also serve as the implementer. • Many implementation efforts are unsuccessful in the case of ICT projects because the scope is underestimated and there is little or no preparation to receive the technology. While the top management pours in all the resources to procure the best ICT technologies with the aim of improving processes, there is little resource addition in the case of implementation.	Gichoya (2005)
Operational Risk Factors	• Despite the robustness of ICT infrastructure, many networks tend to experience hardware and software downtimes and outages. This leads to mounting losses for the organization. While the IT department tries to deal with the downtime, it is the business organization that has to face the consequences. These consequences may be loss of revenue, reputation damage and loss of productivity.	Touray, Salminen and Mursu (2013)

	• Unplanned outages are majorly caused by ill-planned changes implemented prematurely in the organization. Additionally, misconfiguration caused due to reduced knowledge also leads to performance errors.	
People and Management Risk Factors	• Successful adoption and implementation of ICT projects is highly dependent on top management's capabilities and abilities. ICT governance, a subset of ICT infrastructure, is defined as the responsibility of the top management and it consists of the processes, structures and organizational structures needed to ensure that the organization's ICT is able to sustain during challenging situations and is an extension of the objectives and strategies of the organization. It is therefore important to formulate a valid ICT management framework that throws light on how decisions are made, the main people responsible for input, who is accountable for the ICT implementation process and how co-ordination is achieved with respect to ICT activities to ensure that the stakeholders have taken in the correct roles and responsibilities to manage the organization's resources and ICT activities. • The executive heads of the organization must ensure that the ICT governance committee is comprised of the top management, business managers of the major departments. It should be chaired by an executive manager. • The executive heads of the organization must ensure that the ICT governance committee convenes meetings regularly with full participation from the members along with adequate documentation in order to make use of the committee's work. • The executive heads of the organization must ensure that the ICT governance committee's work and	Nijkamp and Cohen-Blankshtain (2013); Balocco, Ciappini and Rangone (2013); Ab Razak and Zakaria (2015)

	performance is reviewed regularly to ensure that all the grievances are being addressed.	

Table 2.4: Major risk factors for ICT implementation

2.5 Cost Overruns in ICT Network Implementation

Cost overrun is defined as the amount by which the actual cost of a project exceeds the actual budget that was planned and estimated prior to the beginning of the project, after due diligence (Taylor, 2015). Cost overruns have plagued the ICT systems industry for a long time, even after acquiring in-depth knowledge about project management. Project management is based on three core principles also known as the Iron Triangle: schedule, cost and benefits. According to Anthopoulos et al. (2013), ICT projects tend to deviate by more than 10% from their original initial cost estimates. Academicians argue that Black Swan Blindness and Optimism Bias are two major causes of these overruns as they cause the forecasts to fall short of the actual costs that are associated with large-scale ICT projects (Ameh, Soyingbe,. and Odusami, 2010). Optimism bias is linked to the delusion wherein top management considers only the inside view and ignores the distributional information while undertaking vital decisions. In the case of Black Swan Blindness, decision makers ted to completely ignore the outside view while the vital decisions are entirely based on this outside view. It is due to these two major reasons that large ICT projects face cost over-runs, which often results in complete project failure (Nawi, Rahman, and Ibrahim, 2011). The researcher discusses the various reasons for ICT project delays and cost overruns in detail below:

- **Design Errors:** This is considered to be one of the most vital reasons for cost overrun in major ICT projects. According to Anthopoulos et al. (2013), the proper representation of the requirements of the organization and the blueprint for achieving the necessary technical input for the execution of the ICT projects are mapped out based on the project designs (Nawi, Rahman, and Ibrahim, 2011). Therefore, when there are design errors, it means there is wrong or insufficient demonstration of the project deliverables. This in turn leads to incorrect application of the techniques to achieve the desired results. However, when the actual execution phase takes place, the design errors come to the fore and the attempt to correct them at this stage leads to delays and cost overruns. Additionally, as pointed out by Calisir and Gumussoy (2005), project estimations are solely based on the project designs.

Thus, when there are errors in design, leading to omissions and misrepresentation, it means the project cost estimation also includes these omissions and this leads to extra work and changes in the implementation process, which leads to delays and cost overruns (Nasir and Sahibuddin, 2011). It is important to note that those designs which are produced without conducting an extensive investigation of the site usually have potential errors. It is because such designs which are produced without actual visits lead to additional work with revisions in the scope of work as well as contract revisions. This will thus have a severe effect on the project delivery time and cost. The usual cases of design errors as cited by researchers (Nawi, Rahman, and Ibrahim, 2011) include insufficient field investigation, error in acquiring the right specifications, design changes and plan errors. In order to control the project delay and cost overrun caused by design errors, it is advisable to involve personnel with professional technical skills to execute the job along with the necessary competent tools. Additionally, good communication with the design team is essential, as is integration of the design process with proper planning wherein sufficient time is provided to make necessary correction (Nasir, and Sahibuddin, 2011). There should also be extensive investigation and review of the design process. In the opinion of Anthopoulos et al. (2013), effective project planning and monitoring should be established that will help to increase the project performance. ICT implementers must conduct site visits and consider the site conditions to develop the best, most cost-effective ICT project design options.

- **Scope Change:** Researchers have also identified that delay and cost overrun may be caused due to scope change. As discussed earlier in the chapter, scope is the term that defines the deliverables of the project. Therefore, it can be said that project plans, schedules, estimations, quality and base lines are designed according to the project scope (Othman, Zain, and Hamdan, 2010). When there are any changes in the project scope at the time of execution, the project plan that was developed initially has to be reviewed and re-developed with concentration on the budget, quality and schedule. This in turn leads to delays and more resources being required than in the initial plan. Nasir and Sahibuddin (2011) note that, with each scope change, there is increasing pressure on the ICT project budget and schedule. The reason for such project scope change may be due to incorrect initial scope definition, inherent risks, uncertainties, change project funding and change of interest. Such changes lead to change in ICT project deliverables. It has also been noted by Ameh, Soyingbe and Odusami (2010) that poor scope management may also lead to disputes amongst the various parties involved in the implementation process. This in turn causes delays and cost overruns. In order to establish control over scope management, it is important to identify the fact that change is inevitable in the adoption process of ICT systems and that this change is a necessity for the overall success of the project. Therefore, as stated by Othman, Zain and Hamdan, (2010), the most important step to take is to integrate a proper change management plan which includes a proactive approach towards change. This approach can be adopted by means of involving the project stakeholders and ensuring the incorporation of their needs during the lifecycle of the project. It is advisable to identify the key success factors during the planning phase itself and establish the KPIs by formulating important milestones which will help to measure the success of the project scope implementation. In order to avoid any disputes, it is advisable to seek approval for project changes from stakeholders and sponsors and communicate the changes that are being implemented in a timely manner. In the case of highly evolving changes in a project, it is best to freeze the scope so that the focus is on expected deliverables (Othman, Zain, and Hamdan, 2010).

- **Inadequate and Improper Procurement:** This is one of the other major reasons for cost overruns and delays in ICT projects. Furthermore, to add to this factor is the faulty contractual management system that causes delays and cost overruns. Contracts are an important part of ICT projects as they specify all aspects of business correlation, which includes the pricing, payment terms and service agreements (Nasir, and Sahibuddin, 2011). Thus, when a contract does not highlight the project scope, it can lead to disputes. To give an example, if the initial contract does not specify the important aspects of project work, it could lead to long and winding negotiations and often mitigation in order to accommodate the work changes and develop new contractual agreements with revised budgets as well as schedules. This therefore leads to project delays as well as cost overruns. Similarly, if the contractual agreement is ambiguous in nature, and the clauses are unclear, it can cause potential disputes, which may generate delays and cost overruns. the majority of ICT projects are executed by third-party contractors and therefore it is important to note that, for the successful completion of an ICT project's adoption and implementation process, accurate procurement and process along with contract management are required. When contractors are selected poorly for governmental ICT projects based on low bids, they may not have the technical know-how to handle huge ICT projects, which may inevitably lead to cost overruns, inferior quality of work execution and schedule delays. The final result may not be acceptable and thus a redo from better contractors may be required, leading to increased costing. Othman, Zain and Hamdan, (2010) also point out that a contract management system with those clients who have a delayed payment structure could lead to delays and cost overruns. In order to solve such problems, it is advisable to firstly identify trustable contractors using an ethical tender system while also drawing upon a suitable contract type which is applicable to the project conditions (Nawi, Rahman, and Ibrahim, 2011). Furthermore, Calisir and Gumussoy (2005) also suggest explicitly defining the terms and conditions that will govern the contract. These clauses must mention the penalties that will be incurred upon delays and cost overruns and which party will be held responsible for the same. Similarly, it is also essential to specifically state any important clauses that may cause future disputes in a clear and unambiguous manner. Researchers suggest avoiding the use of generic contract terms and carefully considering all aspects of the project with respect to what may happen during operations. This will help to safeguard the organization from delays and cost overruns, and demonstrate effective contract management (Nawi, Rahman, and Ibrahim, 2011).

- **Project Complexity:** It has been noted by experts that project complexity can also be a major factor which may cause delay and cost overrun. Complexity can be defined in terms of the size of the ICT project as mega ICT projects tend to have long implementation periods (Nawi, Rahman, and Ibrahim, 2011). Thus, such long periods may be affected by inflation, material price changes and changes in exchange rates. This may cause cost overruns and long periods of negotiations, leading to project delays. As pointed out by Nasir and Sahibuddin (2011), those projects which have a high degree of complexity also have complex execution schedules, plans and estimates. This may also cause change orders when certain aspects of project plans and estimates that may not be important are not omitted. On the other hand, Calisir and Gumussoy (2005) define project complexity in terms of stakeholder diversity wherein everyone has different interests as well as requirements, which leads to a long chain of communication and slow feedback loops. Therefore, when their interests are integrated, it results in many resources being spent and, when overlooked, it further causes disputes and conflicts, which affects the project implementation process and ultimately causes delays and cost overruns. In order to eliminate such delays as well as cost overruns caused by project complexity, it is important that organizations and ICT implementers conduct vigorous planning wherein all important aspects of the project are incorporated (Calisir and Gumussoy, 2005). These include: scope, detailed deliverables, milestones, stakeholders, methodology that is to be used and delivery time. In the opinion of Calisir and Gumussoy (2005), in order to manage complex ICT projects, experience and expertise along with exposure are needed. This will keep the project on track; thus building of a competent team to execute the project is of paramount importance.

- **Closure-Post Execution Phase:** It is during this phase that potential factors may lead to delays and cost overruns. The last part of the project lifecycle is often ignored by organizations, especially those organizations with a multi-project environment (Nasir, and Sahibuddin, 2011). A slow closure is often seen as dragging of the handover activities due to disputes linked to acceptance by client, procurement and contracts, issues related to change orders not resolved, final change orders not executed, closeout accounts not accurate and poor documentation of the work phases (Anthopoulos et al., 2013). All this causes unexpected delay and in many cases stray charges are levied. Delay in payment to contractors and suppliers after the project has been completed may lead to disputes and signing of the final completion certificate for the ICT project. The delay and cost overrun of a slow closeout can be avoided if there is proper implementation of the project closure phase. Some of the important aspects or phases of project completion include (Othman, Zain, and Hamdan, 2010):

    1. Completion: Make sure that the project is completed 100% so that it can help to avoid any disputes as well as payment delays.

2. Documentation: It is important to have detailed documentation so that it can help to avoid any future changes and, if necessary, few efforts are required to execute the changes.
3. Project system closure: This is in terms of closing the financial systems including payment to sub-contractors and work termination payments.
4. Project review: This is important for the transfer of tangible knowledge to practical knowledge with respect to cost and time.
5. To avoid cost overruns and extra overheads, it is advisable to disband the project team members as soon as possible.
6. Stakeholder satisfaction: Provide the stakeholders with all the important information that they need. This will help to avoid any conflict and doubt. This may include a timeline that shows the progress of the project, the milestones that are achieved and the problems that were faced as well as an overview of the financial spending.

In conclusion, it can be stated that, while delay and cost overrun are inherent issues of all major ICT projects, they can be controlled and reduced by making use of proper project performance monitoring and control systems which help to integrate the key activities of the various project phases. The design of this system could be a closed-loop feedback system along with a feed-forward system that is integrated right from the beginning phase to the close out of the project. Implementing this cycle can be extremely advantageous since proper planning combined with measuring, monitoring and taking corrective steps are all a part of the control cycle. The integration of additional factors with these factors will help ICT implementers in gaining a better understanding of the issues. It is imperative for the top management team to clearly define the management success criteria and product success so that the workforce has a clear understanding of the objectives. The risk factors that have been discussed above should be reviewed by ICT implementers and the ICT governance committee so that such factors may be avoided and an integrated approach can be established towards the achievement of ICT project implementation goals.

All the above factors lead to a common result, which is project delays and cost overrun. As explained earlier, when a project undergoes delay it leads to additional costs. When all these additional costs are calculated in the end, it leads to major cost-overruns which have a direct impact on the manner in which the ICT project is implemented. The above factors also present an association with the risk factors as grouped into four sections previously. Thus, these cost overrun factors lead to risks which result in difficulty in adoption and implementation of the ICT infrastructure.

Factor	Description	Sources
Design Errors	This is considered to be one of the most vital reasons for cost overrun in major ICT projects. The proper representation of the requirements of the organization and the blueprint for achieving the necessary technical input for the execution of the ICT projects are mapped out based on the project designs. Therefore, when there are design errors, it means there is wrong or insufficient demonstration of the project deliverables. This in turn leads to incorrect application of the techniques to achieve the desired results. However, when the actual execution phase takes place, the design errors come to the fore and the attempt to correct them at this stage leads to delays and cost overruns.	Othman, Zain and Hamdan (2010)
Scope Change	Delay and cost overrun may be caused due to scope change. Project plans, schedules, estimations, quality and base lines are designed according to the project scope. Therefore, when there are any changes in the project scope at the time of execution, the project plan that was developed initially has to be reviewed again and re-developed with concentration on the budget, quality and schedule. This in turn leads to delays and more resources required than the initial plan.	Calisir and Gumussoy (2005)
Inadequate and Improper Procurement	This is one of the other major reasons for cost overruns and delays in ICT projects. Furthermore, to add to this factor is the faulty contractual management system that causes delays and cost overruns. Contracts are an important part of ICT projects as they specify all aspects of business correlation, which includes the pricing, payment terms and	Nawi, Rahman, and Ibrahim (2011)

	service agreements. Thus, when a contract does not highlight the project scope, it can lead to disputes.	
Project Complexity	Project Complexity can be defined in terms of the size of the ICT project as mega ICT projects tend to have long implementation periods. Thus, such long periods may be affected by inflation, material price changes and changes in exchange rates. This may cause cost overruns and long periods of negotiations, leading to project delays.	Nasir and Sahibuddin (2011)
Closure-Post Execution Phase	The last part of the project lifecycle is often ignored by the organizations, especially in those organizations which have a multi-project environment. A slow closure is often seen as dragging out of the handover activities due to disputes linked to acceptance by client, procurement and contracts, issues related to change orders not resolved, final change orders not executed, closeout accounts not accurate and poor documentation of the work phases. All this causes unexpected delay and, in many cases, stray charges are levied.	Nasir and Sahibuddin (2011)

Table 2.5: Risk factors

2.6 Leadership in ICT Network Development

Nations across the globe are spending a high number of resources on ICT systems. This is mainly fuelled by the need to grow and to gain a global competitive edge. In a technology-driven age, national leaders and ICT implementers are facing the challenge of harnessing information technology for management of domestic processes, improving the governance structure for the advancement of social justice and re-positioning the national economies to compete globally. This is mainly due to the growing awareness of ICT and its ability for use in developmental strategies. However, researchers have noticed a severe lag in investments in leadership and implementation capabilities. According to Gupta, Dasgupta and Gupta, (2008), this gap can cause severe consequences such as failure in ICT implementation and integration, poor development and high transaction costs, and unsustainable growth of the promising technological markets. E-leadership, according to Gichoya (2005), is a key role in the integration of an economy into the knowledge economies across the globe. Thus, in order to leapfrog into the knowledge economy, there is a need to bring about fundamental changes in the leadership practices. However, while such change is extremely important, it has been observed that it is rather slow or negligible, mainly because of the political leader's limited understanding of the opportunities that are presented by the ICT revolution (Naidoo, 2013).

E-leaders are required to influence the ongoing technological revolution so that they can build competitive knowledge economies within the global market-driven economy that is prevalent today (Gupta, Dasgupta, and Gupta, 2008). In order to bring about this change, it is necessary that leaders have a broad understanding about the different forces driving societal, economic and technological change. Furthermore, there is a need to develop frameworks and skills to act upon the acquired understanding so that it does not just mobilize the leader but also others. Unless concentrated efforts are made to transform leadership into e-leadership, the amount of money spent on the adoption, implementation and integration of ICT systems and networks is likely to be wasted.

2.6.1 New Leaders

In the opinion of Naidoo (2013), new types of leaders are the present necessity in order to operate efficiently in the e-world and to bridge the gap that exists between the public policy makers and the information technology managers. The new leaders must have a clear understanding of their role, the cross-cutting nature of ICT systems and the manner in which transforming into an e-government by making use of ICT systems could be beneficial to the public sector as a whole. Furthermore, there is also a need for e-leaders to integrate the ICT-developed strategies into the efforts for national development.

To fulfil the requirements of an ICT-enabled nation, diverse types of leaders are required. These include (Gupta, Dasgupta, and Gupta, 2008):

- Leaders who are able to function effectively in an ICT projected system.
- Leaders who develop frameworks for ICT integration, co-ordinate ICT-backed programs and address the growing digital divide.

- Leaders who are able to design and manage ICT processes, integrating them into specific businesses, organizations, departments and sectors.

In order to fulfil the need to become an ICT-enabled nation, a national strategy has to be formulated. This strategy is a guide to the policies, implementation mechanism and investment on how to develop ICT in order to achieve the developmental and progressive goals of the country (Naidoo, 2013). Such a national strategy is concentrated on the actions and resources of the various stakeholders, along with the government regarding the national ICT priorities. The strategy also explains the various interdependencies and the phases of those actions and investments. It also provides specifications regarding the manner in which institutions, personnel and the public will collaborate to share responsibilities and ensure ICT-enabled development of the nation.

There are key and interdependent elements in ICT development: an enabling policy along with the right institutional environment, an information structure that is affordable as well as competitive in nature, a dynamic ICT industry that is competitive, ICT literacy and education, an investment

programme that helps in the application of ICT into the modernization of the public sector, incentives for the use of ICT within the private sector for development and, lastly, empowerment of the civil society (Loukis et al., 2016).

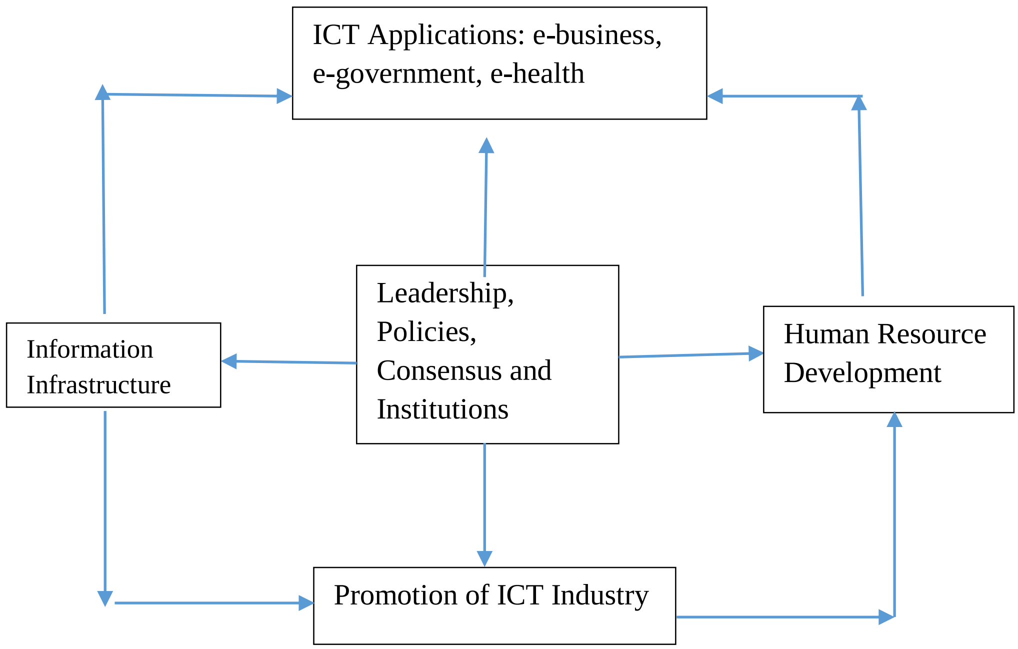

Figure 2.6: E-Development Framework

It is important to note that co-evaluation of the complementary components of the e-development framework is vital. According to Gupta, Dasgupta and Gupta, (2008), a holistic view of the e-development framework will address the importance of synergy between the various key elements of the framework. Collectively, the policies, institutions and investments which are the pillars of e-development should leverage the ICT for an overall social and economic development, while transforming into the knowledge economy. It is the new leaders who are the architects of this technology-driven, ICT-enabled development strategy. In time, it is imperative that e-leaders identify more synergy among the various components of the e-development framework, such as human resources, technological competencies and infrastructure, and their application in the e-government, e-health and e-business components.

2.6.2 Demand for New Leaders

Each sector and component of e-development requires e-leaders who are able to orchestrate efficiently the e-development initiative. Such leaders assume various roles which range from development of e-policies to ICT governance frameworks. They must also engage with local communities and organizations in order to identify the information and communication requirements for ICT applications.

There are many core competencies that e-leaders must possess, such as ICT application knowledge, understanding the potentials of ICT and the trends in order to develop their own leadership skills in the new world (Loukis et al., 2016). These competencies are also required to communicate the future development strategies and the results of development. This helps give the business leaders, strategy makers, policy makers and mainstream development strategists a better understanding. There exists a divide between the ICT specialists and development practitioners; this divide needs to be addressed and resolved. For this, it is imperative to gain the support and confidence of the business and political leaders while also inspiring the stakeholders who are a part of the development process.

In order to be able to secure a balanced e-development process, e-leaders require new competencies (Gupta, Dasgupta, and Gupta, 2008). E-leaders are responsible for the entire e-development process; however, this process is extremely dynamic and therefore it involves continuous learning and adaptation. Thus, it is imperative that e-leaders master the tools of measuring and benchmarking the e-readiness of the economy, establishing as well as implementing the ICT governance frameworks and designing schemes for private-public partnerships, developing coalitions for regulatory frameworks and legal policies.

It is advisable to enlist the involvement of younger leaders who have technical know-how of the manner in which technology can be leveraged to benefit the governmental organization. Technology is becoming increasingly complex and therefore it is also vital that the leaders constantly update their technical knowledge. It can be assumed that the younger generation of leaders are able to keep up with the changing scenario of technology and therefore they may be able to implement the necessary changes to the ICT projects when required.

It can thus be concluded that the UAE requires e-leaders as it aspires to become ICT reliant. Implementation of ICT requires technical know-how along with the correct vision for the future as it will lead the nation to progress more. It is thus important that e-leadership be encouraged in the nation, as a preparation for the implementation of ICT projects in the governmental organizations.

2.7 E-readiness of the UAE

For the purpose of this study, e-readiness is referred to as the ability of the government to assimilate the ICT technologies that are being implemented and take advantages of these technologies for enhancing as well as improving the administrative functions of the departments. There are several components of e-readiness, which include human resources, infrastructure, legal and policy framework, and telecommunications (Bui, Sankaran, and Sebastian, 2003). To conduct an assessment of the e-readiness of the UAE, the following aspects must be considered:

- The data systems infrastructure of the government.
- Legal infrastructure of the government.
- Institutional infrastructure of the government: This includes the standardization of the various means of communication as well as technology that is being utilized by the departments.
- Human infrastructure.
- Technological infrastructure.
- Leadership and strategic thinking readiness: This includes the short- and long-term plans of the governmental personnel.

In this manner, e-readiness assessment can be utilized as an information-gathering instrument by the government as it plans for the implementation of ICT projects. This will also help the project team in gaining a better idea of the impediments to the adoption and implementation of ICT projects, based on which it can be determined what initiatives need to be taken to overcome these impediments.

It is therefore critical to analyze the e-readiness of the UAE in order to gauge whether it will be able to undertake the technological changes that are a part of ICT project implementation. Previous cases of African countries have depicted that, since the nations did not have the required technical know-how and the leaders did not have the skills to execute the important ICT implementation processes, this led to failures and therefore it is important that the UAE gauges its e-readiness before the implementation of ICT projects.

2.7.1 ICT Implementation in the UAE

The UAE's government, in the recent past, has made considerable capital investments for the implementation and installation of ICT frameworks. Mutual partnerships between the government and project developers have been formed in order to ensure that investment-funding activities materialize as per expectations. In the case of ICT-centric investments, a majority of these have been fulfilled with the help of funding from overseas. With respect to the government's inputs, it mainly accomplishes support and technical needs and requirements – such as providing manpower and setting-up facilities such as buildings.

To date, the UAE's Communication and Information Technology vertical continues to helm and execute responsibilities pertaining to modernizing the country's technological advancements, adaption and adoption. All of the UAE's federal ministries have been reaping the benefits of the e-government culture that continues be one of the cores of the country's technological vision and strategy. The government is proactively developing and implementing new systems of technology so that the country's federal bodies are independent yet technologically well integrated with the country's government's plans, strategies, and actions.

Although similar attributes have come to underline many developing nations, in the case of the UAE there also exist a host of different obstacles that are known to hamper or interfere with the possibility of ICT projects being implemented successfully in the country. The following traits underline the UAE's ICT scenario:

- Initially, most of the ICT projects are commenced with the help of funds acquired from different donors.

- In some cases, a handful of donations come through without pertinent analysis and consultation by the concerned organization.

- The government looks after the operational costs incurred. When the project comes to a close, capital and human resources also need to end at the same time.

- Budget allocation for ICT projects has been observed to be insufficient; budget requirements continue to escalate nonetheless.

- In terms of investment direction, there appears to be an absence of appropriate policy framework for the same. As a result of the rampant disorganization, the same ICT product is at the receiving end of multiple funding

- Instead of concentrating on developing ICT applications that provide processing and distribution support in and out of governmental bodies, there is heavy support for conventional ICT applications – ones that mainly take care of functional and administrative activities and transactions.

- Imbalance in availability and allocation of ICT resources.

The trend of lacklustre project planning and management in companies is attributed to mainly three reasons in particular: risk management had not been attended to and carried out thoroughly, lapses in business systems occurred as they had not been legitimated, and full management participation was absent (Mimbi and Bankole, 2016). Having identified these reasons, it is also necessarily important to mention that these are merely the primary reasons – they are not the only ones. The varied nature of implementation environments is responsible for this. Moreover, Bannister and Remenyi (2000, p.1) have also pointed out that, at the time of taking intricate decisions, managers were observed to think unconventionally, outside of the pre-set traditional norms of sensible decision making.

Researchers noticed that managers' decision-making tendencies were pillared on either acts of faith, gut instinct or blind faith (also known as strategic insight) (Anderson et al. 2015). Harindranath (1993) cited that, even though developing countries can allocate considerable resources for ICT development and implementation, in order to extract maximum gains for it, meticulous planning and coordination need to be executed before putting the plan into action. Also, it is advisable that trial and error methods are not used, as these would trigger scarcity and wastage of valuable project resources.

2.8 Conclusion

This chapter has reviewed the expansive literature to identify the various aspects of ICT project implementation in the UAE. Apart from defining what it means, the researcher was able to identify whether or not the nation is ready to take on the new technologies which form a part of the ICT projects. E-readiness is therefore an important component that tests whether the nation is geared towards ICT project implementation in the public sector. It has been observed that the UAE has always strived to stay at pace with the technological changes across the globe. Thus, e-readiness is a factor that is vital while considering the implementation of ICT projects.

In the later part of the literature review, it became possible to identify the various benefits associated with the implementation of ICT projects. This knowledge can be utilized to help implementers decide whether or not ICT implementation in governmental departments can be beneficial for the economy. In this research, the emphasis is on ensuring to utilize literature from varied sources to reinforce the benefits of ICT project implementation. However, while there are many benefits of implementing ICT projects, there are also certain risk factors and barriers which may cause difficulty in the adoption of the ICT projects.

An in-depth analysis of the various factors that act as barriers and cause difficulty in the adoption and implementation process has been carried out. For the ease of the study, these factors have been divided into four main categories, namely: Planning and Development, People and Management, Operations, and Technology and Hardware. It was noted that the implementation and integration of the ICT projects is extremely complex and therefore there are many barriers which may make complete adoption of the networks difficult. In the case of such incomplete adoption, the nation may incur losses and wastage of time. It is therefore extremely vital that the discussed factors are dwelled upon further and applied in the context of the UAE.

Many reasons are associated with delayed project implementation and cost overruns. In order to identify these factors, it is vital to find the various reasons for delay first since it is the delay in a project which ultimately results in the cost overrun. Design Errors, Scope Change, Inadequate and Improper Procurement, Project Complexity and Closure-Post Execution Phase were identified as some of the major factors that cause delays in ICT project implementation as well as cost overruns. When there are project delays, this invariably results in resource wastage and thus cost overruns. Such cost overruns sometimes lead to inadequate or improper implementation of the ICT projects. Thus, it is imperative for the leaders and top-management to identify and address such project delay and cost overrun factors.

It was also possible to identify that top management is one of the main entities that is responsible for the accurate and inclusive implementation of ICT projects. Top management is responsible for reviewing the various processes that go into the adoption and implementation of ICT projects. Furthermore, after the implementation process takes place, it is the duty of the top management along with the ICT governance committee, which constitutes business managers, seniors and working committee members, to continuously review and document the progress. In the case of any discrepancies, it is up to the top management to initiate the required action. Therefore, in the opinion of the researcher, it is extremely vital that the top management comprises new leaders, implementers and business managers who will be responsible for many areas of adoption, implementation and integration of ICT projects in the sphere of UAE governmental departments.

Since ICT technologies are a part of the new world, which is technology driven, it is imperative that the leaders of such ICT-adopting nations are also well aware of these technologies and have the competencies to address the rapidly changing scenario of a technology-based knowledge economy. Thus, this chapter also addressed the need for new e-leaders who are equipped with the important knowledge and competencies for a technologically advanced nation. The UAE must ensure that it encourages new leadership which will address the constantly changing scenario of a technology-driven nation. The findings that have emerged from this literature review have enabled the researcher to identify the important factors that have impeded the adoption and implementation of ICT projects in the UAE. The aim is to develop a conceptual framework that will address these factors in detail. The developed framework can be utilized by the government while adopting and implementing the ICT projects so that there are no barriers to the ICT implementation process. It is the aim of this research to develop this framework that may be utilized by future implementers and policy makers in the UAE. The next chapter is the methodology chapter, which will address the research strategy, research paradigm and research methodology that is being adopted for this research.

3 CONCEPTUAL FRAMEWORK

3.1 Introduction

The aim of this chapter is to develop a conceptual framework for identifying the risk factors in ICT network development, adoption and implementation in the UAE. The framework consists of four main categories: Planning and Development, People and Management, Operations, and Technology and Hardware. Major risk factors are listed under each of these categories and, based on the same, the conceptual framework will suggest the ways in which these factors can be dealt with during the adoption and implementation of ICT networks in the UAE. In this chapter a conceptual framework will be developed on the previously identified risk factors and provide the perceived solutions. A taxonomy of these factors and their characteristics is also provided

The presented facts will help in justifying the development of the conceptual framework. However, it is vital to test the conceptual model and validate it as there is not much literature available on ICT network implementation, especially with respect to the identification of the key risk factors and the crucial variables within these risk factors that affect the implementation process. Therefore, based on this gap in the literature, along with the review of the previous models, a conceptual framework has been proposed in this chapter that will enable future researchers as well as implementers to identify the risk factors so that there can be successful ICT network implementation in the UAE. It is expected that the conceptual framework that is developed in the present chapter will be utilized by implementers, academicians and managers to explore the implementation process and risk factors of ICT network adoption and implementation process.

3.2 Factors Influencing ICT Network Implementation in the UAE

As discussed in the previous chapter, there are four main categories of risk factors namely: Planning and Development, People and Management, Operations, and Technology and Hardware. With respect to the implementation of ICT networks in the UAE, the government needs to identify the complex issues that will have an impact on the implementation process. According to the literature review in Chapter 2 and discussion in the previous chapter, the issues have been categorized in the above-mentioned categories. The aim of the researcher is to develop a framework which can be utilized by implementers and leaders in order to evaluate the risk factors. The proposed framework would thus enable public sector organizations to attain more knowledge regarding the implementation process in the context of the UAE.

For the determination of the factors that would have an impact on ICT network implementation, four categories have been taken into consideration, which were narrowed down after conducting a literature review. From amongst these categories, the researcher further narrowed down those factors which had the maximum impact on the implementation process. These sub-factors were identified after conducting a survey of 209 participants in the UAE, all belonging to IT fields. After analyzing the survey results, it was possible to narrow down to the sub-factors under each category that had an impact on the ICT network implementation in the UAE.

3.2.1 Planning and Development Risk Factors

This relates to the risks associated with the initializing, planning, developing and implementing of ICT networks and their associated processes. In the opinion of Nawi, Rahman and Ibrahim (2012), information and communications technology provides many opportunities for organizations to improve their competitiveness, productivity, wealth creation and growth. Governments in the UAE can greatly enhance and improve public services that will also improve the relationship between them and the public. However, for ICT networks to be successful, there needs to be an alignment as well as integration of the existing processes with the new ones. In order to achieve that, a number of steps need to be undertaken by the organization, which usually involves initializing, planning, developing and implementing.

From the literature review and the survey results, it was possible to narrow down to four important risk factors within this category that affected the ICT implementation. The themes identified under this category are: ‘human resource mismanagement’, ‘procurement mismanaged’, ‘inadequate project communication’ and ‘business requirements not understood’. These are the core processes of the ICT network and their effective management ensures that the project is on schedule and is well on time. When ICT projects are delayed, they result in added costs and in many cases this also leads to complete failure. Therefore, it is imperative for managers to ensure that they take notice of these risk factors and act upon them before the implementation of the ICT networks in the UAE. The below discussion will explain each factor in detail, justifying its inclusion in the ICT network implementation framework.

3.2.1.1 Human resource mismanagement

Human resource is an integral part of any organization and its management is concerned with the hiring, compensating and performance management of the workforce. The success of any ICT network is based on the technology and the people component. When this people component is not managed accurately, it results in delays and mismanagement. Sometimes this may even cause a complete failure of the implementation process. When there is failure to recruit and retain employees with the appropriate skills and knowledge, it results in failure of the ICT network implementation (Sherwood, 2005). Thus, human resource mismanagement in the implementation of ICT networks can have severe implications to the entire process and therefore it is important to manage it effectively.

3.2.1.2 Procurement mismanagement

The implementation of an ICT network will ensure that, if adopted accurately and efficiently, it can bring about a transformation in the organization as there will be better accountability and more efficiency in the overall administration, encouraging good governance (Van Slyke, 2008). Procurement policies should be developed and be in place to ensure easy and error-free adoption. During the adoption of an ICT networks, it can be time consuming since many parties are involved. Important operations should be carried out effectively by everyone involved during the procurement phase so that they are able to fulfil their duties, leading to a smooth adoption of the ICT network (Dutta and Coury, 2002).

3.2.1.3 Inadequate project communication

Successful ICT project management and implementation is all about effective communication whenever there are any changes with respect to the budget, cost, standards and requirements. It is also important to note that to manage an ICT project effectively it is important to manage the schedule. Ineffective communication can have a negative effect on the execution of the ICT project. A number of projects in the UAE lack effective communication management, leading to project failure. Managers therefore need to develop a well thought-out communication strategy and make sure of the tools which have been designed for use specifically for ICT project implementation (Adomi, 2010). According to Adomi (2010), it is vital to tailor communications targeting different stakeholders of the project. Furthermore, while organizations can make use of standardized project communication methodologies, they should be used effectively. Lastly, it would be beneficial if the workforce appreciated the value of project communication and used it as a business tool to achieve ICT network implementation.

3.2.1.4 Business requirements not understood

When there is inadequacy in planning and managing the resources required for the achievement of ICT implementation goals, it results in project failure. Some of the common businesses requirements that are not met include time overrun, inadequate time and cost management of ICT projects. Furthermore, managers also need to ensure that there is easy integration of the ICT project with the business processes of the organization (Sherwood, 2005).

Based on the above analysis the following hypothesis is formulated:

H1: *Planning and Development Risk Factors will positively influence Cost Overrun*

RISK SOURCES	REFERENCE
Project scope not understood	Nawi, Rahman and Ibrahim (2012)
Business requirements not understood	(Dutta and Coury, 2002)
Missing or inadequate project charter/project initiation document (PID)	(Dutta and Coury, 2002)
Inadequate management of or missing business case	(Dutta and Coury, 2002)
Failure to align project scope with organization or business strategy	(Sherwood, 2005)
Initial current state not understood	(Sherwood, 2005)
Budget not adequately estimated or planned	(Dutta and Coury, 2002)
Budget not provided or budget withdrawn	(Dutta and Coury, 2002)
Risks not properly analyzed or mitigated	Adomi (2010)
Unrealistic schedule at start of project	Adomi (2010)
Unclear project responsibilities	Nawi, Rahman and Ibrahim (2012)
Contractual or legal risk not understood	Adomi (2010),
Technical risks not analyzed or mitigated	Nawi, Rahman and Ibrahim (2012)
Unsuitable system development lifecycle/process	Adomi (2010)
Inadequate project planning	Nawi, Rahman and Ibrahim (2012)
Inadequate resource planning	Nawi, Rahman and Ibrahim (2012)
Inadequate project communication plan	Nawi, Rahman and Ibrahim (2012)
Testing not planned properly	Nawi, Rahman and Ibrahim (2012)
Project rejected because of inadequate business continuity planning	Adomi (2010)
Unable to secure an implementation partner	Adomi (2010)

Stakeholders mismanaged or not identified	Adomi (2010)
Contractors/vendors mismanaged	(Sherwood, 2005)
Plan rejected by business	Adomi (2010)
Inadequate understanding of project benefits	(Dutta and Coury, 2002)
Changes to business requirements during the project	(Dutta and Coury, 2002)
Changes to scope during the project	(Dutta and Coury, 2002)
Quality mismanaged	(Dutta and Coury, 2002)
Human resource mismanaged	Adomi (2010)
Procurement mismanaged	Nawi, Rahman and Ibrahim (2012)
Time/schedule mismanaged	(Sherwood, 2005)
Delayed on approval	(Dutta and Coury, 2002)
Inadequate project management	(Dutta and Coury, 2002)
Insufficient human and financial resources	Australian Publics services Agencies, Department of Finance and Deregulation
Inadequate management of project development lifecycle/process	(Sherwood, 2005)
Delays in external approvals or decision making	Nawi, Rahman and Ibrahim (2012)
Inadequate testing	Nawi, Rahman and Ibrahim (2012)
Inadequate planning for migration from old to new system/network	Nawi, Rahman and Ibrahim (2012)
Training not planned or conducted adequately	(Dutta and Coury, 2002)

Table 3.1: Risks Sources for Planning and Development Risk Factors

3.2.2 Technology and Hardware Risk Factors

The core of ICT is the use of technology to achieve business goals. Thus, it becomes imperative that there is proper integration of technology and hardware with the system. Furthermore, it is imperative that there is integration of old systems with the new systems, only then will effective and successful ICT network implementation be achieved. Under this category, the main risks identified are: ‘failure to address integration with existing technologies’, ‘failure to address the integration of components within the project’, ‘failure to provide supporting infrastructure on time’, ‘technology failures caused by unstable project team’ and ‘technical failures caused by quality mismanagement’. These factors play an important role during the implementation process since ICT networks are dependent primarily on the technical components. When these components fail to integrate and there are failures on various levels, it leads to extended phases and delays and in many cases it may also result in complete failure of the implementation process of the ICT network. Therefore, the researcher has narrowed down the main risk factors under this category and provided a discussion about the vulnerabilities they cause.

3.2.2.1 Failure to address integration with existing technologies

It has been observed that often the implementation of an ICT network does not have the desired effect. This is due to faulty implementation and integration of the new technologies with the existing technology (Bouwman, Van Den Hooff and Van De Wijngaert, 2005). This leads to the development of inapt systems with old and obsolete technologies. Another complicating factor that has been identified through literature review and interview is the fact that ICT systems have to be attached to those systems that are already in operation, which creates problems as there is no compatibility (Nawi, Rahman and Ibrahim, 2012; Leydesdorff and Wijsman, 2007). Thus, for an ICT network to be successful, it is extremely vital that the systems that are chosen are not just compatible but there also exists interoperability that can be adopted by the existing systems.

3.2.2.2 Failure to address the integration of components within the project

The ICT network is made up of a number of components and their successful integration is a vital element for the success of the ICT network implementation process. Thus, it is vital to successfully integrate the various chosen components of the ICT network with one another, which will lead to a smooth implementation process. In order to do so, Sherwood (2005) also suggests that there should be adequate ICT systems architecture that will help to ensure flexibility as the business process changes with the implementation of the ICT network.

3.2.2.3 Failure to provide supporting infrastructure on time

As ICT involves a number of components, there is a need to develop a strong infrastructure that is able to handle the changing components and business processes. According to Warren, Davies and Brown (2008), organizations should develop products and solutions that are flexible with the ICT infrastructure.

Management of applications and supporting infrastructure is important; however, it may prove to be difficult since application and configuration technology changes rapidly. Thus, there is a need to constantly update and maintain the supporting infrastructure.

3.2.2.4 Technology failures caused by unstable project team

Lack of technical know-how along with practical training is a major cause of the failure of ICT projects (Mahendra et al., 2014). Unclear use of infrastructure combined with limited knowledge is what causes ICT projects to fail. Furthermore, in the opinion of Mahendra et al. (2014), lack of clarity regarding the concept and use of ICT components, from the perspective of the users, caused due to insufficient education of the management and project team, also causes ICT network project failures. Furthermore, it can also be concluded that there are certain other causes that may lead to delays such as late integration, errors and omissions that are not accounted for, poor assessment and assumptions, non-compliance of the project team with the established procedures, plans, schedules and policies, and cost overruns due to all these failures. Therefore, it is imperative to address this risk factor before the implementation of the ICT network.

3.2.2.5 Technical failures caused by quality mismanagement

When there is inadequate architecture which does not properly define the technical criteria for ICT network implementation, this leads to system failure. Quality mismanagement refers to the lack of testing for integration and interoperability. Furthermore, when there are no inspections carried out for evaluation of design defects, this causes technical failure and leads to phases being added during the implementation process. It is the responsibility of the management to train and offer technical knowledge to the users and workforce to ensure there is proper integration of the processes.

Based on the above analysis the following hypothesis is formulated:

H2: *Technology and Hardware Risks will influence Cost Overrun*

RISK SOURCES	REFERENCE
Failure to address integration of components within the project	Warren, Davies and Brown (2008)
Failure to address integration with existing technology	Bouwman, Van Den Hooff and Van De Wijngaert (2005)
Inadequate or incorrect design	Warren, Davies and Brown (2008)
Incompatibility of new with existing technology	Bouwman, Van Den Hooff and Van De Wijngaert (2005)
Information security not properly addressed or understood	Mahendra et al. (2014)
Technical complexity not understood	Mahendra et al. (2014)
Technology not meeting the business requirements	Mahendra et al. (2014)
Use of unproven technology	Bouwman, Van Den Hooff and Van De Wijngaert (2005)
Inadequate or missing development tools or environment	Warren, Davies and Brown (2008)
No support from manufacturer	Warren, Davies and Brown (2008)
Technical failures caused by quality mismanagement	Bouwman, Van Den Hooff and Van De Wijngaert (2005)
Unexpected technology failures	Mahendra et al. (2014)
Technology failures caused by unstable project team	Bouwman, Van Den Hooff and Van De Wijngaert (2005)
Failure to provide supporting infrastructure on time (e.g. power)	Mahendra et al. (2014)
Failure to take account of operating conditions (harsh physical environment)	Mahendra et al. (2014)

Table 3.2: Risks Sources for Technology and Hardware Risk Factors

3.2.3 Operational Risk Factors

Operations of the ICT networks need to align with the business processes in order to ensure there is a cohesive approach to implementation. Operational management requires a setup wherein all the processes are linked. Only when these processes work in coordination does it result in a successful project implementation. The themes explored under this category are: ‘inadequate design leading to operational failure of the network’, ‘instability of the delivered network’, ‘failure to address environmental impact on network’, ‘operational problems caused by poor implementation’ and ‘change in operation processes and polices’.

For implementers of ICT networks, being cognizant of these operational risk factors is vital as it will affect the implementation process. The UAE is susceptible to these operation-related factors as the country is still learning and growing with respect to IT and technology. In such a case, these risk factors can have an impact on the ICT implementation process in the UAE.

3.2.3.1 Inadequate design leading to operational failure of the network

One of the causes of operational failure is the poor development and designing practices. Inadequate testing practices of the designed systems contribute to operational failure. When the design strategy is poor and it is not addressing all the grievances, this can lead to increased failure rate of the ICT network systems. In many cases, it may also lead to complete failure. Design strategy also relates to the ease of using the systems, especially by the end users and the workforce, which is usually untrained in handling technological systems efficiently. Therefore, there is an urgent need to address the designing aspect of the system to ensure the implementation process is smooth and error free.

3.2.3.2 Instability of the delivered network

As mentioned earlier, the ICT systems consist of a number of components. However, when there is instability amongst these components, it results in failure. By failure, it means when one or more of the components is not able to integrate or does not function efficiently. This results in instability throughout the system and therefore it is important to check the operation of each component and that will result in a cohesive system that functions accurately. It is important to note that, if there is persistent instability in the delivered network, it becomes susceptible to attacks and outside threats (Satapathy et al., 2014).

3.2.3.3 Failure to address environmental impact on network

ICT networks consist of systems which contain hardware components along with software components. Therefore, when planning the implementation of ICT networks, specific planning is necessary with respect to the environmental factors. The environmental externalities such as heat, humidity, heavy rains, pests and vermin all cause damage to the hardware components, giving rise to instability in the systems. It is due to this reason that it is important that, during the planning stage, environmental conditions are taken into consideration and appropriate plans be made so that, when there are any such environmental issues, the systems are in place to combat them.

3.2.3.4 Operational problems caused by poor implementation

ICT networks can provide cost-saving solutions as well as accelerated results. However, these advantages can be rendered useless if there is poor implementation of the ICT systems. It is important that ICT networks be built on reliable and secure platforms and they must make use of secure data. By doing so, managers can complement their other services and offer a service that is not just stable but also reliable. Furthermore, it is also vital to provide complete customization along with security in order to alter the system according to the requirements (Howard and Lipner, 2006). By including these features, adoption and implementation of the ICT systems will be accelerated. If these aspects are not touched upon, then it can lead to operational problems, caused mainly due to the poor implementation process. This in turn makes the ICT network project adoption a slow process and sometimes it may also culminate in failure.

3.2.3.5 Change in operation processes and policies

Management of operational changes brings about discipline and quality control in ICT networks. In order to ensure success it is vital to pay heed to the operation processes and policies. Adoption of a formalized approach towards management of operational change will help to deliver a more efficient and organized ICT infrastructure (Leydesdorff and Wijsman, 2007). During the course of ICT network implementation, there will be changes in policies and processes and thus being able to deal with these changes in operations is vital for the delivery of ICT networks. In order to garner control, top management will have to take note of the changing policies and processes and direct the implementation process in order to ensure smooth implementation (Barki et al., 1993).

Based on the above analysis the following hypothesis is formulated:

H3: Operational Risks will influence Cost Overrun

RISK SOURCES	REFERENCE
Operational problems caused by poor implementation	(Leydesdorff and Wijsman, 2007).
Instability of delivered network	(Leydesdorff and Wijsman, 2007).
Inadequate budgeting for maintenance and support	(Satapathy et al., 2014).
Inadequate requirements management leading to operational failure of the network	(Satapathy et al., 2014).
Inadequate design leading to operational failure of the network	(Satapathy et al., 2014).
Failure to properly migrate from old to new network	(Satapathy et al., 2014).
Inadequate training leading to operational failure of the network	(Barki et al., 1993).
Inadequate testing leading to operational failure of the network	(Barki et al., 1993).
Market development pace rendering products obsolete	(Satapathy et al., 2014).
Changes to business requirements after network delivery	(Satapathy et al., 2014).
Inadequate monitoring of the network/system	(Barki et al., 1993).
Changes in operation process and policy	(Leydesdorff and Wijsman, 2007).
Poor management of third parties necessary for network operation	
Failure of third parties to deliver necessary services for network operation	(Barki et al., 1993).
Organizational changes leading to operational problems	(Leydesdorff and Wijsman, 2007).
Inadequate change control after delivery	(Leydesdorff and Wijsman, 2007).
Inadequate operational processes	(Barki et al., 1993).
Failure to address environmental impact on network (harsh conditions, vermin damage etc.)	(Satapathy et al., 2014).

Table 3.3: Risks Sources for Operational Risk Factors

3.2.4 People and Management Risk Factors

The adoption of an ICT network is directly affected by the top management that is responsible for its implementation process and direction along with the people component, which is the users or the workforce that will make use of the network. A shortage of skilled management with the relevant experience in ICT processes and implementation means that inexperienced managers will be hired (Mueller-Jacobs and Tuckwell, 2012).

The main risk factors identified under this category are: ‘contractual issues’, ‘misalignment of the project with the organization’s standards and policies, ‘failure to achieve compatibility with the strategic business direction of the organization’, ‘organizational changes not properly managed’ and ‘failure to achieve compatibility with the organization’s strategic IT direction’.

By addressing these issues in the conceptual framework, the chances of successful implementation of the ICT network can be increased. These themes have been explained in detail below to ensure that these risk factors are addressed before the implementation process.

3.2.4.1 Contractual issues

In order to achieve the implementation process, management needs to draw up certain legally abiding contracts since many entities work on the implementation procedure simultaneously. Only when these entities work harmoniously does it become possible to achieve the desired result. Contracts thus play a major role in the organization’s current implementation process. A contract allows the integration of legal documents into the project execution so that each entity is aware of its duties and thus performs according to the contract drawn up. In a case where such a contract is absent, discrepancies emerge, and this gives rise to blame and incomplete work with targets not being met. Such delays cause heavy losses and, in many cases, this leads to a complete failure of the implementation process.

3.2.4.2 Misalignment of the project with the organization’s standards and policies

As stated earlier, all projects are guided by certain rules and regulations and following these regulations becomes necessary. Similarly, the organization chalks out its own standards and policies which need be totally respected. These are developed to ensure that the organization’s priorities are in place while also making sure that each entity is committed to its personal responsibilities regarding the ICT implementation process. The policies and procedures of every organization are developed keeping in mind the strategic goals and thus it is vital to adhere to these policies and procedures. When there is misalignment, it leads to chaos and sub-standard works, which causes hurdles to the successful ICT implementation process.

3.2.4.3 Failure to achieve compatibility with the strategic business direction of the organization

Every organization has its strategic business direction which includes the goals that the company wishes to achieve and the path that it will take in order to achieve those goals. This includes planning, allocation of resources and strategic decision making. A number of business analysis techniques are utilized to achieve this strategic business direction. With the implementation of ICT networks, it is expected that the road to strategic direction will be easier since it will help to streamline the processes and expedite the processes to achieve the organizational goal (National Research Council, 2000). However, when there is no compatibility between the strategic business direction of the company and the ICT processes, this leads to failure to achieve strategic goals.

3.2.4.4 Organizational changes not managed properly

With the onset of ICT implementation, organizational change is inevitable especially since all the business processes will now become a part of the technology-driven ICT systems. The changes will bring about unrest within the workforce, especially when the workforce is not proficient with making use of technology in their daily work. Management needs to manage this organizational change in order to ensure the effectiveness of ICT networks. The development of ICT represents the profound change that it will bring about in the organizational processes and methodologies (De Waal et al., 2014). When these changes are not managed adequately, this results in the failure to adopt the ICT network.

3.2.4.5 Failure to achieve compatibility with the organization's strategic IT direction

The implementation of an ICT network requires a technical leader who is able to take control of the architecture of the project (Leydesdorff and Wijsman, 2007). Every organization today has a strategic IT direction wherein they aspire to achieve certain IT milestones. Implementation of an ICT network is a step further in achievement of these vital IT milestones. However, if there is no compatibility between the IT direction of the organization and the ICT network, this results in the failure to achieve compatibility. If this compatibility is missing, it results in improper implementation of the ICT network. The technical lead of the organization builds each portion of the system in such a manner that each portion is compatible with the other and it leads to a successful ICT system. When this kind of compatibility is absent, there is no proper IT direction, which leads to a failure in achievement of IT goals as envisioned by the technology head.

Based on the above analysis the following hypothesis is formulated:

H4: People and Management Risks will influence Cost Overrun Factors

RISK SOURCES	REFERENCE
Failure to achieve compatibility with the strategic business direction of the organization	(Mueller-Jacobs and Tuckwell, 2012
Failure to comply with legislative requirements, such as finance regulations	(Mueller-Jacobs and Tuckwell, 2012
Misalignment of the project with organization's standards and policies	(National Research Council, 2000)
Mismanagement of scope and requirement changes during the project	(National Research Council, 2000)
Contractual issues	BSI Standard 100-2.(2005)
Failure to ensure project staff have the necessary skills	(Mueller-Jacobs and Tuckwell, 2012
Failure to manage confidentiality (information disclosure)	(Mueller-Jacobs and Tuckwell, 2012
Failure to manage staff priorities	(Mueller-Jacobs and Tuckwell, 2012
Failure to manage the budget	(Mueller-Jacobs and Tuckwell, 2012
Failure to provide enough project staff at the required time	(Mueller-Jacobs and Tuckwell, 2012
Inadequate management of budget needed for staff	(National Research Council, 2000)
Mismanagement of project schedule	BSI Standard 100-2.(2005)
Failure to achieve compatibility with the organization's IT strategic direction	(Mueller-Jacobs and Tuckwell, 2012
Organizational changes not properly managed	BSI Standard 100-2.(2005)
Failure to manage and deliver necessary training	(Mueller-Jacobs and Tuckwell, 2012
Inadequate management of budget needed for training and support	(National Research Council, 2000)
Inadequate management of changes to operational processes and policies	(National Research Council, 2000)
Issues caused by external agencies on which the project depends	(National Research Council, 2000)

Table 3.4: Risks Sources for People and Management Risk Factors

3.2.5 Cost Overrun Due to the Risk Factors

A large set-up is required to implement ICT network systems in the UAE. Many resources need to be added to achieve the desired results with respect to these ICT networks. Many studies have linked these cost overruns to certain major anomalies as below:

- Over-ambitious and complex projects that are difficult to execute.
- Management outsources most of the ICT network components, which results in increased costs.
- Commissioners usually do not possess the required skills and there is also an absence of training and thus there is inability to manage large projects and procurement processes.
- Lack of technical staff leads to more resources required to train the staff and the users.
- Resources are not managed effectively.
- Decision making is not well thought out or well planned. Does not account for the increased budgets in case of any emergencies.

These factors are not considered and thus cost overruns ensue. It is therefore important that during the implementation process special attention is given to these factors to ensure smooth implementation of the ICT network without delays or cost overruns.

3.3 Proposed Conceptual Framework

It is vital to develop a conceptual framework in order to determine as well as identify the factors of ICT network implementation. This is based mainly on the risk factors identified in the literature review and the results of the conducted survey and the subsequent discussion in the previous chapter. The conceptual framework consists of a part that consists of the four main risk categories in the ICT implementation process and the main sub-factors under each category. Another part included in the framework consists of the cost overrun factors as discussed in the previous chapter along with its research in the literature review in Chapter 2. After reviewing the literature and conducting a survey, a conceptual framework has been proposed that integrates the risk factors along with the cost overrun in the implementation of ICT networks in organizations within the UAE. These factors can thus be addressed by implementers and aid in ensuring that the cost of the project is kept within the limits of the budget as decided by the management. The proposed conceptual framework is demonstrated in Figure 3.1.

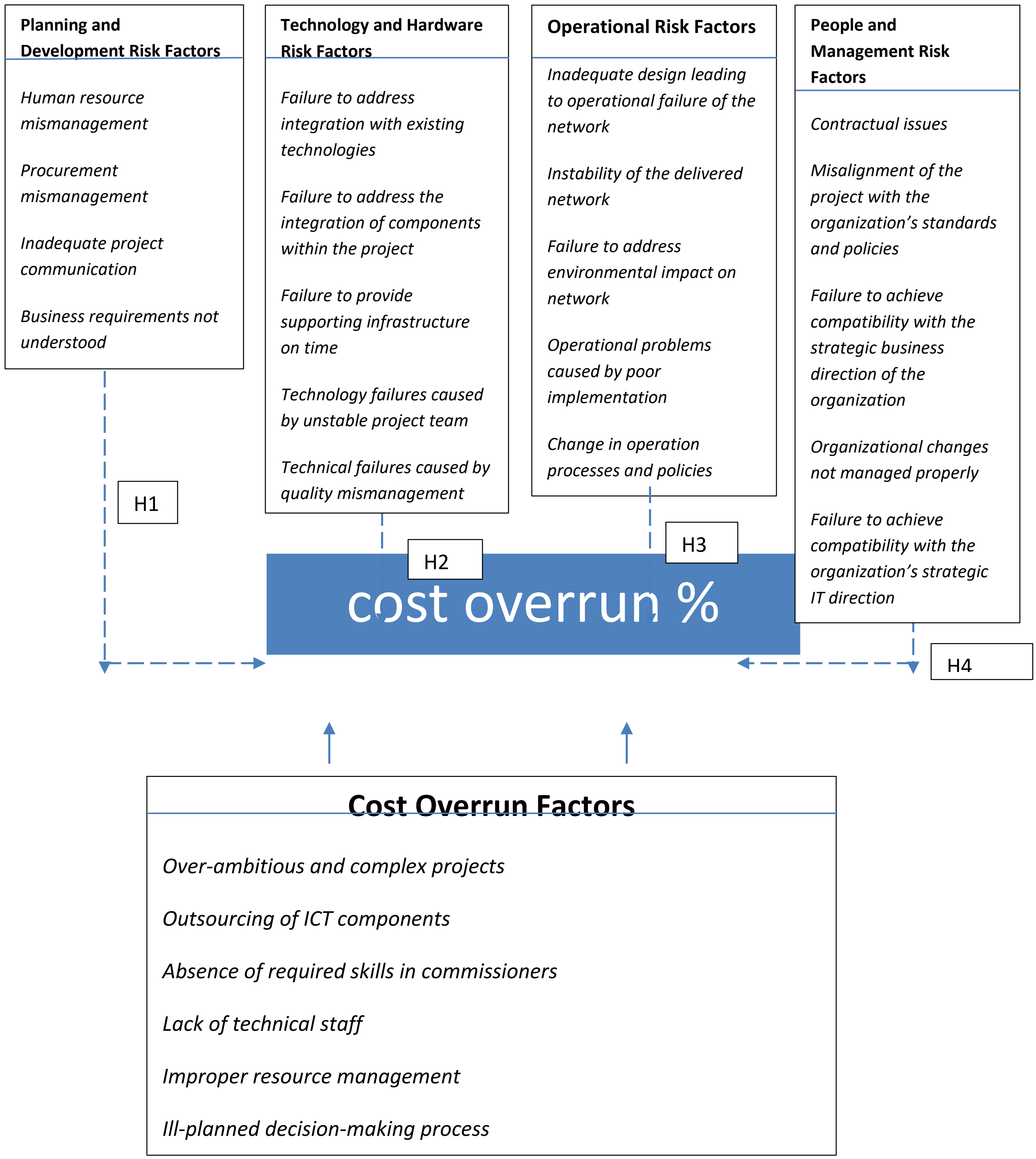

Figure 3.1: Conceptual Framework for ICT Implementation in the UAE (author's own based on hypotheses developed in section 3.2 and its sub-sections)

3.4 Conclusion

The conceptual framework was developed after conducting a literature review and a detailed analysis of the factors affecting ICT infrastructure implementation in the UAE. Every aspect of the framework has been evaluated and, only after identifying those factors that have the highest impact on the implementation of ICT networks in the UAE, were they included in the conceptual framework.

The framework has examined the factors from the implementers' and management's point of view. Furthermore, main factors which lead to cost overruns in the implementation of ICT networks are also taken into consideration. The literature review was utilized to develop the said framework in order to ensure a theoretical construct was developed to address the factors affecting ICT network adoption and implementation in the UAE. It is important to note that, for the sake of clarity, the researcher identified additional factors under each category and for cost overrun factors so that all aspects were covered within this framework.

This framework is a useful tool for governmental entities, implementers, managers and leaders, and decision makers to apply the necessary changes in the ICT network implementation and it will also help to increase the understanding of the factors that play an important role in the decision-making process. It is important to note that the framework consists of various factors and parts and these could be tracked to lead to more factors. By identifying additional factors, the conceptual framework can be revised further to close any gaps that may be left in this research.

From an academic point of view, this conceptual model is set to deliver an understanding of the issues, risk factors and cost overrun factors that impact the ICT implementation process. This will help academicians to further this research and identify the issues and concerns with respect to the ICT implementation process and the barriers that may not allow the application of the conceptual framework in the UAE ICT network projects.

4 METHODOLOGY

4.1 Introduction

The aim of this chapter is to critically look at various options for adoption in the quest of networking component of ICT implementation. However, while the adoption of ICT promises many benefits it also presents some challenges which will directly affect the delivery as well as the security of the system. This chapter will look at some of these risks to networking plans and their effect on the delivery of Information Communications Technology (ICT) in the UAE. In the last chapter, a conceptual framework was developed to assess the factors governing the ICT implementation from the existing literature as well as to test and validate specific services that could be offered by ICT. This chapter will utilize qualitative and quantitative research methodologies to evaluate various properties articulated within the research. It will look at the comparison between these two methods of research in the hope of identifying the one that is best for this research by looking at the merits and demerits of each type. This was the process utilized to identify quantitative research as the best method for this research especially considering that the aim is to identify risks of ICT use that influence implementation and delivery in the UAE, which means that a deductive approach must be adopted to fulfil the aim.

4.2 Epistemological Perspectives

It is paramount in any methodology to identify the philosophical paradigms that will guide the research. Krauss (2005) defines epistemology as the philosophy of knowledge or the process of coming to know. The epistemology of quantitative and qualitative research is different in many ways. First of all, epistemology depends on the ontology and methodology; ontology defines the philosophy of the reality while epistemology looks at the specific means of attaining the knowledge making up the reality. However, the philosophical aspect of epistemology acts as a differentiating property between qualitative and quantitative research. The research paradigms are defined as the assumptions made philosophically or theoretically to attempt to explain the reality in its nature and allow for an understanding of perspectives to utilize in the study design (Krauss, 2005). As previously mentioned, qualitative and quantitative research have different philosophical paradigms. In qualitative research, it is common to utilize constructivist and interpretivist paradigms that reject the positivist paradigms common in quantitative research. This is due to the argument that idealism, post-modernism, constructivism and humanism are superior (Johnson & Omwuegbuie, 2004). The most utilized paradigms in conducted ICT research include: positivism, interpretivism and even critical paradigms (Hirscchheim & Klein, 1992; Dickson et al., 1977; Orlikowski & Baroudi, 1991a, b; Walsham, 1995; Trauth & Jessup, 2000; Hirschheim & Klein, 2003; Chen & Hirschheim, 2004).

4.2.1 Positivism Paradigm

Healy and Perry (2000) state that positivism is common in sciences and based on an assumption that it is possible to measure independent facts using a single reality. Therefore, this involves the use of a test theory in a bid to increase understanding of the new phenomenon. In ICT networking, research is classified as positivism by various authors when there is a formal proposition, quantifiable variables, testing of hypotheses and drawing of conclusions based on a population sample as a representative of the entire population. This is based on the belief of a strictly empirical method whereby the experience acts to build on to the existing body of knowledge (Bogdan & Biklen, 2003). It is important to note that empirical knowledge is different from metaphysical or theological knowledge in that it is based on scientific knowledge, which is a better representative of the reality (Schwandt, 2001; Krauss, 2005). Positivist ideology considers science to be the only way of finding out the truth as it is considered that everything in the universe is determined by laws of cause and effect. This involves the use of deductive reasoning to make theories and hypotheses that can be tested to indicate whether the theory explains fully the phenomenon being tested or needs to be revised (Trochim, 2000; Krauss, 2005). This scientific method is based on trial and error or experimentation in the hope of finding out the natural laws using manipulation and observation (Schunk, 2008, O'Leary, 2004). It has been postulated severally that positivism follows a four-point doctrine. The first is the doctrine of phenomenalism, which is based on the belief that experience is the only true determinant of reality and any other abstractions such as matter or spirit are rejected. The second is nominalism, which indicates that words such as generalizations and abstractions do not give any insight into the world. The third is the separation of facts from values, and fourth is the unification of the scientist methodology (Krauss, 2005; Kolakowski, 1972). Therefore, the positivist paradigms are often combined with quantitative research (Mackenzie & Knipe, 2006).

4.2.2 Interpretivism Paradigm

This paradigm is based on the acceptance that research is value bound and so it is impossible to differentiate between causes and effects (Blaikie, 2000; Alghamdi, 2015). It is based on the philosophy introduced by Edmund Husserl and Wilhekl Dilthey's research on hermeneutics. Therefore, the focus of this paradigm is understanding the human experience in its totality based on the belief that reality is also a social construction (Mertens, 2005; Cogen & Manion, 1994). Therefore, research using this philosophy relies on the respondent's views on the item of study. Even more interesting is the fact that the research does not begin with a set theory; the theories are generated as the researchers induce information on the item of research throughout the process of study. Therefore, this kind of research largely relies on qualitative research or mixed methods research in a study and rarely quantitative data that needs to build upon existing qualitative data (Mackenzie & Knipe, 2006; Creswell, 2003). Researchers using this paradigm believe that knowledge is largely subjective and the truth or 'reality' lies in human experience.

Interpretive research in ICT networking has the aim of understanding or analyzing the ICT system context and the effect of the process of ICT influence, as well as the effect of this process on context (Dix, 2007). One of the most common assumptions in this paradigm is that reality cannot be limited in a single context, time, space or individual as realities are different to each person or group. Researchers, therefore, embark on looking at individuals as well as individual realities with the research process (Mertens, 2009). Therefore, statements on what is true are based on the culture, history and context ,while some might be universal. The assertion is that even the researcher is inevitably a product of their values, which in turn determines the choice of enquiry, choice of paradigm, choice of data collection and methodology, and interpretation of the data. This reality helps interpretive researchers to accept the real possibility of bias in research (Mertens, 2009).

4.2.3 Critical Paradigm

Critical theory acts as a response to the failures of the positivist and interpretivist paradigms. Researchers have identified the role of these paradigms as a reduction of the positivist and the conservation of the interpretive paradigms (Kim, 2003). Critical researchers make the assumption that actually historically created in interpretative but is constantly produced and changed by the people (Neuman, 1998). This, therefore, means that the power to change their social and economic circumstances lies with the people with a simple act. This paradigm also ascertains that the power for change is often constrained by social, cultural or political factors, which means that the major aim of critical research is to act as a critique of the socially created status quo and bring about the eventual exposure of the isolating and restricting conditions (Alghamdi, 2015). In many ways, this paradigm shares the idea with interpretive ideas but its main philosophical goal is to lead to the creation of knowledge through focusing on the opposition of the status quo, confrontation, as well as existing contradictions of what is termed as a 'normal' society. In this light, the interpretive ideology strives to predict or ascertain the ensuing conditions while the critical theory seeks to deconstruct those conditions through critique, analysis and eventually modification of existing conditions (Morris, 2006). Kim (2003) suggests that critical theory also depends on self-reflection, which is necessary before any modification of the conditions. Also, this ideology relies on the belief that the reality is in multiple layers and, while the surface can be seen, the deeper layers are often hidden and need to be unmasked (Kawulich & Chillisa, 2012). Due to all these factors related to the critical ideology, it is the best paradigms to utilize when a researcher needs to find new knowledge. This ideology goes best with a quantitative and qualitative research methodology used together often as mixed research methods (Kawulich & Chilisa, 2012)

4.3 Appropriate Research Paradigms

Based on its aims, the appropriate paradigms for this research are the positivism ideology. The aims are the critical analysis of risks affecting the delivery of ICT networking projects within the UAE, and finding out the actual risks influencing the delivery of ICT networking. This study will need quantitative data which is best matched with the positivism paradigm. The interpretive paradigm best suits qualitative research, and critical ideology is not suitable for this type of research (Chen & Hirschheim, 2004).

4.4 Research Design

The research design is a crucial part of any study as it has a direct effect on the type of data found to determine the hypothesis. It is defined as a blueprint for conducting research that promises total control over all factors that could interfere with research validity (Salazar, 2010). Furthermore, it is also a plan describing how, when and where the collection of data will take place and the analysis of the same data (Wabwoba & Ikoha, 2011). A simpler definition is provided by Polit et al. (2001), who consider the research design as the overall way for a researcher to answer their research questions and test their hypothesis. The research design allows use to be made of a detailed guide in the process of research to ensure that the study remains focused on its objectives.

The design is made up of the research objectives that are borrowed from the established research questions, specified data collection methods and analysis of the eventual data collected including a well-articulated description of any ethical issues encountered during the research. The research framework has three levels in this study; the first is the research design, data collections and eventually data analysis. In order to create a compatible research design for this study, it is important to conduct a detailed literature review of existing sources of research in ICT networking. This will also include a look at the use of the ICT networking framework in the determination of relationships, if any, between risk, overrun costs and ICT networking project success. This research utilized the survey research methodology in the first stage, whereas, in the second stage, a pilot study was conducted using questionnaire whose validity and reliability had been determined. This allowed the researcher to make any modifications in the final study based on the success of the pilot study as well as the final questionnaires. The main data collection involved 215 respondents who completed a survey questionnaire and, of these respondents, 209 responses were utilized in data analyses. The final stage is the analysis of the results conducted using the Statistical Package for Social Sciences (SPSS) and later a discussion based on the SPSS results. The framework was a great tool for keeping the study focused on the research objectives and is as indicated in the first chapter. Additionally, the figure below will give an overview of every step taken within the research framework presented in this text.

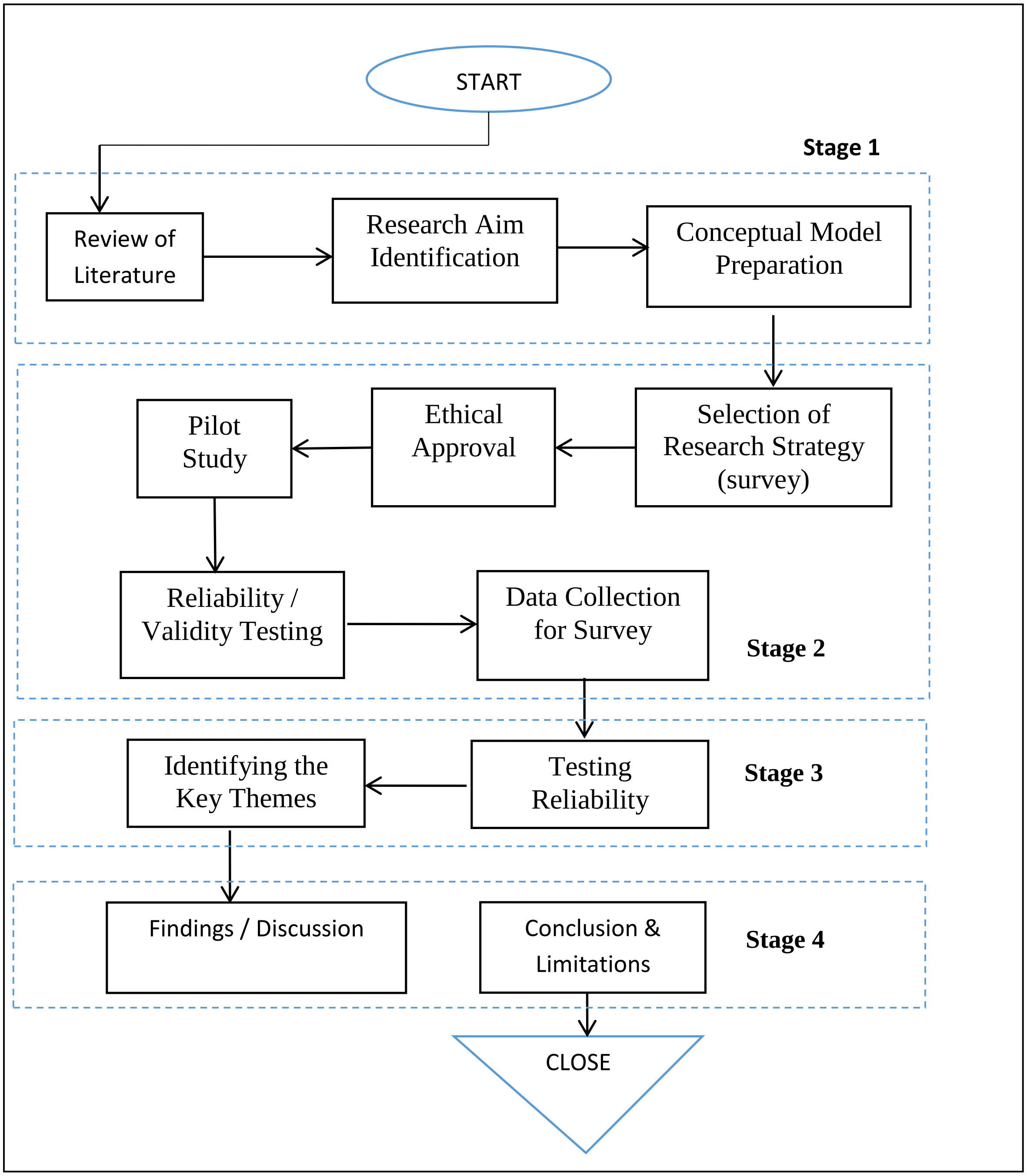

Figure 4.1: An Overview of the Research Design

4.5 Research Approach

The research approach can be defined as the method of enquiry that analyses the assumptions, principles and procedures in a particular manner of enquiry (Schwardt et al., 2007; Teddlie & Tashajjori, 2007). There are two main research approaches, qualitative and quantitative. These two approaches differ based on the nature of the knowledge as well as in collection and analysis of data that paves way for generalizations or representative inferences. This section will compare the two approaches as well as present a justification for choosing quantitative research for this study.

4.5.1 Quantitative Approach

This research approach utilizes objective ideologies to test the hypothesis by examining the relationship between the variables (Leedy & Ormrod, 2001; Williams, 2007; Yilmaz, 2013). The best-suited approach in quantitative research is the deductive approach, which is guided by the philosophical theory (Elo & Kyngas, 2007). The deductive approach begins with the researcher's theory with the aim of formulating the research hypothesis. This stage is followed by the collection of data, which will endorse or reject the hypothesis in the beginning of the research. Depending on the results of stage two, the researcher makes revisions to their initial theory as well as their hypothesis (Williams, 2007). The quantitative approach, as mentioned earlier, is compatible with the positivism theory as the positivism paradigms seek to test a single reality, through testing of the established hypothesis and theory so as to help gain a better understanding of ensuing phenomena or conditions (Krauss, 2005). Experimental and survey data collection methods are the best choices for quantitative research (Bryman, 2006). Surveys utilize methods such as structured interviews and questionnaires, and may include the use of structured observations of actions and decisions made by respondents (Williams, 2007).

4.5.2 Qualitative Approach

Qualitative research, on the other hand, is subjective and utilizes an exploratory approach to determine the meanings that society and individuals give to certain human or societal conditions (Myers, 1997). This methodology, therefore, emphasizes the collection of words expressed by respondents through analysis of data often using methods such as thematic analysis (Yimaz, 2013). The method takes an inductive approach where the end outcome is the creation of a theory.

Inductive research is based on making extrapolations from generalized findings and observations to create a new theory (Abosede & Onnauga, 2016). The paradigm best suited for qualitative study, as previously mentioned, is the interpretive ideology where the researcher begins studying a topic within the context of the study using new signs, as well as during the process there is categorization because the basis of this ideology is that individual and group realities differ and cannot be generalized (Myers, 1997; Myers & Avinson, 2002; Elo & Kyngas, 2007). Qualitative approaches may utilize a variety of strategies including narrative, ethnography and even case studies theory (Yilmaz, 2013). Table 3.1 shows a clear comparison and contrasting of qualitative and quantitative research utilizing four main factors: paradigms, the role of theory, research strategy and properties.

Features	Quantitative Research	Qualitative Research
Characteristics	Analysis of the relationship between variables being examined in the study. The statistical analysis of data leads to the derivation of a numerical value	Utilizes data collection methods to collect data on respondent meanings and beliefs regarding the condition of study leading to formation of a new theory
Role of theory	It plays a deductive role where it tests if the hypothesis can be accepted or rejected	It plays an inductive role where the researcher first makes a generalized extrapolation that is later modified to form a new theory based on findings and observations of the research
Research philosophy	Utilizes the positivist approach whose aim is to test the theory or hypothesis presented in the hope of understanding ensuing phenomena or conditions	Uses the interpretivist approach where the goal is to record different realities in the individual and group levels using new designs to allow division of data into categories
Research strategy	Utilization of surveys	Utilizes strategies such as narrative theory and grounded theory

Table 4.1: Qualitative versus Qualitative Research

4.5.3 Quantitative Research as the Right Choice for this Study

The best option for this study is the quantitative research methodology due to the deductive approach. Qualitative research is not appropriate for this research because it depends on a 'loose' theory that is refined at the end of the research. This research requires a specific theory and hypothesis to guide it and keep the focus on the determined research aims. Quantitative research is best also considering that the epistemology of this research takes the positivism ideologies which are compatible only with quantitative methods. This research takes the positivism ideology because the main objective is to look at the proposed ICT networking conceptual model for projects in the UAE. The only way to meet this aim is through the use of quantitative research.

The questionnaire utilized in this study was formulated using developed measurement frameworks and instruments for ICT networking construction from existing studies with the objective of determining the value of the ICT within the networking project framework. The results from the data collection will then be analyzed statistically, which is only possible in a quantitative study. The quantitative approach also allows for the use of surveys and experimentation to determine or understand a specific condition.

4.6 Research Strategy

The research strategy can be defined as the plan that the researcher intends to utilize to respond to the research questions. It involves the relationship of the philosophical paradigms and the methods of data collection and analysis. There are a few existing strategies including survey, case study, grounded theory, archival research, ethnography and experiment. Since this research is utilizing quantitative methods, the choice is between experimentation and surveys (Saunders, Lewis, & Thornhill, 2003). Earlier, the researcher identified the use of quantitative methods and surveys in the study.

4.7 Data Collection Methods

Data collection involves the use of an adopted methodology for the collection of information from respondents that qualifies as a way of answering the research question and meeting the research objectives. The data collection process is divided into three phases; the first phase involves the identification of the sampling method, followed by calculation of the right sampling size, and, lastly, adoption of the questionnaire method of data collection (Benbasat et al., 1987).

4.7.1 Sampling Methods

Sampling means choosing a representative portion of the population that allows for the testing of the hypothesis through collection and recording of observations as well as information, and the generalization of the research inferences as a true representative of the entire population. A sample is, therefore, a fraction of the population (Benbasat et al., 1987). The population is the totality of the case group from which the sample respondents are picked. In this study, our population is made up of IT personnel, System Managers, System Engineers and Operations Managers. The choice of these groups is that they directly cause growth in the ICT networking sector in the UAE. Another benefit from these groups is the value-added aspect of existing research through the use of their experience, skills and other forms of input. In order to look at the role of the participating population the researcher assessed their fitness using the following prerequisites:

- Managing ICT networking and computer systems.
- To maintain the security of the ICT networking system including ensuring that there is a backup system to protect the data in that system.
- Overall planning and organization of ICT networking operations.
- Recommendation of strategies regarding changing technology in ICT networking as well as policies and processes of evaluation of ICT networking project success based on organizational objectives.
- Prompt identification and resolution of any problems with the ICT networking system.
- The training of non-specialist personnel on ways of utilizing the ICT networking systems.

It was not possible to collect and analyze data from all the group members mentioned above; this would only be possible with the use of a census. This would be tantamount to surveying the entire population while not everyone contributes to the delivery of ICT networking effectively in the UAE. It was also impossible due to other factors such as budget and time as well as expected difficulty in analyzing and assessing such a large amount of data. The best solution was to utilize a much smaller sample that is a true representative of the population, which guarantees accuracy in the results, as well as working within the time and budget set for the project. It also allows for enough time in making the research design as well as setting the pilot study.

In this study, the choice was between probability and non-probability sampling. Under probability sampling, each individual within the entire population has an equal chance of being picked to make up the sample. Often, this probability sampling is stratified to ensure that the sample is made up of an individual from existing groups of the population (Uprichard, 2011). Non-probability sampling involves the use of a convenient quota or a snowball sample (Uprichard, 2011). Therefore, in non-probability sampling all members of the population do not have an equal chance of being picked to make up the sample. In fact, the probability of each individual is unknown as there are no guarantees; as the individuals making up the sample will be made up of people that the researcher believes will contribute most to the study (Wilson, 2014). This was the case in this study: it was cheaper and more time-saving to utilize non-probability sampling with a convenient sample, which acted as a way of ensuring that the researcher would get the data required to make a conclusion in this study as well as answer the research questions. Convenience sampling is defined as a sampling method that utilizes the first available respondents (within a sample) based on convenience (Uprichard, 2011). The benefits include its simplicity, which guarantees easy access to respondents who will enrich the study with necessary data (Etikan et al., 2016). Also, it allows collection of large amounts of data within a short period of time and is cheaper in execution compared to other sampling methods. Therefore, convenience sampling was the best choice for this research because it leads to a sampling process that is focused using criteria that allow relevance to the research goals. More importantly, the researcher's main motivator for this study was a chance to utilize convenience sampling to solve research questions related to ICT networking projects in the UAE. There is no available data on the number of professionals directly involved in ICT network projects. The author assumes the population is less than 10,000. To improve the usage of convenience sampling, the research did not utilize the whole population available in the UAE, but rather selected a sub-set of the population by choosing companies implementing ICT network projects in the public sector. With this as the base, the responses collected through the convenience sampling were increased as all respondents were from the ICT industry. To eliminate bias (inconsistency between actual population and the selected sample), it was ensured that all respondents are related to the ICT industry in the UAE. The sampling error (deviation from the actual sample) was lowered by choosing a high sampling population, thereby allowing it to represent the population. The sampling error was reduced by considering the sampling population to be network professionals only, with confidence interval considered as 95%. The participants were first contacted through the support of the HR department within the respective companies, by sending an email invitation to participate in the study.

4.7.2 Sampling Size

The decision to use non-probability sampling, more specifically convenience sampling, has been discussed in the above section. The next agenda is to determine the right sample size. Sample size is defined as a representative of an actual population in statistical terms wherein the inference derived from the sample is replicated on the population it represents (Wilson, 2014). It is paramount that the study utilizes the right sample size for the results to be considered an accurate representation of the entire population. This is because the idea being sampling is to utilize a smaller; yet perfect representation of the population of study that allows for adherence to budget and time allocated for the study while promising the accuracy of results because it is a true representation of the entire population (Bartlett, Kotrlik & Higgins, 2001). More importantly, the sample size must allow for the resolving of the research questions discussed at the beginning of this project. The main aim is therefore to use a sample that allows accuracy in the generalization of the results as a true reality for the entire population. Often, the utilization of small sample sizes makes it impossible to use statistical analysis on the hypothesis as well as the presented theory dynamics (Martinez-Mesa et al., 2016; Omair, 2014). This study utilizes SPSS statistical analysis to analyze all the data from this conceptualized model study, which will allow for the examination of the factors limiting or promoting ICT networking projects in the UAE. This also means that in order to fully address this goal the researcher must utilize the perfect sample size. Furthermore, the SPSS sampling technique for this kind of study categorizes sample sizes as follows: 100 is poor, 200 is fair, 300 is good, 500 is extremely great and 1000 is excellent. Initially, the estimated number of emails sent with the survey invitation corresponded to 1500 (appx. – based on employee size) of which 209 responses were received. Given the categories from poor to excellent (as discussed above), the sample size of 209 was accepted. This was also supported using factors such as the budget, analysis capabilities, time and, eventually, the need to ensure that the results from this study were considered as an accurate representation of the population. Given the heavy time consumption in collection of the responses and the respondents' unwillingness to participate, 209 was accepted as the sample size, as shown in the table below and the estimated population in the previous section

	Continuous data (margin of error=.03)			Categorical data (margin of error=.05)		
Population size	Alpha = .10, t=1.65	alpha = .05, t= 1.96	alpha = .01, t= 2.58	alpha = .50, t=1.65	alpha = .50, t= 1.96	alpha =.05, t=2.58
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250
500	72	96	147	176	218	286
600	73	100	155	187	235	316
700	75	102	161	196	249	341
800	76	104	166	203	260	363
900	76	105	170	209	270	382
1,000	77	106	173	213	278	399
1,500	79	110	183	230	306	461
2,000	83	112	189	239	232	499
4,000	83	119	198	254	351	570
6,000	83	119	209	259	362	598
8,000	83	119	209	262	367	613
10,000	83	119	209	264	370	623

Table 4.1 Sample size for a given population size from Bartlett et al. (2001)

4.7.3 Questionnaire Method

The questionnaire methodology of data collection is one of the most common methods of data collection considering its simplicity and ease of design. The method is also characterized as a low-cost approach, as well as time saving, all the while guaranteeing the accuracy of results. One of the best benefits of using a questionnaire is the fact that the researcher can code the questions in such a way that makes an analysis of responses easy as well as less complex (Yu & Cooper, 1983; Bird, 2009). The other benefit is that often it is easy to disseminate the questionnaire to the respondents at their convenience within a short time at very little cost. The problem is that the interview method is hard to implement considering that the respondents must find time to attend the interview or the researcher has to travel to where the respondent is, which eventually causes delays as well as increases the cost of the study. Another factor is the possibility of researcher and respondent bias. Often, respondent bias comes from their perception of the person interviewing them, while researcher bias comes from their perception of the respondents on first seeing them. However, with a questionnaire, the process is streamlined by reducing much of the human contact as well as eliminating the bias component, which increases the chances that the responses will be accurate and an accurate representation of the reality. The other factor is the convenience for both the respondents and the researcher: the respondents can complete the questionnaire when they have the free time, while the researcher has the flexibility of using online platforms such as SurveyMonkey to disseminate as well as collect completed questionnaires. This convenience also increases the chances that the entire sample will finish their questionnaire, increasing the amount of data to analyze. The successful use of a questionnaire for a study involves ensuring that the design is simple and easy to comprehend to increase the response rate as well as improve the consistency and accuracy of the collected data. Therefore, the method of disseminating and collecting the questionnaire is an important component when deciding on the design of the questionnaire (Ponto, 2015).

There are two main ways of gathering data using questionnaires: interviewer-completed or self-completed forms. In the self-administered questionnaire, the respondents personally complete and answer questions on the questionnaire based on their own reality, while in the interviewer completed questionnaire the interviewer records the responses on behalf of the respondent. The interviewer-administered questionnaire usually involves the use of telephone interviews or structured meetings with the respondents. The self-administered questionnaire is often online, mailed, intranet mediated or researcher delivered and collected forms. This saves time and cost as well reducing biases. The interviewer-administered questionnaire is time consuming, expensive and introduces the chances of bias. The self-administered questionnaire is more authentic as it contains responses in the respondent’s own words; however, these questionnaires can be difficult to analyze and decode as different respondents have different ways of self-expression, especially when open-ended questions are used. The interviewer-conducted questionnaire is easier to analyze and decode as the interviewer knows exactly what is necessary for terms of responses (Timmins, 2014; Siniscalco & Auriat, 2005; Jones et al., 2013).

This study will utilize online survey questionnaires, as there are many online applications for accurately creating the questionnaire and disseminating it, as well as collecting it, which is often inaccessible in the use of conventional paper questionnaires. Online survey tools such as SurveyMonkey have options such as pop-up instructional boxes, menus, different fonts and a variety of colours, as well as options for font size. Ultimately, the choice of using online surveys apart from the low cost and convenience also provides a rare opportunity to assess a large amount of data from different regions in the UAE, which introduces a variety of opinions in the study (Siniscalco & Auriat, 2005).

Web surveys are also a great option when large amounts of data are necessary as they allow collection and statistical analysis in a single platform, which leads to the production of a general inference for the entire population. They also present a cost-effective way of collecting large amounts of data from a huge proportion of the population at no extra cost, which guarantees the accuracy of results and inferences on the topic of study. Another great benefit is the ease of containing the study as the surveying and the deductive strategy are well linked. The deductive approach in this context begins with the introduction of the theory, development of the hypothesis and eventually the dismissal or approval of the hypothesis (Ali & Birley, 1998; Soiferman, 2010). The positivist ideology is also linked to the survey methodology, which helps to effectively test the theory as well gain an in-depth knowledge and understanding of the phenomena under study (Krauss, 2005). Therefore, while using surveying the choices include telephone, online, postal and direct surveys, but for thesis study, the researcher utilized the online survey method.

The next thing to consider is the fact that survey questionnaires are available in two types, analytical or descriptive. The aim of an analytical survey is to establish the relationship between variables, whilst a descriptive survey acts as a means of determining the phenomena representation at a certain point or in the presence of certain controlled factors (Williams, 2001; Locklear, 2012). The next conundrum to solve is in determining that happens in the five stages of the surveying process. The five stages are: survey designing, pilot testing survey design, modification of questionnaire and sample, data collection and data analysis as the final stage (Czaja & Blair, 2005). Other researchers have condensed these five steps into three steps: sampling, data collection and instrumentation. In this context, sampling denotes choosing a representative sample of the entire population, which then allows for the formulation of inferences from this population and, eventually, the generalization of inferences as a true representative of the entire population. The data collection section discussed before involves choosing the method of data collection as well as the channel by which to implement that method, whether self-administered, direct administration, telephone surveys or use of mail surveys (Sefeiti & Mohamad, 2015). The instrumentation in an important aspect of any study because it determines the quality and accuracy of data from the study, which also allows for responding to the research questions.

This research requires a huge amount of quantitative data to allow for proper statistical analysis and overall generalization of results. Surveys present an effective method that is accurate and saves time, while still ensuring a fast turnaround of responses from a large population sample like in this study. It was also earlier articulated that this research would utilize a positivism ideology with a deductive approach, all of which relate well to quantitative research. This survey will have three main steps, as discussed below: sampling, data collection and instrumentation (Soiferman, 2010). Below is a representation of the research matrix being utilized in this study. The table shows the research matrix for this study showing a summary of the research questions, research objective, data collection method and data analysis method. The data collection column shows the type of data collection utilized in fulfilment of every research question and the corresponding data analysis method.

N	Research Question	Research Objective	Data Collection	Data Analysis
1	What are the components influencing the delivery of ICT (Information Communications Technology) networking projects in the UAE?	To identify the factors influencing the delivery of ICT networking projects in the UAE	Online Survey Questionnaire	Excel
2	What is the association between risks, cost overrun and success of ICT networking projects in the UAE?	To determine how risks and cost overrun are associated or affect the success of ICT networking projects	Online Survey Questionnaire	Excel
3	What role can the UAE play in encouraging successful enactment and implementation of new opportunities, ideas and technology that can add value to the ICT networking project?	To verify and make recommendations on improvements that the UAE government can introduce to encourage adoption and enactment of new ideas and opportunities adding value to the ICT networking projects	Online Survey Questionnaire	Excel

Table 4.2: Research Matrix

4.7.3.1 Instruments

This study will utilize the Likert Scale (Boone & Boone, 2012), which will act as a way of quantifying the responses given to each question by participants. This is a five-point Likert Scale depending on the question asked to the respondent. The questionnaire was designed in a way that allows for the recording of positive as well as negative realities to get a true representation of the thoughts shared by the respondents. These negative and positive questions allow the respondents to think objectively before answering each question, which also increases the accuracy of the results. While questionnaires are a great method of data collection, the success of a questionnaire survey is also determined by the researcher's capability to design and plan the overall research design in a way that guarantees the accuracy and solid responses and reduces chances of ambiguous responses (Soifreman, 2010). The survey also utilized different survey forms. This includes one closed-ended survey, two open-ended surveys, and three sections made up of a mixture of open- and closed-ended questions. Each form of question added to the wealth of the data. The closed-ended forms provide quantitative and numerical data while the open-ended forms are more subjective in relation to the data content (Reja et al., 2003).

Some researcher believes that closed-ended questions are better due to their simplicity and ease of analysis (Friborg & Rosenvige, 2013). However, other researchers believe that open-ended surveys is better because they may lead the researcher to unveil an important but often misunderstood or unrealized factor due to a new revelation of reality (Cakir & Cengiz, 2016). There is no doubt that subjective data from open-ended questions adds value to the research but also presents problems in the analysis of end reports (Singer & Couper, 2017). Considering this aspect, some researchers believe that it is better to include both closed and open-ended questions in a survey, to gain the benefits of each as well as a way of supplementing each other's shortcomings (Singer & Couper, 2017). This revelation was the motivation behind the use of both closed- and open-ended questions in this research. The most common Likert Scale utilized throughout is the five-point scale mentioned earlier, whose ratings are: None=1, Unlikely=2, Likely=3, Highly Likely = 4 and Very Highly Likely= 5 (Sullivan & Aerino, 2013). The usage of open-ended questions also plays an important role in improving accuracy as the respondents can share detailed information on the subject in terms of their understanding and feelings as well as attitudes. This may not be possible through closed-ended questions.

4.7.3.2 Pilot testing

The previous section discussed the value of pilot testing before conducting the actual research as it allows the researcher to confirm the rightfulness of the research design as well as providing a chance to modify the design where need be. It is also a great way for the researcher to assess the validity and the reliability of the data from the questionnaire (Teijlingen & Hundley, 2002). Validity involves utilizing the views of a few experts on the usefulness of the questionnaire, while the reliability looks at the consistency of responses, which helps determine the accuracy of inferences from data before generalization of the results (Gaberson, 1997).

The validation of the questionnaire was conducted using a group of ICT networking professionals with expertise and experience in this sector in the UAE. This included taking the advice and opinion of these ICT networking experts on the clarity and usefulness of the questions, as well as the appropriateness of the layout, and an often-ignored factor – the overall attractiveness of the questionnaire. The attractiveness is important because, when a questionnaire is too technical and long, it is considered as boring, which reduces the response rates.

The responses allowed for the questionnaire to be modified to cater for the issues raised. The revised questionnaire was then utilized in conducting a pilot study involving 50 respondents looking at the clarity of instructions and the correctness of the layout. This was meant to ensure that respondents did not have any problems while completing the questionnaire, because confusion often leads to reduced response rates. This was followed by testing the reliability to guarantee consistency. The most common method is the Cronbach's α model that categorizes reliability as follows: ≤0.90 is excellent reliability, 0.70-0.90 is high reliability, 0.5-0.7 is moderate reliability and ≤0.50 is low reliability (Tavakol & Dennick, 2011).

In this research, the model revealed a reliability score of 0.78 categorized as high reliability. This indicated that the scales used to measure the research constructs in the questionnaire have high internal consistency and are accepted to be utilized for further testing. Minor modifications were made to the questionnaire post conducting the pilot study. These were based on the feedback provided by the respondents on clarity in understanding the statements used. Primarily, the respondents were confused about whether the risks were associated with projects in general or ICT network projects. To address this, the sections were updated with more details on the project type and what was being measured.

4.8 Data Analysis

The data analysis section is sub-divided into various levels. The first level is data cleaning, which categorizes data as usable, outlier or missing values, and is conducted manually. This stage helps identify the data that will be utilized in the analysis. Microsoft Excel was utilized to conduct the next stage of data analysis, which is data screening, to ensure that there was no missing data. This study had no missing data. The next phase was the data testing phase, which involves the use of descriptive statistics to analyze the data collected, including the reliability and validity tests. This was then followed by regression analysis.

4.8.1 Reliability & Validity

Reliability aims to test the unmistakable quality of data which affects the consistency, accuracy and dependability of the outcome in the generalization phase (Gaberson, 1997; Mohammad et al., 2015). One of the benefits of quantitative research is that information is available numerically which makes acquisition of comparative outcomes fairly easy. However, considering that this research also had subjective data, the availability of outcomes using this kind of data is often problematic and complex. This study utilized discriminant validity with the aim of ensuring that the measurement of constructs is representative of conceptualized interest (Swanson, 2014; Bolarinwa, 2015). Discriminant validity testing is conducted using an evaluation of values composed of average variances from two constructs with a squared correlation approximation between this two constructs. To this end, discriminant validity seeks to prove the multiple measures in which constructs are: first, related, and, secondly, how much more they are related to each other than to the measures of constructs (Lehmann, 1988; Hill & Hughes, 2007; Taber, 2017). Internal reliability is tested using the Cronbach's alpha model which assesses the level of consistency of indicators. Cronbach’s alpha model categorizes reliability as follows: ≤0.90 is excellent reliability, 0.7-0.9 is high reliability, 0.5-0.7 is moderate reliability and ≤0.50 is low reliability (Tavakol & Dennick, 2011; Sijtsma, 2009; Henson, 2001). The reliability test for this study gave a Cronbach’s score of 0.78 characterized by high reliability.

4.8.2 Neural Network Analysis

This research uses neural network analysis based on a multi-layer perceptron to analyze the contribution of risk factors to cost overrun. IBM SPSS statistics version 21 was utilized for the development of the neural network in this research study. The process is explained in detail in Chapter 6 section 6.2.

4.9 Ethical Considerations

Ethics are defined as the moral codes and principles that guide the code of conduct in everyday life. From this definition, research ethics can be defined as the regulation and control of a study including mannerisms of reporting (Stahl et al., 2014). According to Stahl et al. (2014), research ethics determines discipline in research as well as the code of conduct in every area of research design. It is paramount to adhere to ethics in research because they act as a means of promoting research aims such as knowledge and truth. Secondly, reach involves the cooperation between different people from varying cultures; ethics helps in the adoption of principles and values that enhance cooperative work.

The third role is to keep the researcher accountable to the public, which in turn helps gain public support. More importantly, ethics in research acts as a motivator for better moral and social values in other areas of life (Stahl, Timmermans & Flick, 2016).

Some of the ethical considerations in research include ensuring that there is no harm to respondents, confidentiality, the right to pull out of the study, anonymity and voluntary participation (Yip et al., 2016; Manton et al., 2014). In this research, all these ethical considerations were taken into account from the beginning, where participants were informed of the objectives of the study. The respondents had their rights to confidentiality as well as anonymity and were free to leave the study at any time. The purposeful code of conduct in this research utilized the University's ethical guidelines. This guideline requires that the researcher and the supervisor sign a research ethics form that is held by the Academic Programme Office. The research began after that office gave its approval for the study.

4.10 Research Limitations

It is inevitable that there will be some research limitation in a piece of research. In this study, most of the limitations were accrued from the use of quantitative research. The first is the fact that quantitative research, due to its statistical nature, usually requires a large sample size. While the researcher attempted to include a sample size that was viable in terms of budget and time frame, the sample size was still less than ideal. This could explain the reason why the reliability and validity scored were lower than the highest score of excellent. The danger with this limitation is that it could lead to miscalculation of the distribution of probabilities in the population, meaning that the research would lack accuracy. The second limitation was the lack of resources to conduct proper and extensive research due to budget and time constraints; another factor was difficulties in accessing the professionals who would be utilized in this research as respondents.

The utilization of online surveys gradually reduced the budget and time constraints; however, the challenge of cost was still experienced throughout as a determining factor even on the sample size the researcher could utilize. While the research attempted to record the actual situation on ICT networking project in the UAE by use of both open and closed-ended questions in the survey.

The use of closed-ended questions still limited the respondents in the number of answers they could give, which indicates a possibility of limitation in terms of response and hence reduced accuracy. Overall quantitative research is still more time consuming and expensive as compared to other forms of research. Additionally, there is often difficulty in data analysis, especially in this case, where the researcher incorporated subjective data through open-ended questions. While this added to the accuracy of the data it also increased the complexity and difficulty of analysis (Sudeshna & Datt, 2016; Choy, 2014; Atieno, 2009).

5 RESULTS

5.1 Introduction

In the UAE, there is much scope for technological advancements as the economy is diverse and is focused towards increasing the business of the region. It has been observed that companies with global presence are setting up offices here. However, these global companies require a standardized technologically-charged environment wherein all their global processes can be streamlined. In recent years, the government has taken steps to make the country more technologically advanced wherein all its processes are being updated and there is more interest in e-services. Furthermore, the government is building the necessary infrastructure for ICT network adoption and implementation for all businesses and users to benefit from this. However, there are many issues in the adoption of ICT and therefore it is vital to identify the risks that cause the slowdown, delay and often failure of ICT network projects. To study the same, the researcher carried out a survey and gathered the results, based on which a discussion is built and, in the next chapter, a framework will be developed based on these findings.

This chapter provides the detailed results of the survey conducted for the purpose of identifying those risk factors that influence the delivery of ICT networking projects in the UAE. For the purpose of this study, after conducting a literature review, a survey was carried out with closed-ended questions administered to 209 participants within the UAE. All the participants are in the field of technology and are associated with ICT programs and thus have a better understanding of the risk factors that affect the adoption and implementation of ICT projects in the UAE. The questionnaire was prepared to address the various risk factors in the fields of planning and development, operations, technology and hardware, and people and management. The literature review in the previous chapters revealed that these are the main categories that are marred by risk factors that influence the ICT implementation and adoption process. The collected data helped to infer the various risk factors and their effects on the various ICT processes. It is important to note that all of these factors have a varying degree of effect on the adoption and implementation of ICT projects; however, a few of them have a greater influence and thus these factors are assessed in detail in the discussion section. The identified factors will help to develop a framework which can be utilized by future researchers as well as implementers during ICT adoption. The present section not only studies the risk factors but also looks to find relationships between risks, cost overrun and success of ICT networking projects. After presenting the results, the neural network analysis is presented in the next chapter followed by the regression analysis.

5.2 Demographics

5.2.1 Profession

For the purpose of this study the researcher approached 209 participants, all working at various levels and positions in the IT and systems departments. Out of the 209 participants, 105 participants worked as IT Managers, 73 as Systems Managers, 15 as Systems Engineers and 16 as Operations Managers. Thus, the researcher ensured that the sample size was chosen from a diverse group of individuals, but all belonging to the IT and Systems departments, so that there is a clear understanding of the importance of the research that is being conducted and also so that the individuals are able to provide better and more articulate responses that will improve better research.

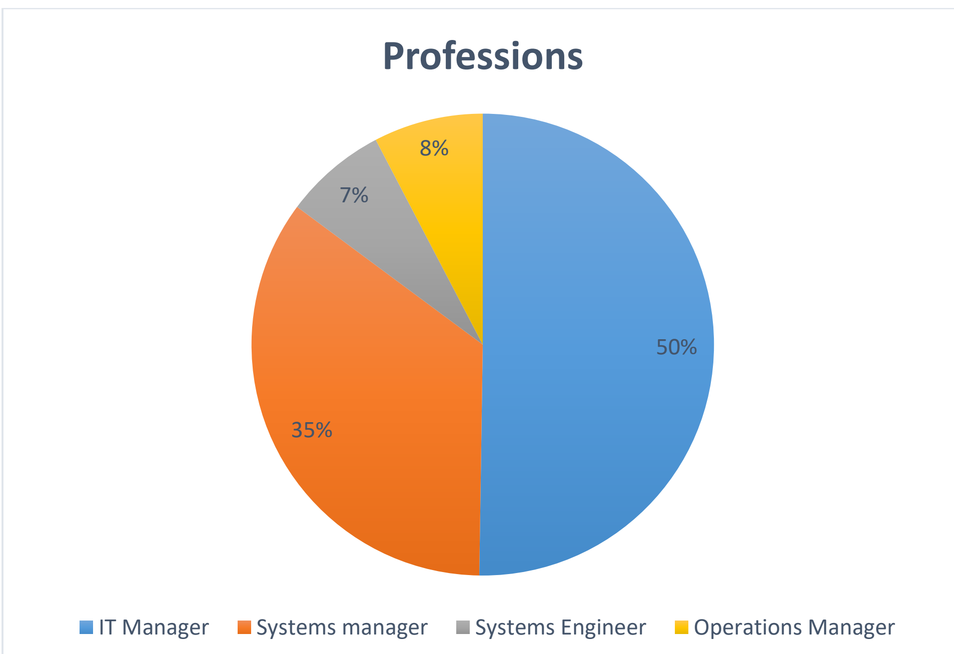

Figure 5.1: Professions

5.2.2 Gender Demographics

Out of the 209 participants, 194 were male and 15 were female. The ratio of gender demographics is skewed in favour of the males as 92.8% of the respondents were males while a mere 7.2% were females. It is also important to note that when the researcher approached a few women professionals for the survey they refused to be part of it and thus the researcher was able to collect responses from very few women participants.

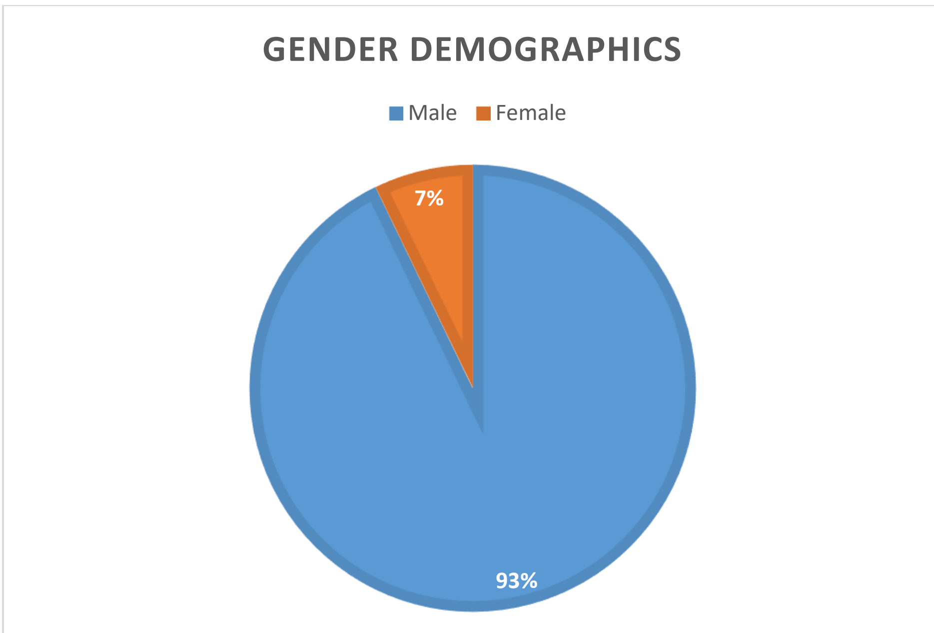

Figure 5.2: Gender Demographics

5.2.3 Work Experience

The participants were asked about their total years of experience as working professionals. A high number of participants (105) had a total work experience of 16 to 20 years, 73 had more than 21 years' experience, 16 people had 11 to 15 years' experience and the remaining 15 had eight to 10 years of experience. Thus, for this study, the researcher was able to gain inputs from highly experienced professionals.

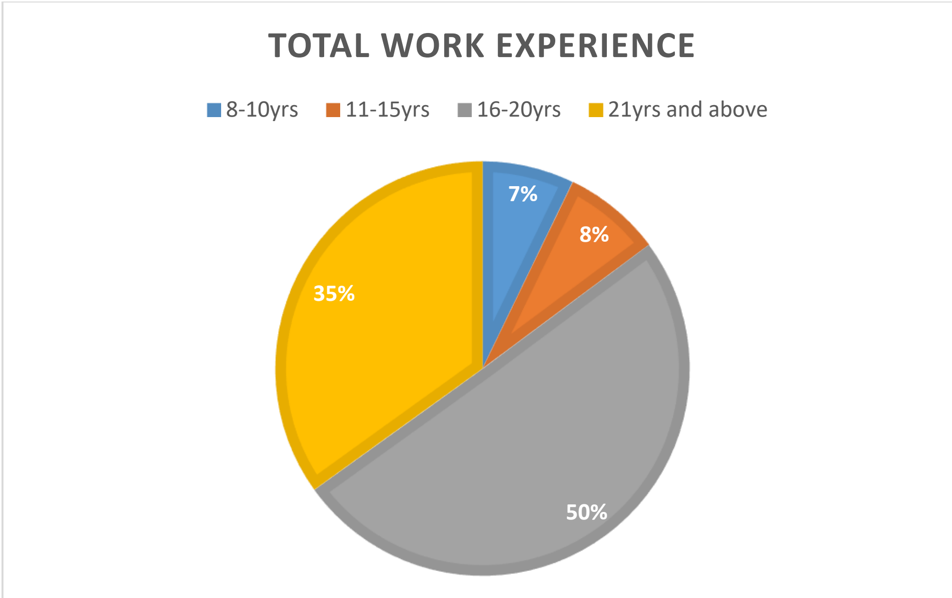

Figure 5.3: Total Work Experience

5.2.4 Years of Experience in the Current Position

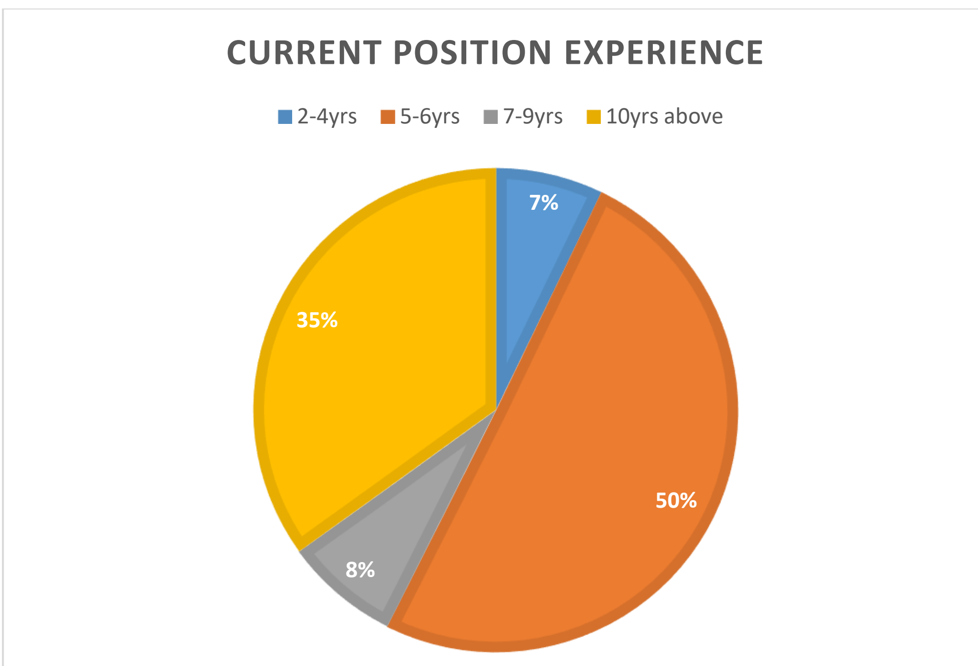

Figure 5.4: Current Position Experience

Further, the participants were asked how long they had been in their current position: 105 respondents selected five to six years, 73 respondents selected 10 years and above, 16 selected seven to nine years and 15 selected two to four years. This further corroborated the fact that, for the purpose of this research, inputs were sought from highly experienced and expert professionals who were well aware of the risk factors, influencers and causes of cost overruns. By choosing to conduct a survey with such professionals, it was ensured that authenticity is always maintained and the received responses act as vital data.

5.2.5 Qualification Levels

In order to gauge the qualification levels of the professionals with whom the researcher was set to correspond, enquiry was made about their highest qualification level. Out of the 209 respondents 152 respondents had completed their master's degree, 24 had a bachelor's, 17 had acquired a PhD and 16 had diploma education (Figure 5.5).

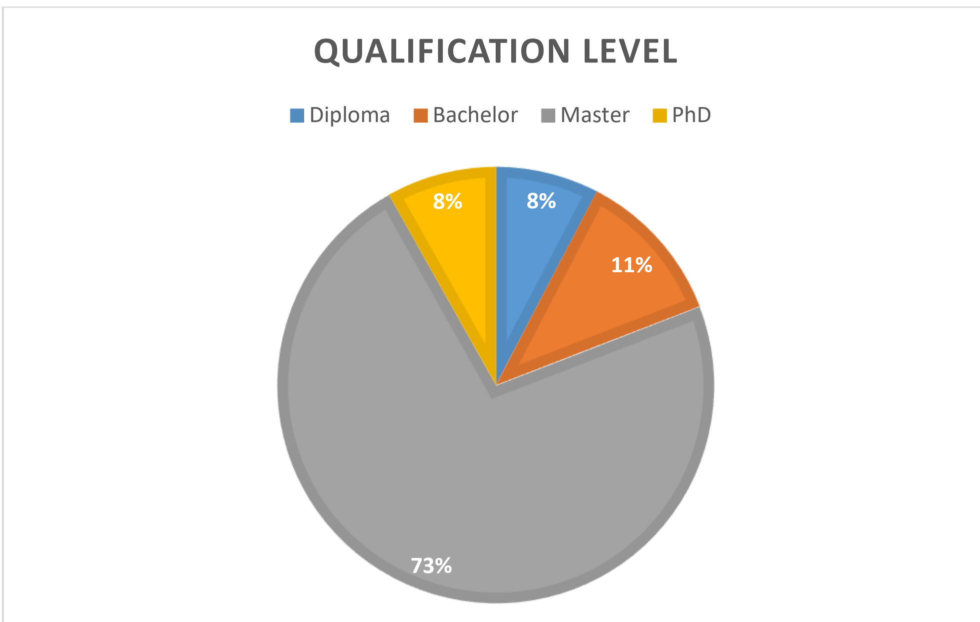

Figure 5.5: Qualification Level

5.3 Influence of Risk Factors on ICT Network Projects Cost Overrun

To be able to understand the impact of the risk factors and what the respondents deemed to be major factors, questions were posed to the respondents on a Likert Scale of none, unlikely, likely, highly likely and very highly likely. In this research, likely, highly likely and very highly likely have been deemed as an indication of agreement and thus they have been utilized to judge the influence of risk factors. Although very highly likely indicates a certainty, likely and highly likely have also been considered as indicating agreement with the statement.

5.3.1 Planning and Development Risks and their Influence on the Cost of ICT Network Development

The respondents were asked to rate the factors under this category on the basis of the likelihood of planning/development risks having an effect on the development of ICT networks. While all the mentioned factors under this category were considered to have a significant effect on the ICT network adoption and implementation, certain factors were thought to be of substantial importance. The responses received for the planning and development risks are shared in Table 5.1 below. Out of the 38 factors outlined, the majority of respondents considered 'human resource mismanagement', 'procurement mismanaged', 'inadequate project communication' and 'business requirements not understood' to be the most important. These factors have a profound effect on the business processes linked with ICT networks. Out of 209 respondents, 200 (95.7%) considered 'human resource mismanaged' as a likely risk factor while 9 (4.3%) considered it to be highly likely. This clearly depicted that, when there is mismanagement of human resource during the ICT adoption and implementation process, it results in failure of the implementation process. Human resource constitutes the manpower of the organization that will enable the smooth transition from the existing systems to the ICT systems. When these are not managed properly, it results in improper implementation of ICT networks.

In the same manner, another major factor identified by the respondents was procurement mismanagement: 192 (91.9%) respondents considered it to be a likely contributor while 17 (8.1%) considered it to be very likely to result in ICT network development failure. Procurement does not only relate to the obtaining of the right resources but also includes capable management. Furthermore, the participants were of the opinion that, when the business processes are not well understood at the start of the ICT network implementation, it leads to unfinished processes, thus causing delays and increase in costs. In Figure 5.6 it can be observed that 96 people considered this factor as a likely and highly likely factor while 17 thought it was a very highly likely risk factor.

Planning and Development Risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
1. Project scope not understood	0	0	40	105	64
2. Business requirements not understood	0	0	96	96	17
3. Missing or inadequate project charter/project initiation document (PID)	0	0	78	26	105
4. Inadequate management of or missing business case	0	0	96	75	38
5. Failure to align project scope with organization or business strategy	0	0	93	86	30
6. Initial current state not understood	16	9	145	39	0
7. Budget not adequately estimated or planned	0	0	109	34	66
8. Budget not provided or budget withdrawn	0	0	94	65	50
9. Risks not properly analyzed or mitigated	0	0	76	74	59
10. Unrealistic schedule at start of project	0	0	154	24	31
11.Unclear project responsibilities	0	0	89	69	51
12.Contractual or legal risk not understood	0	0	40	136	33
13.Technical risks not analyzed or mitigated	0	0	150	42	17
14.Unsuitable system development lifecycle/process	0	0	133	44	32
15.Inadequate project planning	0	0	115	43	51
16.Inadequate resource planning	0	0	120	27	62
17.Inadequate project communication plan	0	0	70	104	35
18.Testing not planned properly	0	0	72	62	75
19.Project rejected because of inadequate business continuity planning	9	25	146	12	17
20.Unable to secure an implementation partner	0	0	167	17	25
21. Stakeholders mismanaged or not identified	0	0	107	59	43
22.Contractors/vendors mismanaged	0	0	123	42	44
23.Plan rejected by business	16	9	143	41	0
24.Inadequate understanding of project benefits	0	0	149	25	35
25.Changes to business requirements during the project	0	25	81	48	55
26. Changes to scope during the project	0	0	116	48	45
27. Quality mismanaged	0	0	77	60	72
28.Human resource mismanaged	0	0	200	9	0
29.Procurement mismanaged	0	0	192	17	0
30.Time/schedule mismanaged	0	0	180	16	13
31.Delayed on approval	0	0	191	18	0
32. Inadequate project management	0	0	142	25	42
33.Insufficient human and financial resources	0	0	41	134	34
34. Inadequate management of project development lifecycle/process	0	0	117	41	51
35.Delays in external approvals or decision making	0	0	90	81	38
36.Inadequate testing	0	17	133	42	17
37.Inadequate planning for migration from old to new system/network	0	0	200	9	0
38.Training not planned or conducted adequately	0	0	167	17	25

Table 5.1: Planning and Development Risks

It is also vital to note that 'inadequate resource planning' was also identified as a factor wherein 120 (57.4%) respondents considered it to be a likely risk factor, 27 (12.9%) thought it was highly likely and 62 (29.7%) thought it was a very highly likely risk factor for the successful implementation of ICT networks. Resources need to be distributed equally during the various phases of adoption and implementation of ICT networks in order to ensure there is no disruption and the cost is controlled throughout the process (Nawi, Rahman and Ibrahim, 2012). Resources may be in the form of finances, components or even knowledge. In order for the various processes of ICT implementation to run smoothly, resources play a vital role.

When there is lack of resources, these processes may halt completely, thus causing a failure in the implementation of the ICT networks. Mismanagement in quality was another factor identified by the respondents as a risk factor: 77 (36.8%) respondents considered it to be a likely factor, 60 (28.7%) considered it to be highly likely, while 72 (34.4) respondents considered it to be a very highly likely risk factor. This indicates that maintaining quality throughout the adoption and implementation process is imperative. Quality management should not be limited to the physical components of the ICT networks but also the processes which become a part of the network should follow certain quality routines. Furthermore, it remains the duty of the top management to ensure that important quality checks are carried out whenever deemed necessary. When there is mismanagement of quality, it results in sub-standard processes which may then face problems during the implementation phase.

An important factor that was identified by the respondents and which requires due diligence of the authorities is 'budget not adequately estimated or planned'. The survey revealed that 109 (52.2%) participants agreed that it was a likely risk factor while 34 (16.3%) felt it was a highly likely risk factor and 66 (31.6%) respondents considered it to be a very highly likely risk factor that could affect the cost of ICT network delivery in the UAE. Such inadequate estimation of cost can prove to be detrimental to the ICT network implementation process. Researchers Nawi, Rahman and Ibrahim (2012) have observed that, when there is no proper management of resources and inadequate budget planning, it leads to cuts in the budget at a later stage of ICT implementation. This then results in failure of the project. Therefore, it is extremely vital that budget planning and distribution of resources are performed before the adoption and implementation of ICT projects to ensure that the process of implementation is smooth, without any hurdles and barriers.

Communication is a vital tool not just within the company module but as a way to clearly project the ICT network adoption and implementation strategy to employees and other stakeholders. According to the responses received from the survey, 70 (33.5%) respondents agreed that it was a likely risk factor, 104 (49.8%) considered it to be high likely, while 35 (16.7%) respondents considered it a very highly likely risk factor. It is extremely important to communicate the latest happenings of the implementation process including the activities and scope, along with the objectives of the project. The channels of communication between stakeholders, employees and management should be easy (Jorgenson and Vu, 2016). Furthermore, it is also vital that regular updates about the project are provided, so that each stakeholder and employee is aware of their role and responsibility towards the successful adoption and implementation of the ICT networks.

In the below figures 5.6, 5.7 and 5.8 the respondents' replies are depicted and the frequency of each variable. It is important to note that all the 38 factors listed under this category have been identified by the respondents as having a significant impact on the ICT adoption and implementation process. All these factors have been identified by the respondents to be risk factors, affecting the implementation process of ICT networks. Thus, if the UAE wants to embrace ICT networks completely in all its public institutions and organizations, it is important to consider the below listed factors and analyze their impact on the adoption and implementation process. As can be observed in Table 5.1, these factors have a significant impact on the ICT network process and thus addressing them would be pertinent.

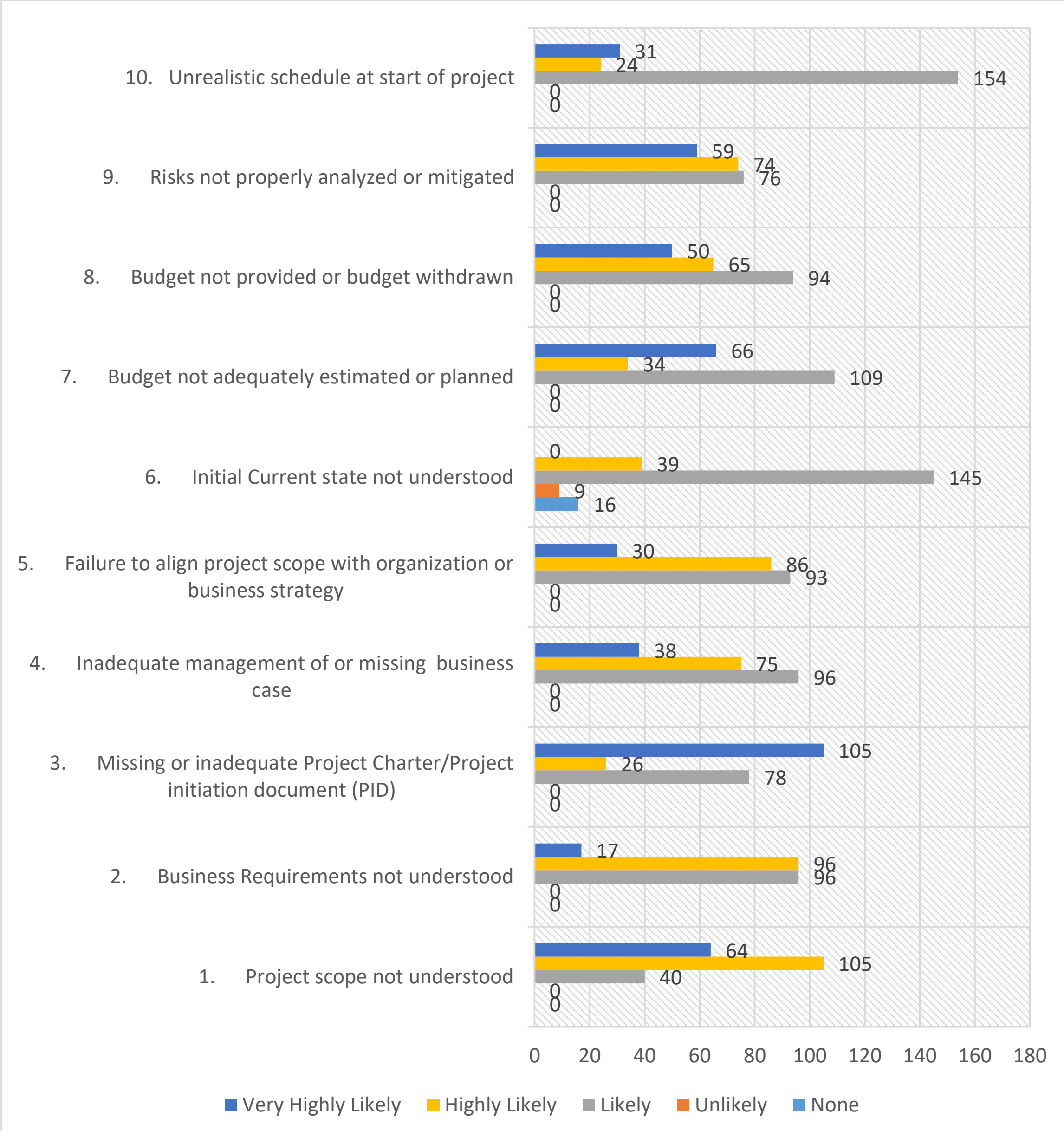

Figure 5.6: Planning and Development Risk Factors (A)

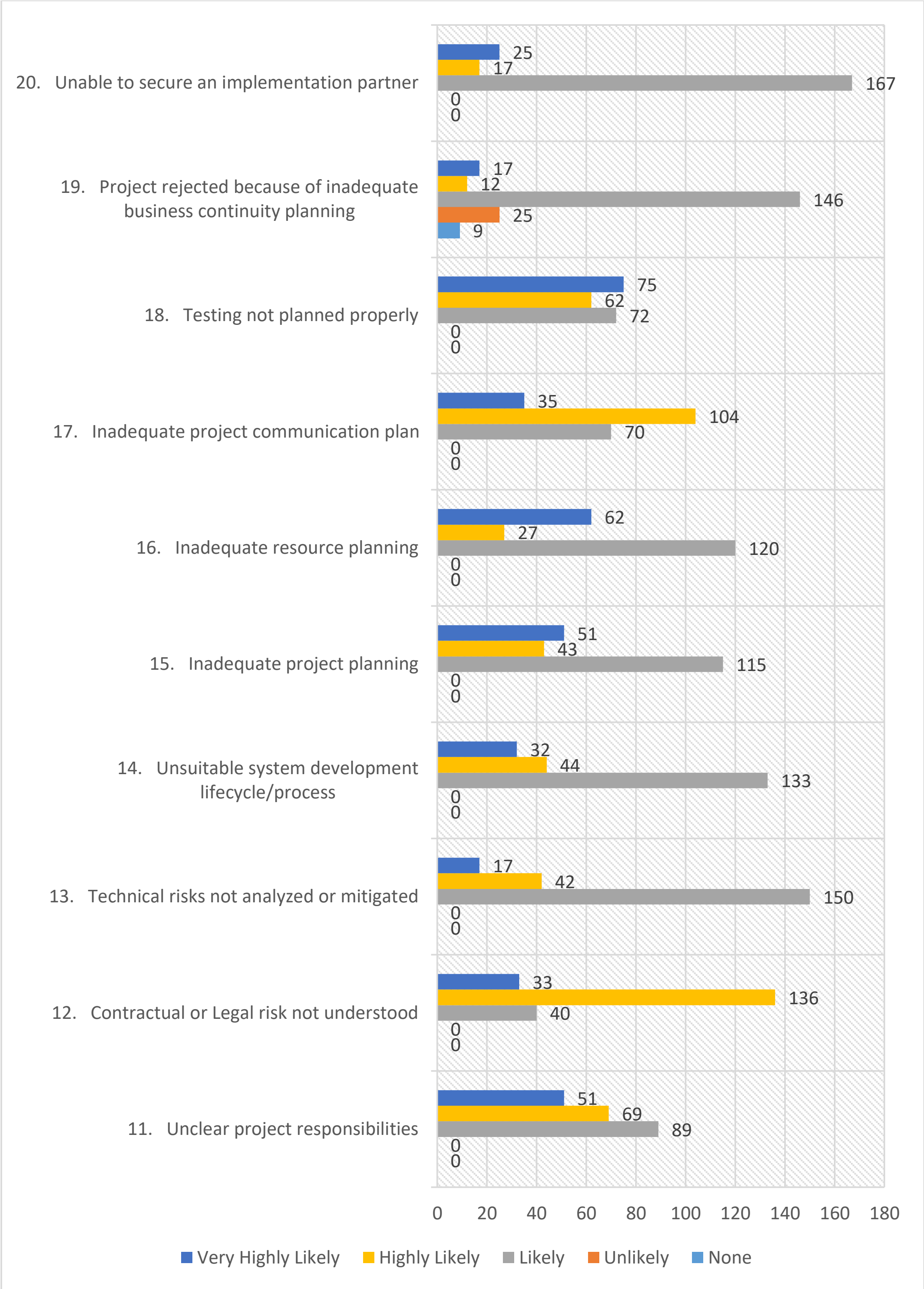

Figure 5.7: Planning and Development Risk Factors (B)

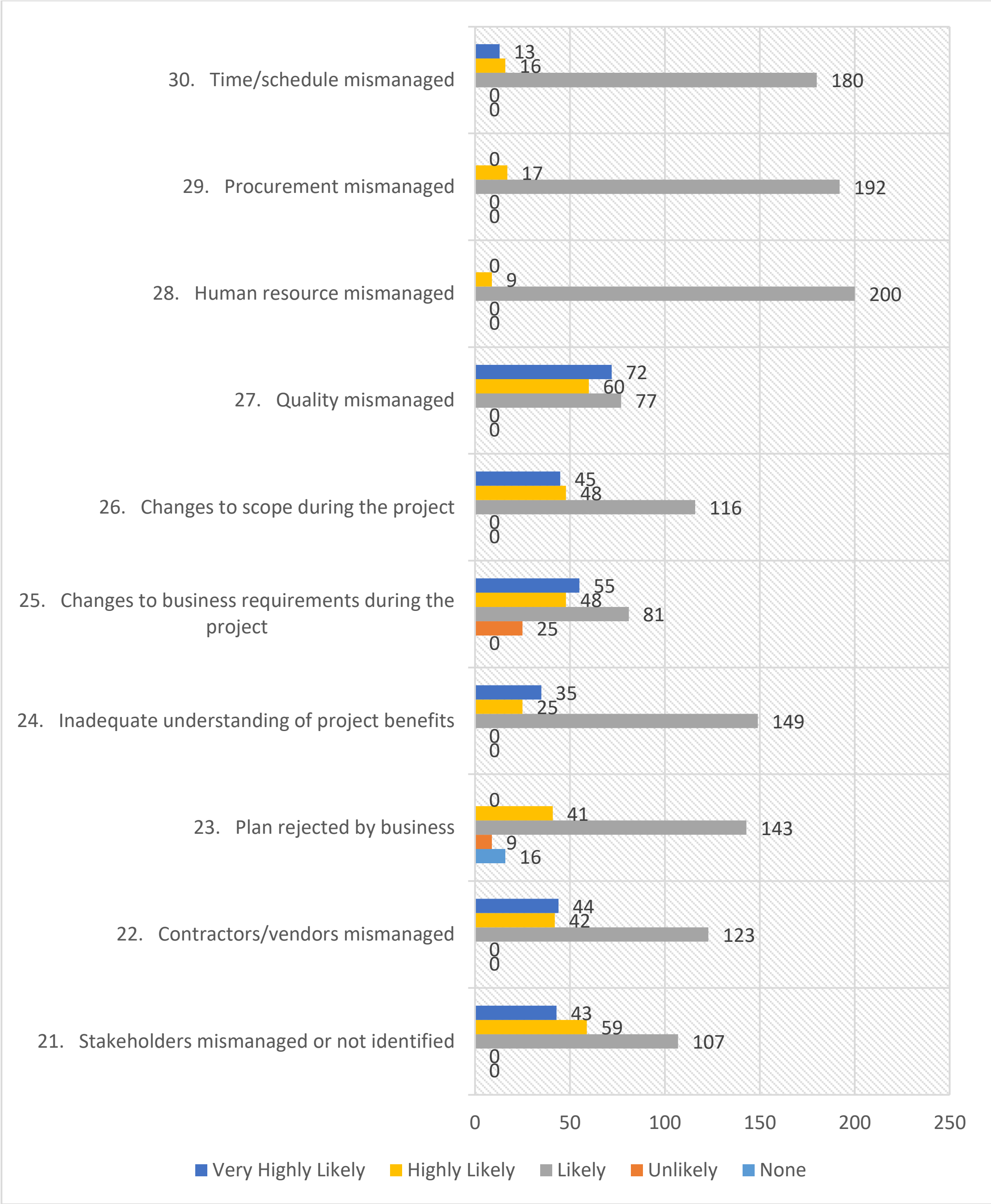

Figure 5.8: Planning and Development Risk Factors (C)

5.3.2 Technology and Hardware Risks and their Influence on the Cost of ICT Network Development

Under this category, the researcher listed 15 different risk factors that may be detrimental to the implementation process of ICT networks in the UAE. From the 15 factors, respondents identified a few factors as having a significant impact while the impact of the remaining factors was not extreme and thus could be addressed by organizations before the start of the adoption and implementation process. It was also noted that these factors can significantly increase the cost of development of ICT networks in the UAE and therefore they need to be addressed on a priority basis. From amongst the listed factors, the major factors identified by the respondents are: 'failure to address integration with existing technologies', 'failure to address the integration of components within the project', 'failure to provide supporting infrastructure on time', 'technology failures caused by unstable project team' and 'technical failures caused by quality mismanagement'. The responses received for the technology and hardware risks are shared in Table 5.2.

Technology and Hardware Risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
1. Failure to address integration of components within the project	0	0	109	55	45
2. Failure to address integration with existing technology	0	0	24	173	12
3.Inadequate or incorrect design	0	0	121	71	17
4.Incompatibility of new with existing technology	0	0	128	47	34
5.Information security not properly addressed or understood	0	0	119	75	15
6.Technical complexity not understood	0	0	103	72	34
7.Technology not meeting the business requirements	0	0	192	17	0
8.Use of unproven technology	0	0	150	46	13
9.Inadequate or missing development tools or environment	0	0	107	40	62
10.No support from manufacturer	0	0	141	44	24
11.Technical failures caused by quality mismanagement	0	0	90	84	35
12.Unexpected technology failures	15	9	98	62	25
13.Technology failures caused by unstable project team	0	0	184	9	16
14.Failure to provide supporting infrastructure on time	0	0	183	26	0
15.Failure to take account of operating conditions (harsh physical environment)	0	0	120	74	15

Table 5.2: Technology and Hardware Risks

Technology forms the core of any ICT network and thus, when the technology requirements are not met, this leads to disruptions and improper implementation of ICT networks. Identifying this fact, 24 (115%) respondents noted ‘failure to address integration with existing technologies’ as a likely risk factor, 173 (82.8%) noted it as highly likely and 12 (5.7%) as a very highly likely risk factor. This indicated that respondents are aware that when there is lack on integration between the new and existing systems it leads to unnecessary delays and disruptions. Furthermore, the new systems may be complicated and not very easy to understand, and thus training for employees becomes mandatory. It is important that, before the transition to a new system, employees and stakeholders be provided with a walkthrough of the new system, its functioning and its benefits along with the challenges in order for them to gain a comprehensive understanding. At the same time, the new system should be well integrated with the existing systems to ensure that the vital components of the old systems are retained. In the absence of these steps, there is limited understanding of the new system and it can lead to difficulties in use of the technologies. When the technology is not utilized to its full potential, it does not yield the desired results, thus ultimately causing a failure of the new ICT network. It is therefore vital that management takes the necessary steps to ensure that there is integration of the old and new technologies.

In case of the factor ‘failure to address the integration of components within the project’, 109 (52.2%) respondents considered it to be a likely risk factor, 55 (26.3%) deemed it to be a highly likely risk factor and 45 (21.5) considered it to be a very highly likely risk factor affecting the cost of ICT network delivery in the UAE. In recent years, a growing number of organizations, both public and private, have been working towards increasing their online presence and inculcating ICT systems within the business processes. This does not just help to streamline functions, but also increase performance. However, in order to increase the level of adoption of ICT networks, it is important that there is integration of the components with the project as it is these components that make up the ICT systems, and when there is lack of integration it leads to issues with the growth of the organization. Easy adoption of the ICT systems is not possible and therefore it is vital that the adoption process be carried out in phases wherein each component within the project is integrated within the ICT network. When this is achieved it will result in a seamless transformation to the ICT network, with minimal data and information loss.

Well-developed infrastructure is a very important factor for successful adoption of ICT systems. It is important to build a secure platform for sharing of information and for the transition towards the new system. The infrastructure building phase is targeted towards rapid exchange of information. In the absence of a well-defined infrastructure, there is difficulty in the transmission of information and it may also lead to failure in successful adoption of ICT networks. Due to these reasons, 183 (87.6%) respondents considered ‘failure to provide supporting infrastructure on time’ to be a likely risk factor, while 26 (12.4%) considered it to be a very likely risk factor that may impede the development of ICT networks in the UAE. Physical infrastructure for ICT networks comprises high-speed computers, cables, related hardware components, power connections and the availability of high-speed internet. When these components are absent, it results in delays which in turn lead to increased costs. When costs rise much higher than the anticipated budget, in the result is failure to adopt and implement ICT networks. It thus becomes vital to ensure that the infrastructure is in place before the onset of ICT network integration.

As mentioned earlier, technology plays an important role in the successful implementation of ICT networks; however, if the technology is not up to date with the modern requirements of the ICT networks it may result in failures. It is thus the responsibility of the project team to ensure that in every manner the organization is ready for the adoption of the ICT. It is due to this reason that ‘technology failures caused by unstable project team’ was considered to be a likely risk factor by 184 (88%) respondents and highly likely by 9 (4.3%) respondents, while 16 (7.7%) considered it a very highly likely risk factor. This shows that, if there are technological failures at any point of the adoption and implementation process, it could result in failure. Thus, it becomes necessary to take all the necessary precautions, which includes backing-up data and having professionals on site who would ensure that the integration process is seamlessly carried out.

ICT programs are developed and implemented in complex technological environments; they are mainly technology focused and thus it becomes imperative to maintain quality throughout the process. To be able to handle the changes that come about with the ICT integration, it is vital that the employees be ‘re-skilled’ with the changing technology. Respondents therefore noted that ‘technical failures caused by quality mismanagement’ was a risk factor affecting the implementation of ICT networks in the UAE. Out of 209 participants, 90 (43.1%) respondents deemed it to be a likely risk factor, while 84 (40.2%) considered it to be highly likely risk factor and 35 (16.7%) respondents believed it to be a very highly likely risk factor. Respondents are aware that technology is the basic component of any ICT network and thus, when there is quality mismanagement in that sphere, it leads to failure of ICT network implementation.

Apart from these factors, all the other factors in this category had varying degree of likeliness to cause failure in the ICT network development in the UAE. Thus, each of these factors need to be reviewed while the ones discussed above should be addressed immediately. In Table 5.2, the responses can be seen while figures 5.9 and 5.10 present the results of this category in an easy to understand format.

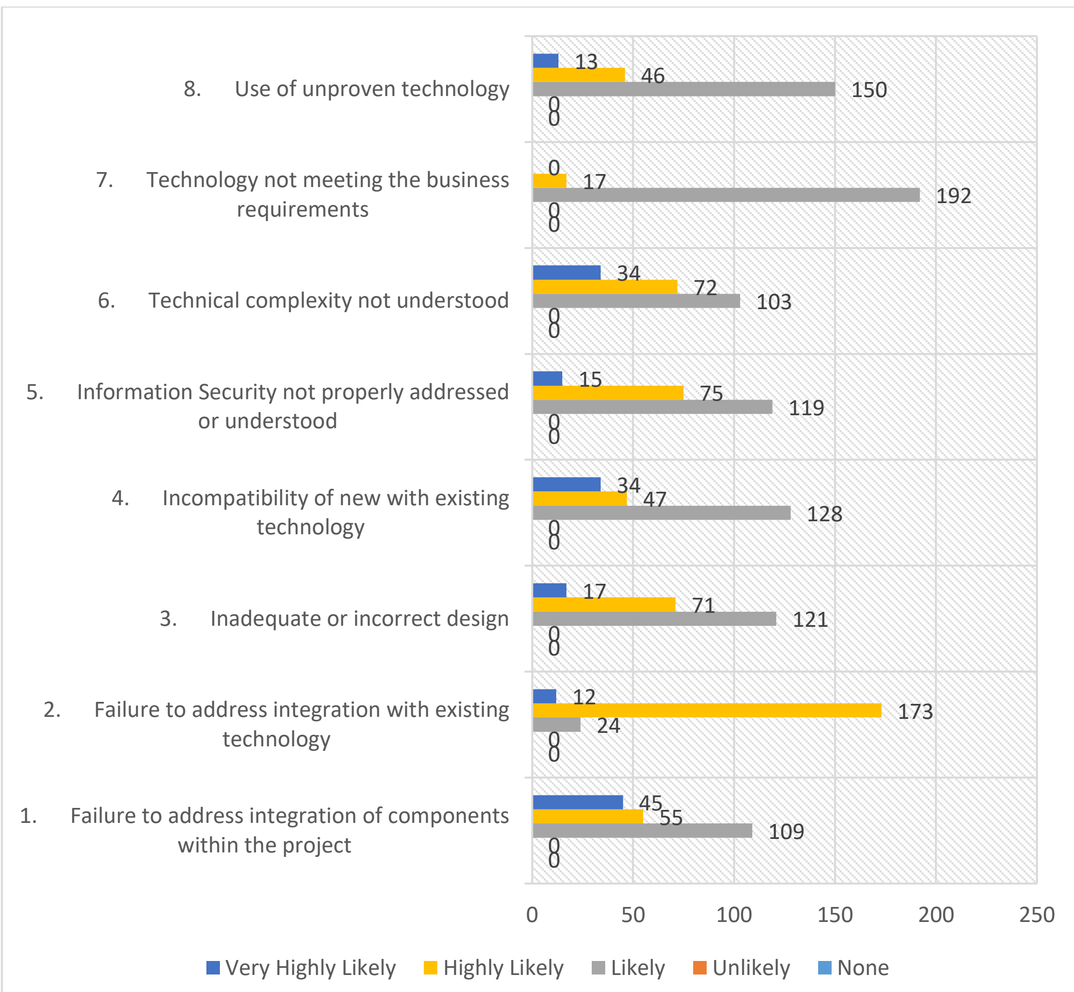

Figure 5.9: Technology and Hardware Risk Factors (A)

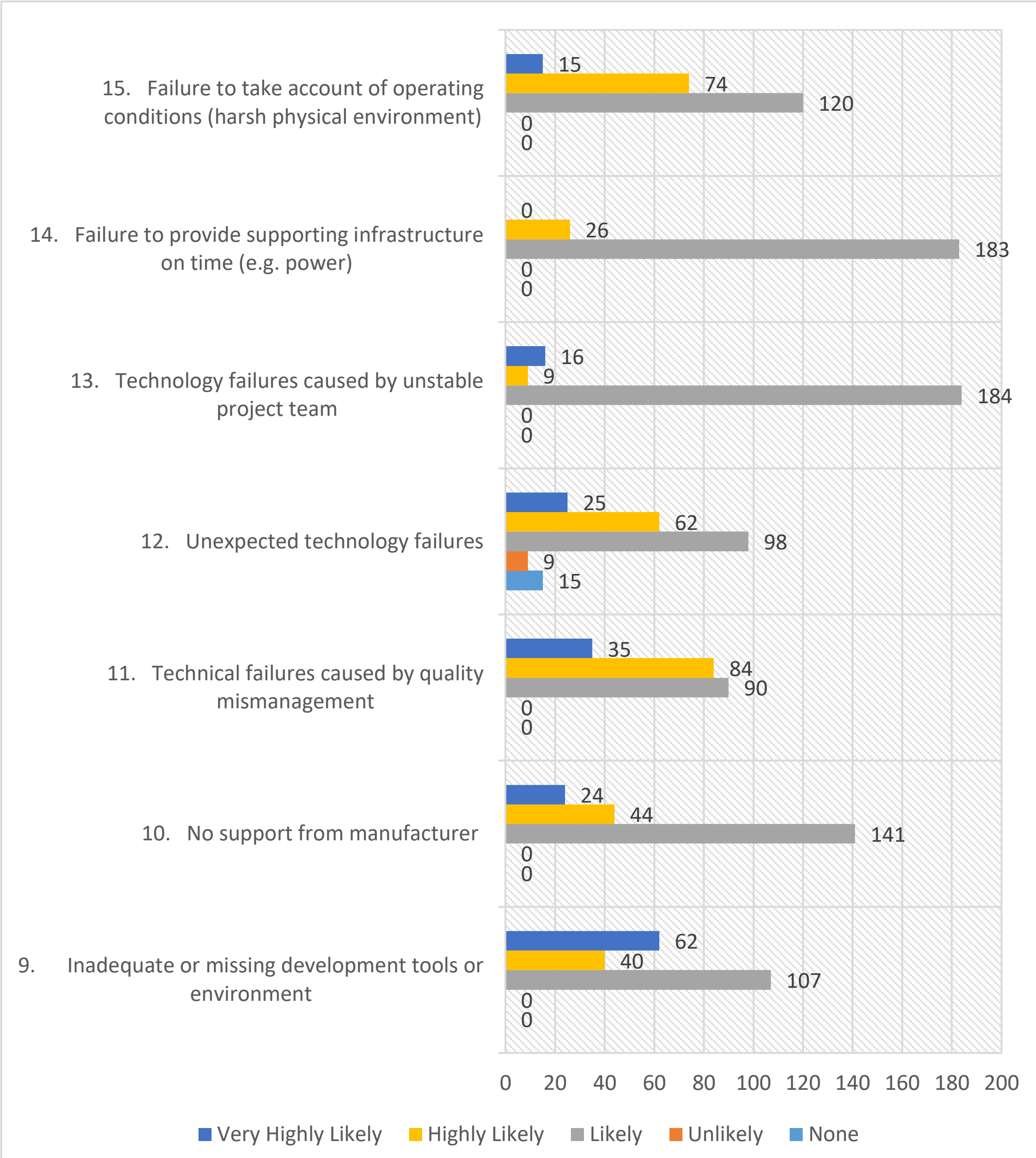

Figure 5.10: Technology and Hardware Risk Factors (B)

5.3.3 Operational Risks and their Influence on the Cost of ICT Network Development

Operations that form a part of the ICT network should be aligned to integrate easily with the ICT and the existing old systems. This leads to many complexities and thus ultimate failure of the ICT implementation. Therefore, 18 factors were listed under this category and the respondents were asked to identify the risk factors that may cause delays and increased costs in the delivery of ICT networks in the UAE. The participants identified ‘inadequate design leading to operational failure of the network’, ‘instability of the delivered network’, ‘failure to address environmental impact on network', 'operational problems caused by poor implementation' and 'change in operation processes and polices'. All these operational risks as identified by the respondents can cause not just delays and increase in cost but in many cases a complete failure of the ICT network implementation. The responses received for the operational risks are shared in Table 5.3.

Operational Risks	**None**	**Unlikely**	**Likely**	**Highly Likely**	**Very Highly Likely**
1.Operational problems caused by poor implementation	0	0	103	47	59
2.Instability of delivered network	0	0	197	12	0
3.Inadequate budgeting for maintenance and support	0	15	111	38	45
4. Inadequate requirements management leading to operational failure of the network	0	0	132	77	0
5. Inadequate design leading to operational failure of the network	0	0	26	166	17
6. Failure to properly migrate from old to new network	0	0	91	68	50
7. Inadequate training leading to operational failure of the network	0	0	136	56	17
8. Inadequate testing leading to operational failure of the network	0	0	37	96	76
9.Market development pace rendering products obsolete	0	0	127	39	43
10.Changes to business requirements after network delivery	0	9	176	24	0
11. Inadequate monitoring of the network/system	0	0	126	42	41
12.Changes in operation process and policy	0	0	196	13	
13.Poor management of third parties necessary for network operation	0	0	98	60	51
14.Failure of third parties to deliver necessary services for network operation	0	0	140	54	15
15.Organizational changes leading to operational problems	0	49	143	17	0
16.Inadequate change control after delivery	0	172	15	22	0
17.Inadequate operational processes	0	0	130	35	44
18. Failure to address environmental impact on network (harsh conditions, vermin damage etc.)	0	0	26	132	51

Table 5.3: Operational Risks

Design of the ICT networks and infrastructure should be such that it is able to easily integrate with the existing business processes. In the opinion of 26 (12.4%) participants, 'inadequate design leading to operational failure of the network' is a likely risk factor, while it is a highly likely factor for 166 (79.4%) respondents and a very highly likely risk factor for 17 (18.1%) respondents. When the design of the networks is faulty, it causes a complete failure of the ICT network; this is mainly because it is not able to integrate, and often during its operation it may stop running or cause disruption. Such a faulty and inadequate design also leads to higher costs as it needs to be redesigned and re-engineered to ensure it functions smoothly.

'Instability of the delivered network' is another factor identified by 197 (94.3%) respondents as a likely risk factor and by 12 (5.7%) respondents as highly likely. This relates to the continuous disruptions, outages and shutdowns of the ICT network. Such a poorly designed network leads to increased costs as more technology needs to be used to not only rectify the faults but also ensure that these faults do not keep recurring. It is important to note that these faults and instability are not only caused due to faulty designs but may also be due to the network not being able to meet the requirements of the organization, inadequate training to the staff or inability to integrate with the existing systems (Leydesdorff and Wijsman, 2007). Thus, this results in delayed implementation and increased budget. Therefore, it is vital to first completely test the new network and then begin its usage throughout the organization.

In a number of cases, the management overlooks the important part played by the environment during the set-up of the ICT networks. Environmental factors relate to the climatic condition and the presence of vermin and other pests. While it might seem like an insignificant point, the fact remains that many large-scale ICT projects have been severely affected due to environmental conditions which were not accounted for by the management. Therefore, 26 (12.4%) respondents were of the opinion that 'failure to address environmental impact on network' is a likely risk factor, while 132 (63.2%) respondents considered it to be a highly likely risk factor and 51 (24.4%) thought it was a very highly likely risk factor that could affect the ICT implementation process. Thus, it is vital for management to keep the environmental conditions such as heat and humidity, storage condition of the hardware and computers, presence of any vermin or any other pests, etc., in mind and commission the designing of the ICT network in such a manner that these environmental effects do not affect the network.

‘Operational problems caused by poor implementation’ is a risk factor chosen by 103 (49.3%) as likely to cause ICT network implementation issues, 47 (22.5%) respondents considered it highly likely and 59 (28.2%) as very highly likely. This refers to the fact that, when the implementation process is not overseen by experts, it leads to poor implementation; such poor implementation results in issues in the ICT network leading to disruptions and increased costs. Thus, it is vital that experts oversee the entire adoption and implementation process to ensure that there are no incongruities during the process.

For the implementation of ICT networks, management have to draw out certain procedures and policies which address the various phases of the implementation process while also allocating the resources. These policies help in the smooth transition as well as integration of processes and also help to adhere to the conceived budget. Any changes in the operation processes and policies lead to slowdown of the implementation process while also increasing the costs. In some cases, they may also lead to complete failure of the ICT networks. Thus, ‘change in operation processes and polices’ was accounted as a likely risk factor by 196 (93.8%) respondents and highly likely by 13 (6.2%) respondents. This indicates that it is vital that the policies and procedures of operation are in place and not changed so that all the components of the ICT network are able to function in harmony. The other factors and the responses of the 209 participants are noted in Table 5.3 while they are represented graphically in figures 5.11 and 5.12 for better understanding.

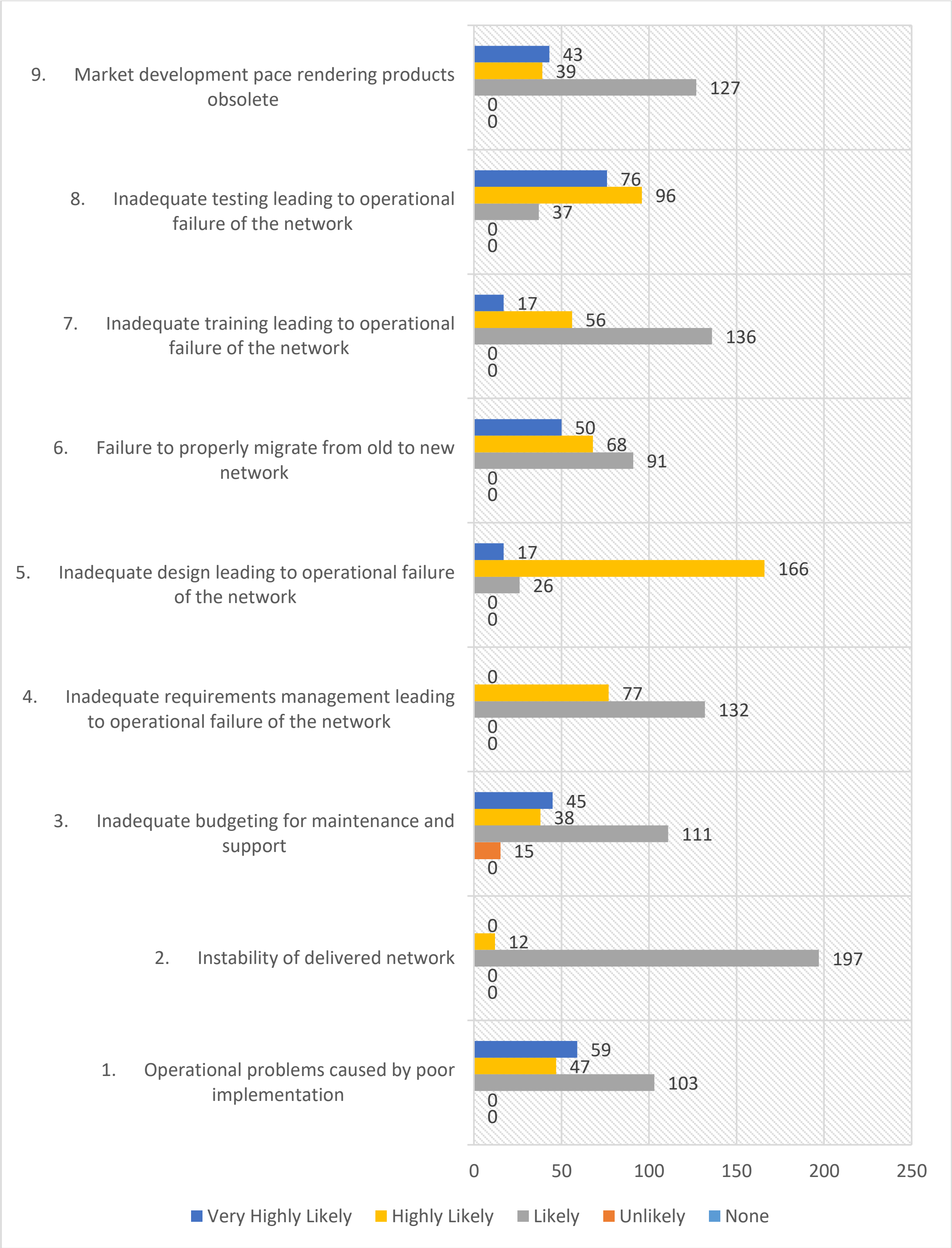

Figure 5.11: Operational Risks (A)

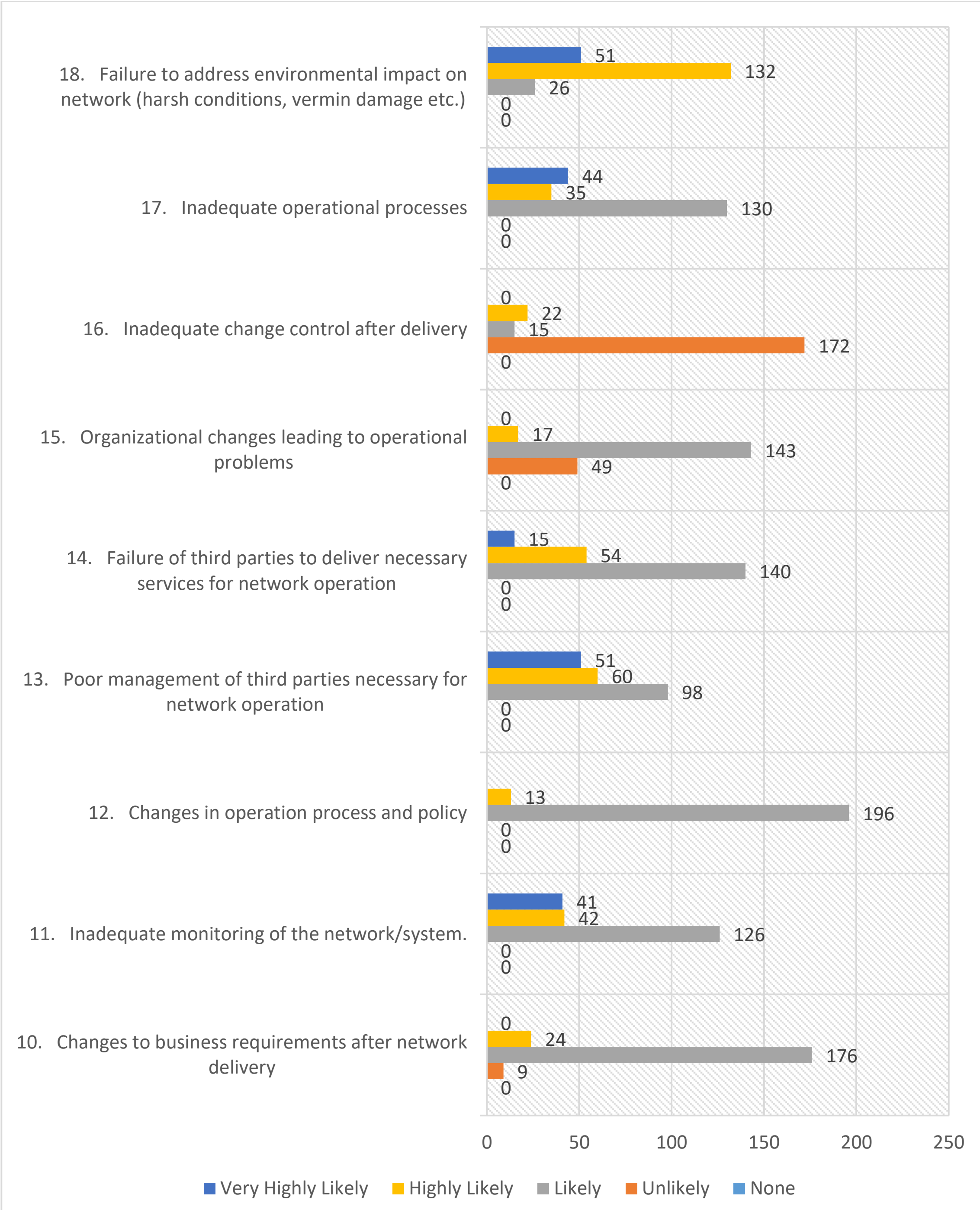

Figure 5.12: Operational Risks (B)

5.3.4 People and Management Risks and their Influence on the Cost of ICT Network Development

The success of an ICT project is dependent on how well the management is able manage the network components as well as the people components. More often than not, poor management leads to complete failure of ICT networks. Lack of strong leadership combined with reluctance to take strong and bold decisions causes loss as well as risks the failure of the ICT implementation process. Therefore, out of 18 factors, respondents identified a number of people and management risk factors that had the most influence on the ICT implementation process and which cause its failure. These factors are: ‘contractual issues’, ‘misalignment of the project with the organization’s standards and policies, ‘failure to achieve compatibility with the strategic business direction of the organization’, ‘organizational changes not properly managed’ and ‘failure to achieve compatibility with the organization’s strategic IT direction’. The responses received in relation to people and management risks in ICT are shared in Table 5.4.

People and Management Risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
1.Failure to achieve compatibility with the strategic business direction of the organization	0	0	148	37	24
2. Failure to comply with legislative requirements, such as finance regulations.	0	0	110	84	15
3.Misalignment of the project with organization’s standards and policies	0	0	42	167	0
4.Mismanagement of scope and requirements changes during the project	0	0	93	71	45
5.Contractual issues	0	0	26	154	29
6. Failure to ensure project staff have the necessary skills	0	0	94	97	18
7. Failure to manage confidentiality (Information disclosure)	0	24	121	64	0
8. Failure to manage staff priorities	0	17	100	58	34
9. Failure to manage the budget	0	0	61	88	60
10. Failure to provide enough project staff at the required time	0	0	42	115	52
11. Inadequate management of budget needed for staff	0	0	70	98	41
12.Mismanagement of project schedule	0	0	114	68	27
13. Failure to achieve compatibility with the organization’s IT strategic direction.	0	0	200	9	0
14.Organizational changes not properly managed	0	0	192	17	0
15.Failure to manage and deliver necessary training	0	0	127	40	42

16.Inadequate management of budget needed for training and support	0	0	114	80	15
17.Inadequate management of changes to operational processes and policies	0	0	96	66	47
18.Issues caused by external agencies, on which the project depends	0	0	26	150	33

Table 5.4: People and Management Risks

'Contractual issues' refers to the inability to align the contractual clauses with the new ICT network. Often, the contracts do not take into consideration the new systems and thus it may not align. However, later during the implementation process it may lead to disputes. It is due this reason that, out of 209 respondents, 154 (73.7%) considered it to be a highly likely factor, 26 (12.4) considered it to be a likely factor while the remaining 29 (13.9%) respondents considered it to be a very highly likely risk factor that may affect the implementation of ICT networks. It is thus vital that the contracts are drawn up in the favour of the ICT project such that various aspects are taken into consideration and there are arrangements to include new clauses whenever required during the implementation process. Contracts are legally binding and therefore they need to be formulated in such a manner that they accommodate the requirements of the ICT implementation process. Furthermore, when a contract is not flexible, it is unable to accommodate the requirements of the ICT networks, thus causing delays and failures in the adoption and implementation process.

Every organization has its own set of policies and standards which are followed by the employees and the stakeholders religiously. However, the implementation of an ICT network requires alignment of these policies and standards with the ICT network so that the implementation process is seamless. Thus, 'misalignment of the project with the organization's standards and policies' was deemed by 167 (79.9%) respondents to be a highly likely risk factor while 42 (20.1%) considered it to be a likely risk factor. Misalignment may also be caused due to limited knowledge about the network systems and little knowledge about how ICT network implementation takes place. It is therefore important that leaders of the organization are well aware of the process that goes on behind the implementation of the ICT network. Furthermore, it is also advisable for the management to keep educating themselves and be up to date with the ICT implementation process so that it becomes easy to align and integrate the standards and policies of the organization with that of the ICT network.

Just like there are set standards and policies in every organization, each organization also has a strategic business direction, which relates to the certain direction for the organization and its components set by the organization's leaders and top management for the achievement of future goals. It requires a detailed strategic planning process and only after much deliberation, does an organization formulate its strategic organizational direction. While this direction is vital for the organization, it may prove to be a hindrance for the implementation of an ICT network. Therefore 'failure to achieve compatibility with the strategic business direction of the organization' is considered to be a likely risk factor by 148 (70.8%) participants, highly likely by 37 (17.7%) and very highly likely by 24 (11.5%). It is vital that, while formulating the ICT adoption and implementation processes, the strategic direction of the organization is taken into consideration. At no point should the ICT pose a risk to the strategic direction of the organization. Achieving compatibility should remain the sole priority during the planning stage. This will involve the co-ordination between the top managerial positions and the technical staff who will make plans for adoption of the ICT network. In case there are discrepancies and at any point the management feels that the strategic direction of the company is in jeopardy, a different approach to the adoption process should be formulated. Quick action will ensure that the goal and strategic direction of the company remain intact while the ICT network implementation is conducted in a way that is compatible with the strategic direction. This will also ensure a smooth transition and easy implementation process.

When an ICT network is implemented, it will result in many changes in the processes and the manner in which work was carried out throughout the organization. These changes are a part of the implementation and adoption process. However, they need to be managed efficiently in order to ensure that there are no issues after the implementation process is completed and the ICT network has been integrated into the business system. Thus, 'organizational changes not properly managed' was identified as a likely risk factor by 192 (91.9%) respondents while the remaining 17 (8.1%) respondents termed it as a highly likely risk factor. This indicated that a majority of respondents considered this factor to be a likely cause of disruption. In order to combat this issue, it is advisable for the organizational leaders to brace the organization for the ensuing changes and ready the staff by providing necessary training with respect to new technologies and application of these technologies to achieve success in the tasks. It has been observed by past researchers that, while organizations are growing, they are not imparting the necessary technology training to the workforce (Mueller-Jacobs and Tuckwell, 2012; Heeks and Bhatnagar, 1999; Leydesdorff and Wijsman, 2007).

Just as every company has a strategic business direction, in the present technologically charged environment, every company also has its own strategic IT direction. This direction aims to connect all the processes of the company, enable easy management of all the files and processes, deliver innovative solutions, and develop and implement an integrated system. These strategic IT directions are a part of all major organizations and thus it is vital that they be maintained even when an ICT network is being implemented. The IT direction of the company is identified by its IT department and it is their responsibility to develop the IT direction in a manner that helps the company to grow and prosper. As has been discussed previously, large-scale organizations have business processes spanning across the globe, and in this age of technology all these processes which are taking place in different parts of the world are streamlined through effective ICT networks. According to the respondents, 'failure to achieve compatibility with the organization's strategic IT direction' is a major risk factor. This was corroborated when 200 (95.7%) respondents considered it to be a likely risk factor and nine (4.3%) respondents considered it to be a very highly likely risk factor. This therefore proves it is a major risk factor as identified by the respondents that should be assessed before the adoption and implementation of an ICT network.

Other risk factors under the people and management category have been assessed and presented in Table 5.4 and depicted visually in figures 5.13 and 5.14. These results provide an idea about how all these risk factors affect the ICT implementation to some degree and thus they need to be looked into prior to the implementation process.

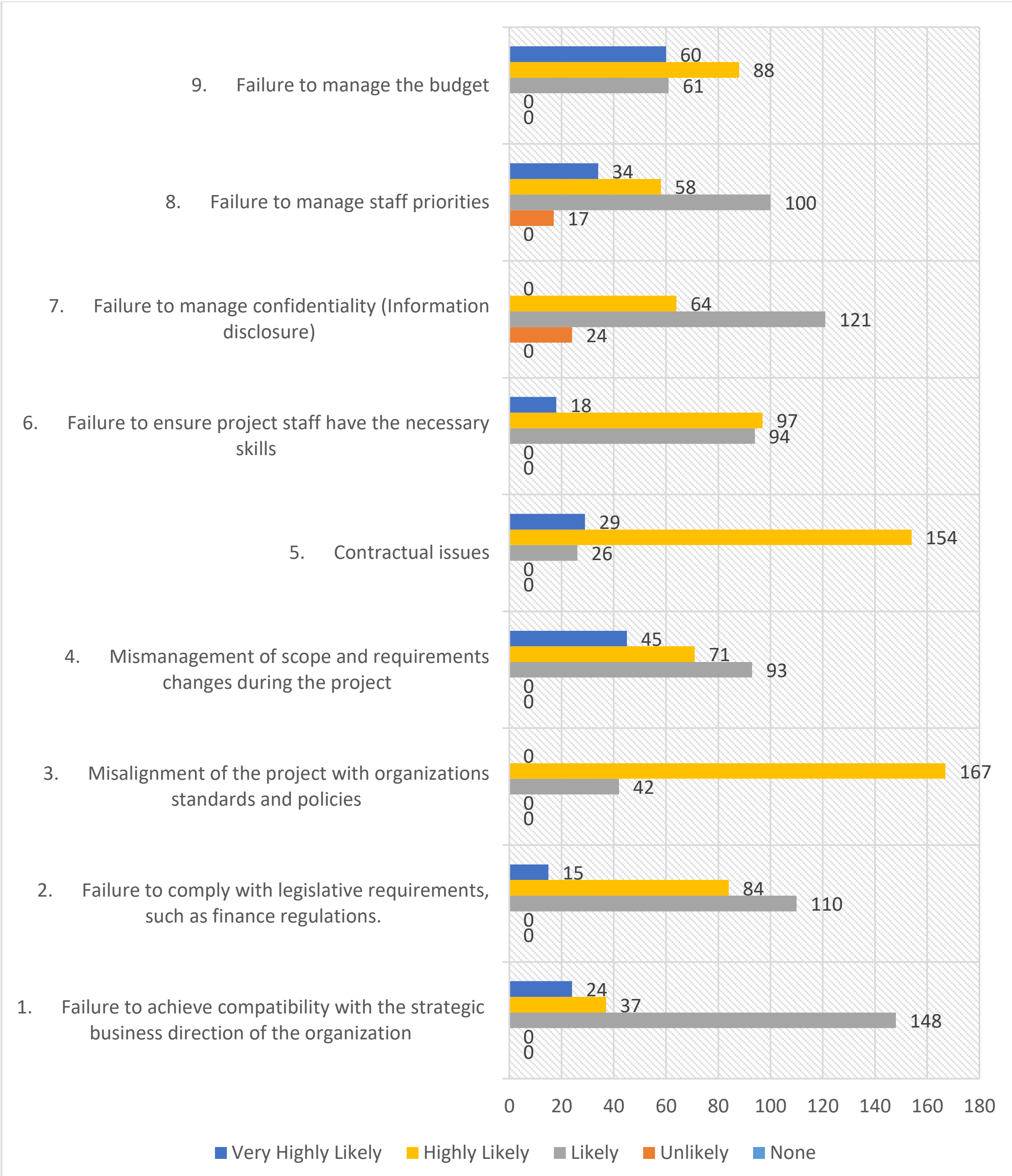

Figure 5.13: People and Management Risks (A)

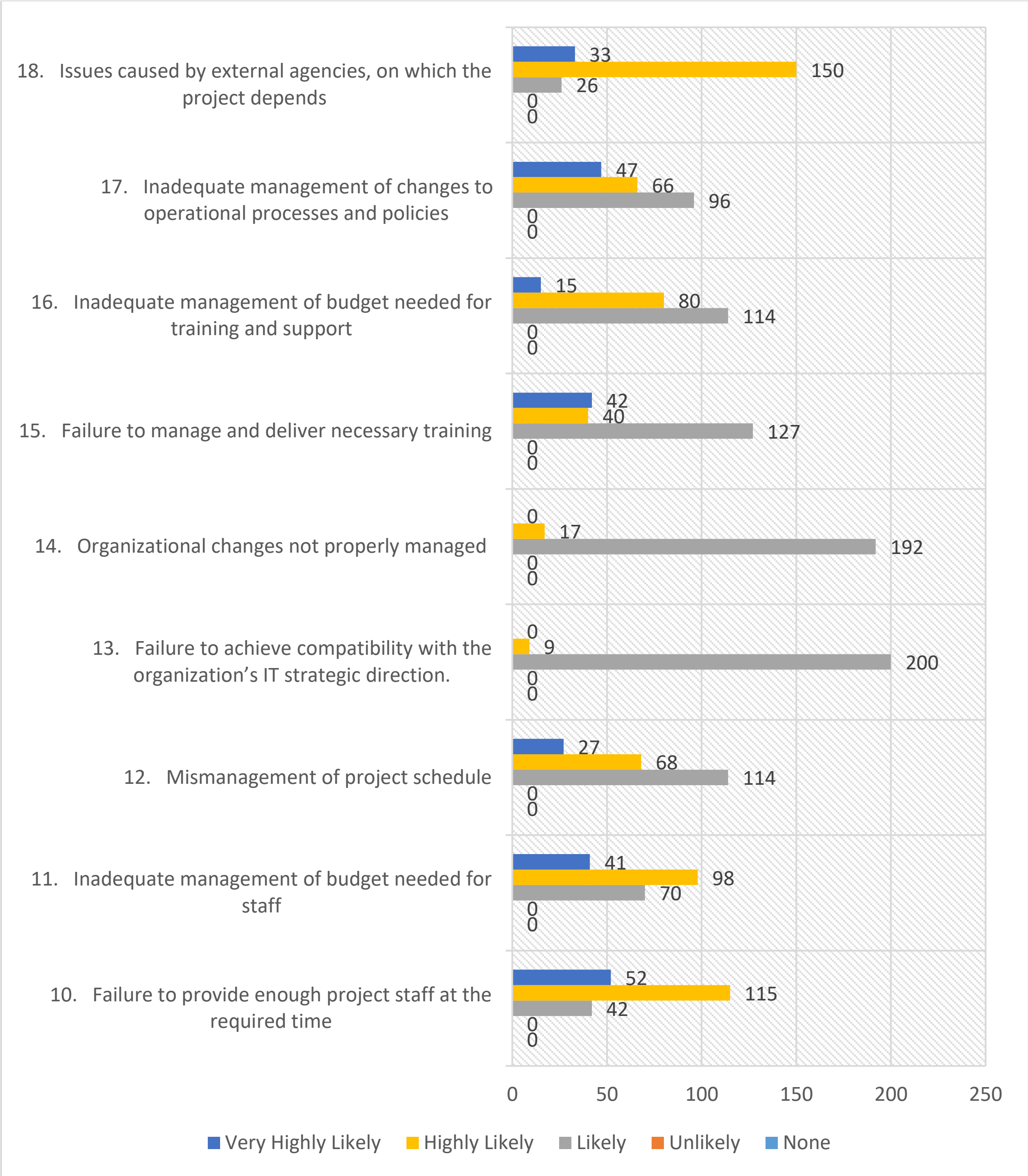

Figure 5.14: People and Management Risks (B)

5.3.5 Estimating the Overrun Cost for Risk Factors

For a large-scale ICT network adoption and implementation process, it is estimated that a certain percentage of overrun costs is expected. In a region such as the UAE, these costs may be higher as there is reduced technologically sound workforce and training the staff would not just be time consuming but also cause an increase in the budget. However, when the above-mentioned risk factors come into play, the cost overruns are far greater and they lead to either failure of the ICT network implementation or losses to the organization. In this section, the aim is to identify the percentage of estimated cost overrun that the participants expected due to the various risk factors identified above in each of the four categories. The results of the same are presented below in Table 5.6 and Figure 5.15. From the below figure it can be concluded that technology and hardware risk factors lead to high cost overruns as 166 (79.4) respondents out of 209 responded that they led to 11-20% cost overruns. Technology forms the core of any ICT network and thus risk factors associated within these categories tend to cause greater overruns. It is thus important to take into account all the necessary precautions, including imparting knowledge to staff about the technical know-how, hiring staff with the technological skills who are able to assist during the implementation phase and ensuring that the quality is maintained throughout the implementation process.

Overrun cost for risk factors	**Not at all/ 0% overrun**	**Low/ 1-5%**	**Moderate/ 6-10%**	**High/ 11-20%**	**Very high/ Over 20%**
1. Planning & Developments	0	16	71	105	17
2. Technology & Hardware	0	17	9	166	17
3. Operations	0	9	92	62	46
4. People & Management	13	104	67	25	0

Table 5.5: Overrun cost for risk factors

In the case of operations risk factors, 92 (44.0%) respondents were of the opinion that these risk factors caused only moderate cost overruns of 6-10% when implementing ICT networks. This thus indicates that, while the risk factors may lead to only moderate overruns, it is always advisable to keep them in check as even moderate overruns in some instances lead to project failure or disruptions. Only when the operations are well maintained can organizations expect the implementation budget to remain constant.

In the case of planning and development risk factors, it was observed based on the responses that these factors were attributed to high cost overrun of 11-20% by 105 (50.2%) respondents. Planning and development are two variables that are constantly updated before, during and after the implementation of ICT networks. When these factors are not properly scrutinized, the adoption and implementation of ICT networks may be at risk. Leaders need to identify the dynamic planning and development risk factors as they pose a threat to increase in costs. Cost overruns can be handled by organizations only if they are under a specific amount. Large overruns cause the budget to get out of control and therefore there is a need to identify the dynamic nature of these risk factors.

People and management risk factors, the last category, is considered rather controllable and it does not lead to major cost overruns. The survey revealed that 104 respondents (49.8%) considered that these risk factors usually had low cost overruns of 1-5%. Such low overruns are accounted for during the budgeting and thus it becomes easy to deal with them. However, while they have a low cost overrun, it is recommended to keep these risk factors in check as unchecked they may lead to higher overruns. Thus, this section of the survey helped to identify which of the risk factors cause a high or low percentage of cost overrun. This helps researchers as well as future implementers and leaders to identify the risk factors and their effect on cost overrun.

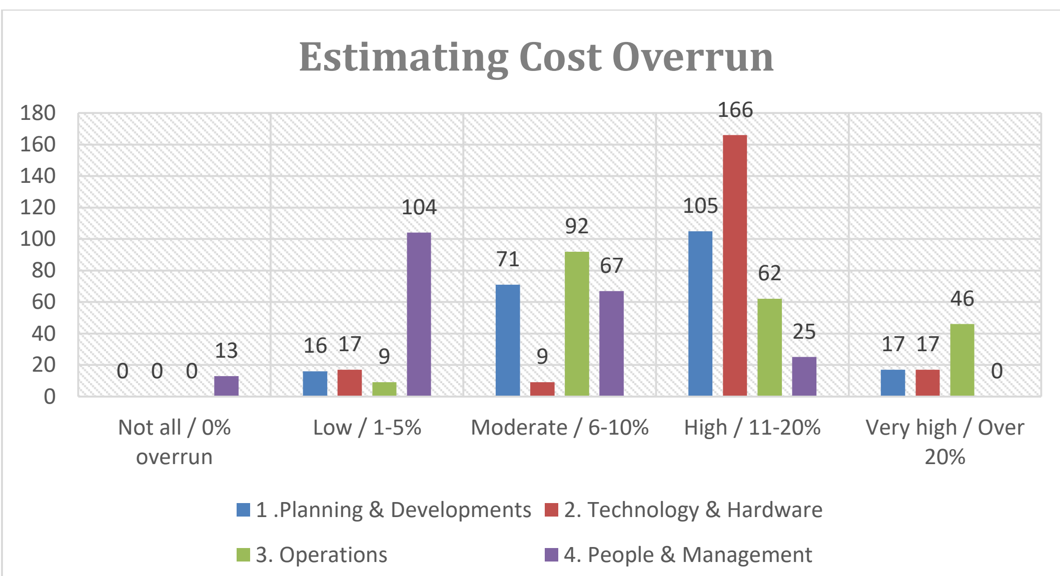

Figure 5.15: Estimating Cost Overrun

5.3.6 Evaluating the Criteria for ICT Network Project Success

In this section, the researcher asked the participants to rate how likely it was that the ICT network risks would influence the ICT project's success criteria. Twenty-one questions were presented with different criteria and the participants rated them accordingly. Results of the same are presented in Table 5.6 and a pictorial depiction is provided in Figure 5.16. As can be observed in Figure 5.16, almost all the criteria are affected by the ICT network risks; however, the participants identified several criteria which in their opinion were more affected than other criteria. These included 'security controls', 'vulnerability management of the network', 'efficient functioning of the network', 'operational reliability', 'operational availability', 'meeting acquisition goals' and 'user satisfaction'.

Criteria for ICT network project success	None	Unlikely	Likely	Highly Likely	Very Highly Likely
1.Vulnerability management of the network	0	0	184	9	16
2.Incident management of the network	0	0	124	43	42
3.Configuration management of the network	0	0	133	43	33
4.Effectiveness of the mobility of the net	12	46	151	0	0
5.Effectiveness of the traffic	0	25	125	59	0
6.Security controls	0	0	188	12	9
7.Efficiency recovery	0	44	149	16	0
8.Operation tolerance (delays, connectivity)	0	0	83	56	70
9.Maintainability	0	0	115	18	76
10.Integrity of the net	0	0	158	21	30
11.Operational availability	0	0	183	9	17
12.Operational reliability	0	0	209	0	0
13.Efficient functioning of the network	0	0	54	114	41
14.Coordination and change management	0	30	137	42	0
15.Improved access to information	0	0	90	71	48
16.User satisfaction	0	0	167	42	0
17.Meeting functional specifications	0	0	143	66	0
18.Meeting technical specifications	0	0	115	52	42
19.Meeting schedule goals	0	0	154	26	29
20.Meeting budget goals	0	0	114	59	36
21.Meeting acquisition goals	0	0	183	17	9

Table 5.6: Criteria for ICT network project success

Security controls: 188 (90%) respondents termed it as likely and 12 (5.7) considered it very likely that this ICT network success criterion would be affected by the risks identified in the section above. Security control is a major criterion of ICT success as it is an important component of ICT. The major reason for any organization to adopt ICT is not just to streamline the processes but also to gain better security control over all the business processes. When the mere criteria is facing threat, then the success of ICT adoption and application may be threatened.

Vulnerability management of the network: For this criterion, 184 (88%) respondents responded that it was likely, while 9 (4.3%) said it was highly likely and the remaining (16 7.7%) opined that it was a very highly likely criterion that may be affected by the ICT risk factors. Any system that makes use of technology and the internet is susceptible to security threats. Thus, the ICT risk factors might make vulnerability management of the network difficult. This was also echoed by the respondents as they considered this criterion to likely to be affected by the ICT risks identified in previous sections.

Efficient functioning of the network: ICT networks involve the amalgamation of many technologies and processes to form a network. When any of these processes come under threat or face difficulty in functioning, it affects the entire network. Therefore, ICT risk factors can have a profound effect on the efficient functioning of the network. Fifty-four (25.8%) participants felt that the risk factors were likely to affect this ICT project success criterion, while 114 (54.5%) responded that this was highly likely and 41 (19.6%) very highly likely. This clearly depicted that the risk factors may affect how efficiently the network is able to function.

Operational reliability: Operational reliability refers to the reliability that is observed when an operation is being conducted. Operations may fail if there are design flaws, components are missing, and there are defects in the network. After a design has been initiated, when in operation there may be some discrepancies leading to failure. Furthermore, if the operation environment is different to the one that was in existence during the design period, management can expect more failures. Thus, risk factors identified in the previous sections pose to alter the operations environment, thus decreasing operational reliability of the network. This was further corroborated by the responses as all the 209 respondents, which makes it 100% of the research sample size, agreed that that it would likely affect and influence this ICT success criterion.

Operational availability: This refers to a systems engineering concept wherein it is determined, in comparison to how long a system should have been used, how long a system was actually available for use. This concept evaluates the downtime of the system, logistical delay of the system and other factors. In the opinion of 183 respondents (87.6%), ICT risk factors would likely have an influence on this criterion, while nine respondents (4.3) felt that the influence would be highly likely and the remaining 17 (8.1) felt it was very highly likely that it may affect the ICT criterion. Operational availability is a major criterion, since ICT is entirely a technology- and systems-based concept and if the systems are down for a long time it can affect the functioning of the ICT networking severely.

Meeting acquisition goals: Acquisitions help companies to grow and, when they are united by single ICT systems, it produces better results. However, in the opinion of 183 participants (87.6%) the ICT risk factors could likely affect this success criterion. On the other hand, 17 (8.1%) respondents felt the effect would be highly likely and the remaining 9 (4.3%) felt it would be very highly likely. Thus, it becomes imperative for management to safeguard the criterion from such ICT risk factors as the influence would cause difficulty in meeting the organization's acquisition goals.

User satisfaction: The main aim behind any ICT network system is to streamline the processes and ensure that the end user along with the stakeholders is able to achieve satisfaction in their interaction. However, this aim may be thwarted by the ICT network risk factors identified in the previous sections. According to 167 respondents (79.9%), the effect was likely, whilst for 42 respondents (20.1%) it was highly likely. Thus, the risk factor should be studied as it could cause difficulty in achieving high user satisfaction, which remains the ultimate aim of ICT networks.

Apart from the above-mentioned criteria, the list consisted of 21 criteria and it was observed that all the criteria were affected to varying degrees by the ICT network risks. This depicted that managers and leaders of the organizations in the UAE would not just have to work on the above-discussed criteria but also consider all the mentioned criteria and accordingly negate the risk factors as they may cause severe difficulty in the adoption and implementation of ICT networks in the UAE.

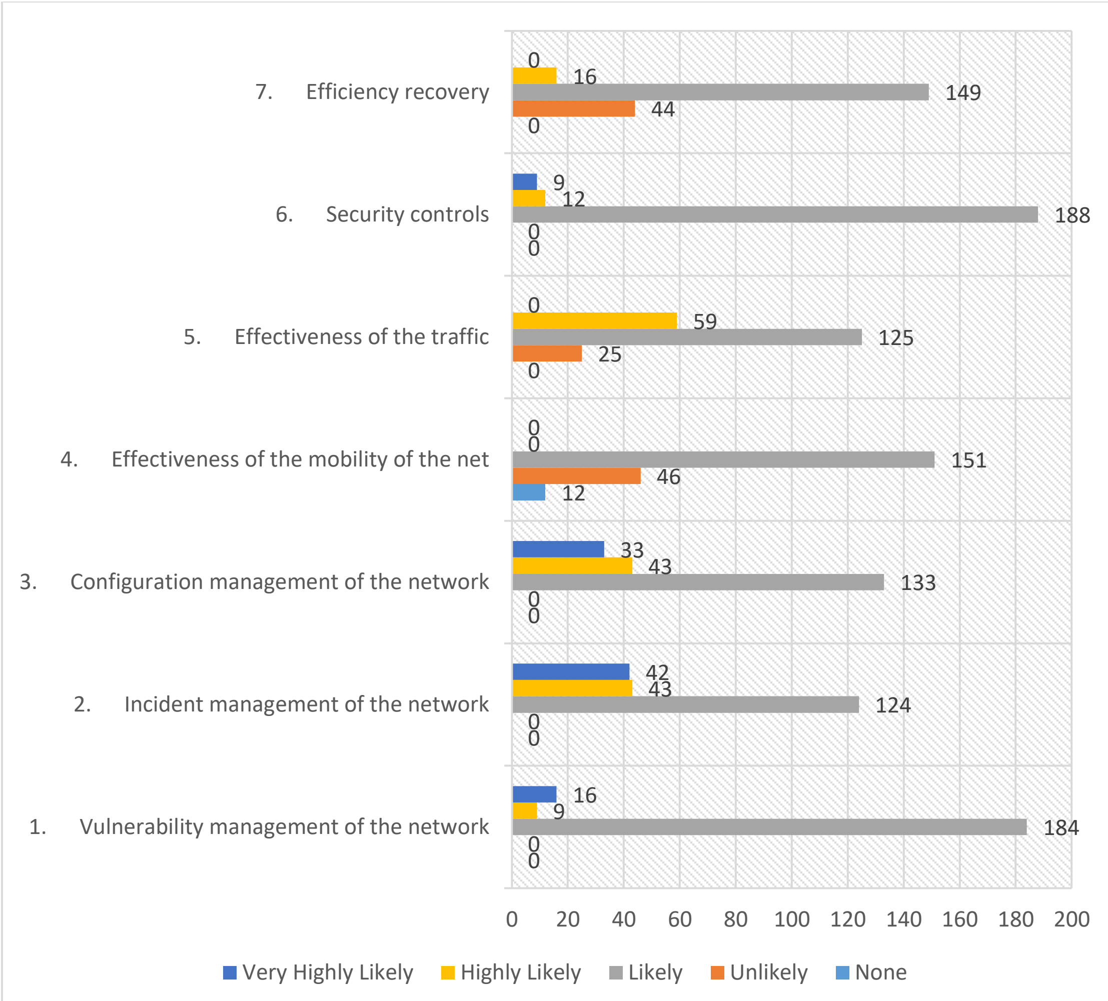

Figure 5.16: ICT Success Criteria (A)

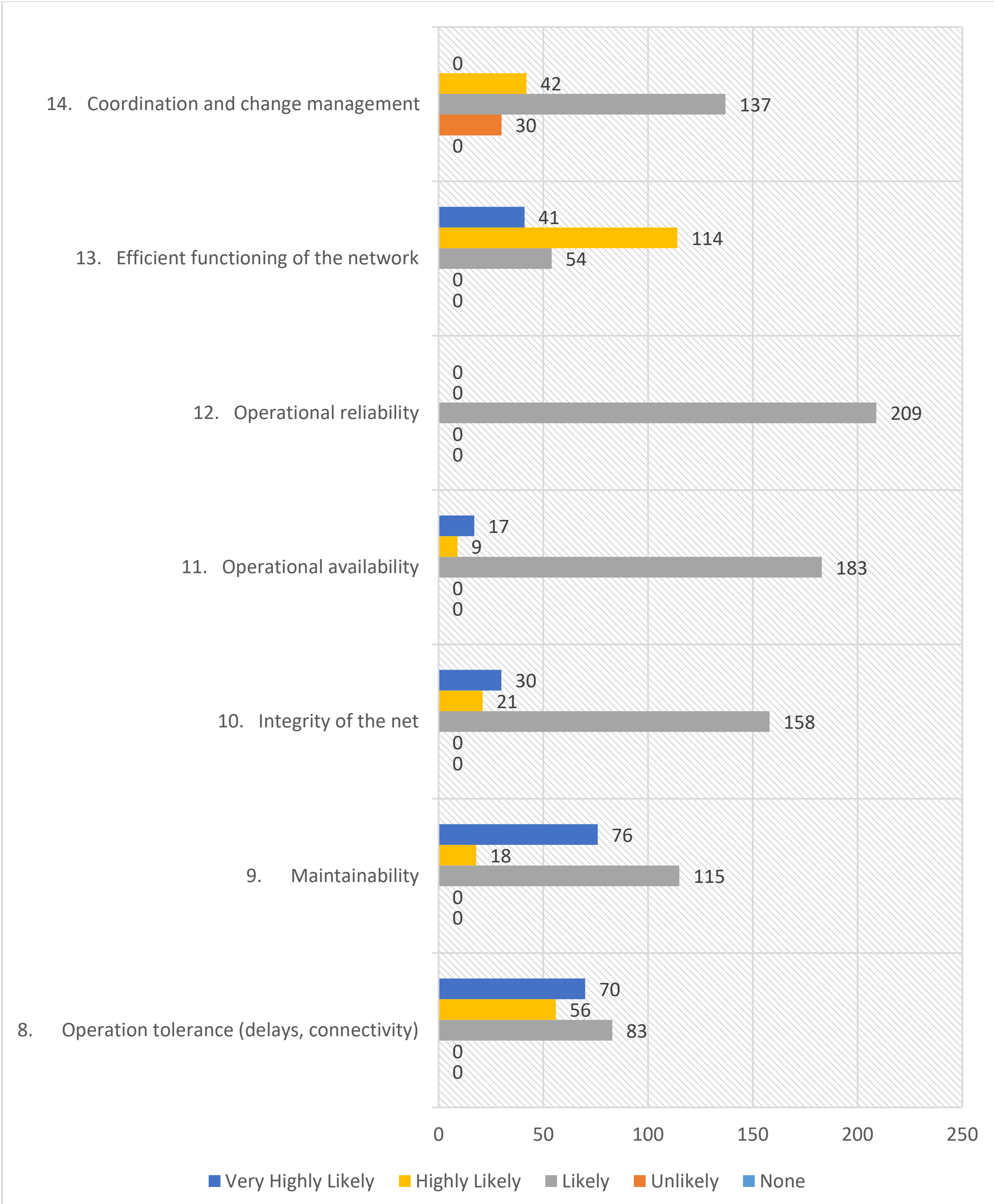

Figure 5.17: ICT Success Criteria (B)

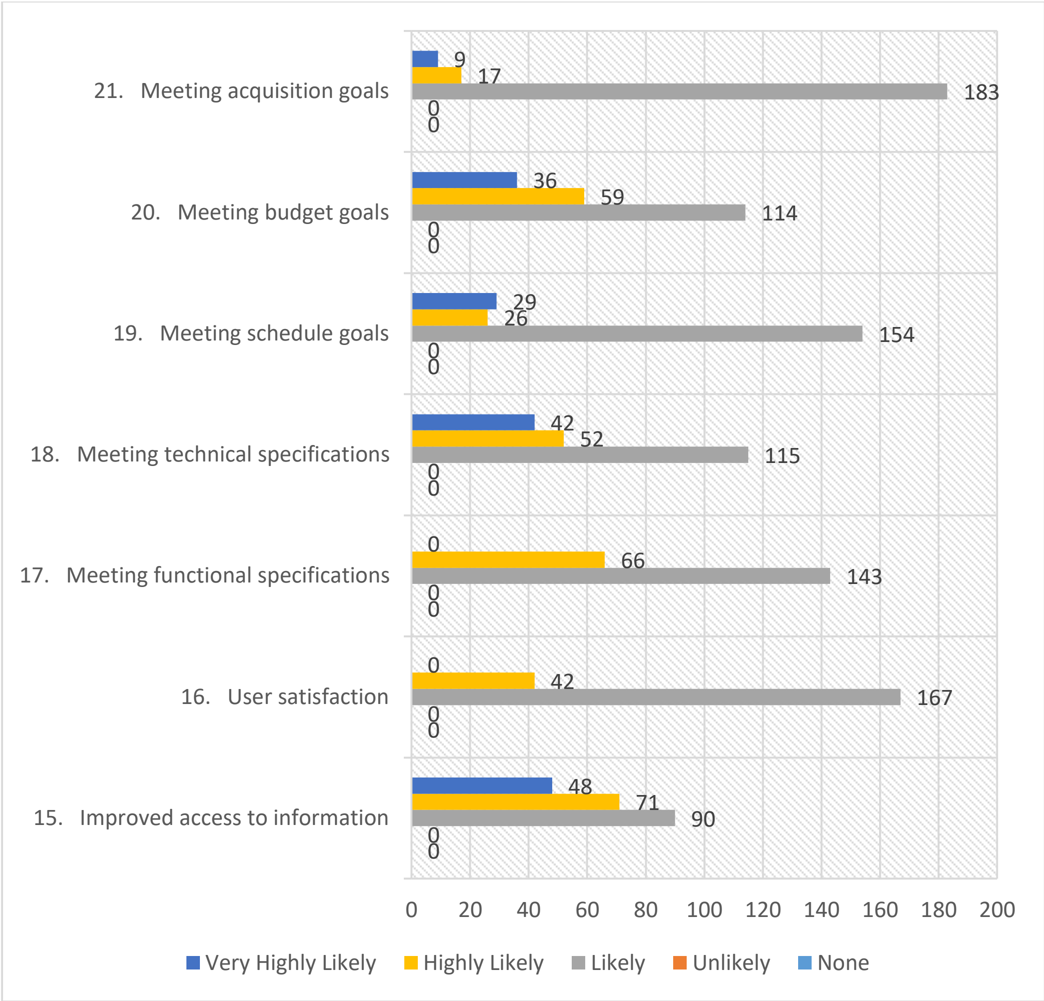

Figure 5.18: ICT Success Criteria (C)

5.4 Reliability Test

This work's study data was collected using a questionnaire method. The questionnaire consisted of four main constructs which were measured by several variables (statements). Thus, these variables must demonstrate a high level of homogeneity. This is necessary to validate the internal consistency of the scale to measure the research constructs. That is to say, the variables used to measure each research construct exhibit a high intercorrelation. To evaluate the validity of the research constructs the Cronbach's alpha is used at 0.7 cut-off point. The results of the test are portrayed in Table 5.7. The table shows that several variables were deleted to achieve the minimum level of consistency. Only the variables that contributed to the research constructs consistency were used to carry out the association analysis.

Factor	Code	Item	Alpha if deleted	Cronbach Alpha (α)
PD	PD2	Business requirements not understood	.700	0.716
	PD7	Budget not adequately estimated or planned	.724	
	PD8	Budget not provided or budget withdrawn	.719	
	PD11	Unclear project responsibilities	.651	
	PD15	Inadequate project planning	.715	
	PD22	Contractors/vendors mismanaged	.656	
	PD24	Inadequate understanding of project benefits	.676	
	PD28	Human resource mismanaged	.701	
	PD31	Delayed on approval	.703	
	PD34	Inadequate management of project development lifecycle/process	.650	
	PD35	Delays in external approvals or decision making	.734	
	PD37	Inadequate planning for migration from old to new system/network	.708	
	PD38	Training not planned or conducted adequately	.728	
TH	TH1	Failure to address integration of components within the project	.613	0.708
	TH2	Failure to address integration with existing technology	.749	
	TH6	Technical complexity not understood	.526	
	TH8	Use of unproven technology	.624	
OP	OP1	Operational problems caused by poor implementation	.700	0.703
	OP2	Instability of delivered network	.713	
	OP4	Inadequate requirements management leading to operational failure of the network	.716	
	OP6	Failure to properly migrate from old to new network	.604	
	OP7	Inadequate training leading to operational failure of the network	.650	
	OP8	Inadequate testing leading to operational failure of the network	.637	
	OP15	Organizational changes leading to operational problems	.635	
	OP17	Inadequate operational processes	.697	
	OP18	Failure to address environmental impact on network (harsh conditions, vermin damage, etc.)	.708	
PM	PM1	Failure to achieve compatibility with the strategic business direction of the organization	.674	0.706
	PM5	Contractual issues	.681	
	PM8	Failure to manage staff priorities	.671	
	PM9	Failure to manage the budget	.669	
	PM10	Failure to provide enough project staff at the required time	.712	
	PM12	Mismanagement of project schedule	.703	
	PM14	Organizational changes not properly managed	.694	
	PM16	Inadequate management of budget needed for training and support	.673	
	PM18	Issues caused by external agencies, on which the project depends	.639	

Table 5.7: Reliability Test

5.5 Conclusion

In this chapter, the key results for the survey data collected are presented. The chapter discussed the demographics of the participating respondents covering profession, gender, work experience, total experience and qualification. It also presented the results for the key variables determining the influence of risk factors in the ICT network lifecycle. In the next chapter, the statistical analysis conducted on the four key overruns (factors) is presented in the form of neural network analysis.

6 ANALYZING RISK AND COST OVERRUN ASSOCIATING USING NEURAL NETWORK ANALYSIS

6.1 Introduction

In this chapter, an analysis of the findings derived from the neural network analysis applying a multi-layer perceptron is presented. With the aim of studying the effect of four types of overrun on the implementation of ICT networks in the United Arab Emirates, this chapter presents the probabilities of the occurrence of the different overruns predicted through the neural network.

6.2 Neural Network and Its Application

Neural networks are artificial computer-based algorithms used to solve problems in a simplified process while imitating brain processes. Similar to a neural network, it makes use of information processing capabilities that comprise nodes/neurons linking the information at three levels (level to level) with no interconnection between neurons at the same level. The architecture of a typical neural network is provided in Figure 5.1 below. The input layer of the network can comprise a series of inputs ranging from 1 to n, fed to the hidden layers, which processes the information and leads to output generation. The summation of the n inputs in the active mode of the neural network thereby leads to generation of output. However, the outputs can be tailed to reflect the options utilized for evaluation.

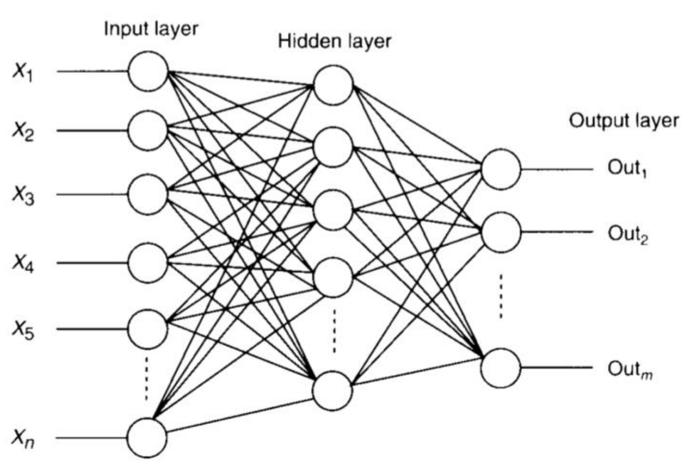

Figure 6.1: Architecture of a Standard Neural network

6.3 Neural Network Analysis

In this study, a neural network analysis was conducted through the application of the data collected from the survey questionnaire.

6.3.1 Variables Considered for the Neural Network Development

Independent Variables:

- Education
- Years of Experience

Dependent Variables: These are the four types of overruns that are categorized into five factors ranging from 1 to 5, with 1 indicating None/0% overrun, 2 indicating Low/1-5% overrun, 3 indicating Moderate/6-10% overrun, 4 indicating High/11-20% overrun and 5 indicating Very high/Over 20% overrun.

- Planning & Development Overrun
- People & Management Overrun
- Operation Overrun
- Technology and Hardware Overrun

6.3.2 Neural Network Design

IBM SPSS statistics version 21 was utilized for the development of the neural network in this research study. It is a multi-layer perceptron wherein the data was analyzed using the condition training (7), testing (3) and holdout (0). In these subsets, the training dataset is applied for finding the weights followed by development of the model. Similarly, the holdout dataset is applied for the validation of the model taken from training, and testing is applied for identification of errors. The minimum and maximum covariates are set at normal condition to return a response between 1 and 5. The stopping rules are as follows:

- Error Steps = 1
- Training Timer Maximum Time = 15
- Maximum Epochs = Auto
- Error Change = 1.0E-4
- Error Ratio = 0.001

6.3.3 Results of the Neural Network

In this research study, the aim was to examine the factors that influence the adoption and implementation of ICT networks in the UAE and lead to cost overruns. Here, the multi-layer perceptron neural network was applied to assess if it can help organizations in correctly predicting cost overruns through the adoption and implementation of ICT networks. The results of the neural network are examined in the sections below.

6.3.3.1 Planning & development overrun

In this section, the neural network analysis was utilized to assess if it can accurately predict cost overrun due to planning and development risks (PDO) associated with the adoption and implementation of ICT networks in the UAE. This is implemented with consideration of the education and years of experience data obtained from the respondents. The results of the neural network analysis for PDO are explained through the charts below:

Predicted by Observed Chart

The predicted pseudo probability for the dependent variable PDO is shared in Figure 6.2 for the full dataset. As observed, the boxplot for PDO reflects the overrun probability in the predicted category as very high overrun (20% and above) for the observed category of low to moderate overrun.

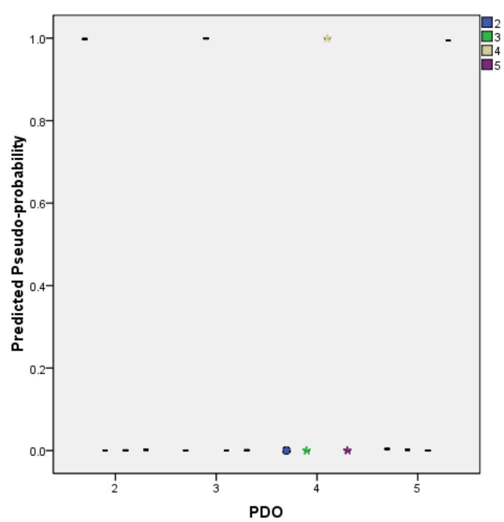

Figure 6.2: PDO predicted pseudo probability

Cumulative Gains Chart

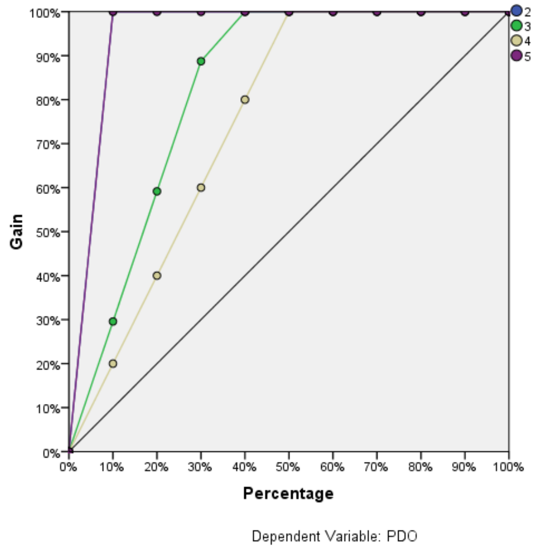

Figure 6.3: PDO Cumulative Gains Chart

Figure 6.3 displays the cumulative gain recorded for the PDO category. It describes the right classification for the PDO model obtained through the artificial neural network resulting out of change and not applying the model. The gains chart is used to identify the correct predictions for PDO in percentage through the application of the model against base predictions without application of the model. As seen in Figure 6.3, there are three curves, each for a different level of overrun. Considering curve 2 given for a moderate level of overrun (green), it can be said that 30% of the moderate overrun for the PDO category predicted 88% of the cases. The gain curve is expected to be higher above the baseline curve as, the higher it is, the better is the overrun prediction.

Lift Chart

Similar in prediction as the gain chart, the lift chart for PDO is shared in Figure 6.4. As observed, the classification model for the overrun provides a clear view of advantage of the model to be used, in contrast to it not being used. The lift factor (or better known as the benefit) is derived from the gains chart, which was found to be at 59% of the PDO overrun. It is 88%/30% = 2.9. Figure 6.8 gives the artificial neural network impact from the independent variables used to obtain the normalized importance, explained in the next section.

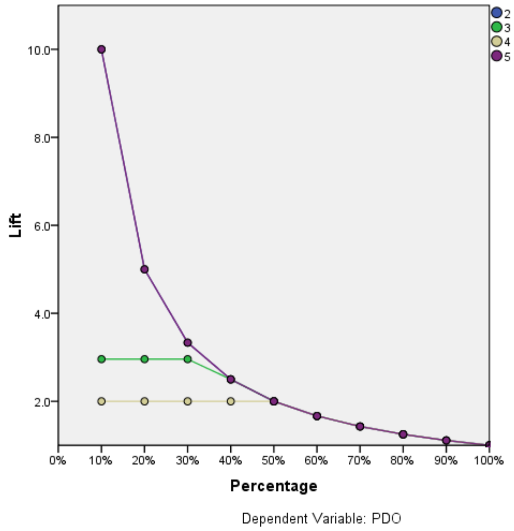

Figure 6.4: Cumulative Lift Chart

Independent Variable Importance Chart

The variable importance is predicted in Figure 6.5 for the PDO artificial neural network model. As observed in the figure, high normalized importance is associated with missing or inadequate project charter/project initiation document (PID) and how it has an influence on the cost of the ICT network development. It is followed by changes to business requirements during the project, risks that are project rejected because of inadequate business continuity planning and business requirements not being understood.

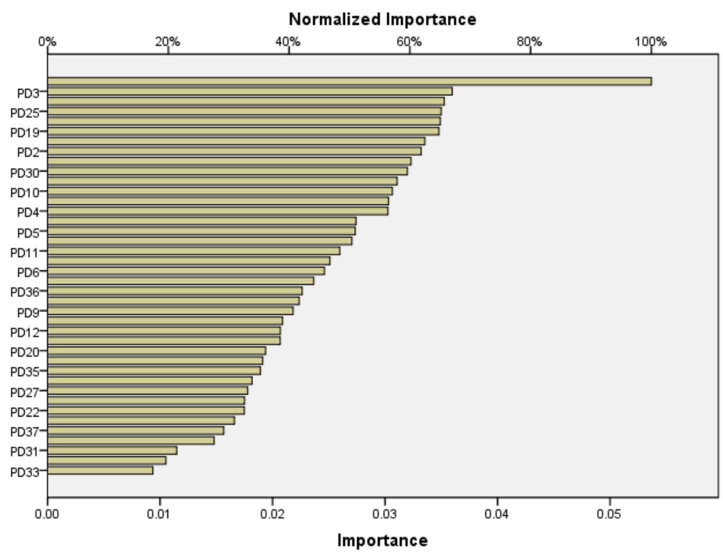

Figure 6.5: PDO Normalized importance

The aim of this section was to investigate if planning and development risks can predict cost overrun of ICT network projects in the UAE: 88% accuracy is identified in prediction of overrun associated with planning and development with the associated benefit identified as 59%. The most powerful predictors were noted in the form of 'missing or inadequate project charter/project initiation document (PID)' and 'changes to business requirements during the project'. It can be concluded that the neural network model was successful in identifying the key factors leading to accurate prediction of cost overrun within this category, thereby allowing efficiency in adoption and implementation of ICT network projects in the country.

6.3.3.2 People & management overrun

In this section, the neural network analysis was utilized to assess if it can accurately predict people and management overrun associated with the adoption and implementation of ICT networks in the UAE. The independent variables considered for the artificial neural network analysis include education and years of experience.

Predicted by Observed Chart

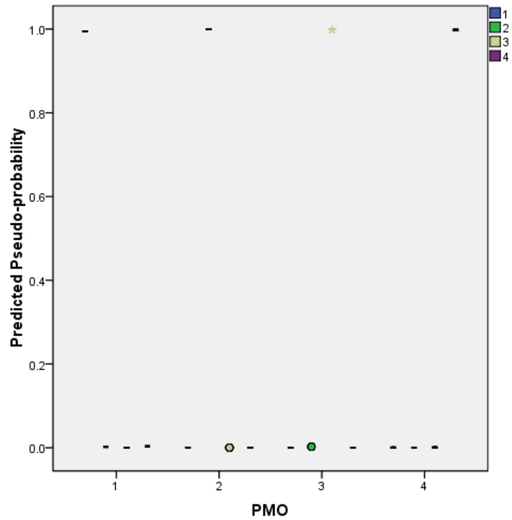

Figure 6.6: PMO Predicted by observed chart

The predicted pseudo probability for the dependent variable people and management overrun (PMO) is shared in Figure 6.6 for the full dataset. As observed, the boxplot for PMO reflects the overrun probability in the predicted category moderate overrun (6-10%) for the observed category of low overrun.

Cumulative Gains Chart

Figure 6.7 displays the cumulative gain recorded for the PMO category for the correct prediction of the model application against the base prediction (without the model) in percentage. As seen, only curves 3 and 4 are considered. For curve 3, 31% of the moderate overrun costs in PMO predicts 94% of the cases whereas in curve 4, 83% of the high overrun costs in PMO predicts 100% of the cases.

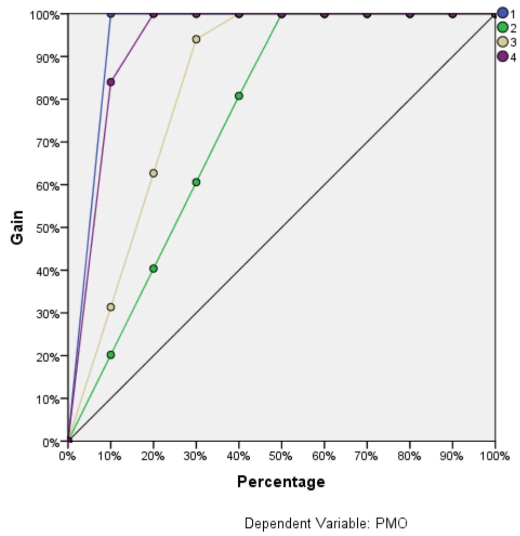

Figure 6.7: PMO Cumulative Gains Chart

Lift Chart

The lift chart of PMO gives the benefit of the model in application against not be used. The lift factor for the gain chart for a moderate overrun prediction is 94%/31% = 3.03, which is derived through the artificial neural network by considering the impact of the independent variables used.

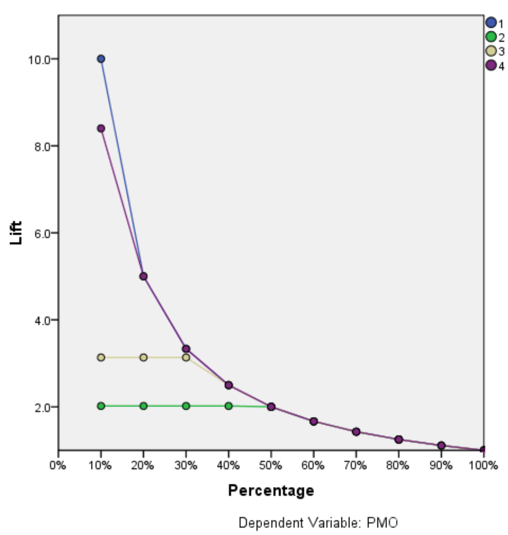

Figure 6.8: PMO Cumulative Lift Chart

Independent Variable Importance Chart

For PMO, the normalized importance is shared in Figure 6.9 for the artificial neural network model. As seen, high normalized importance is associated with education and years of experience, followed by ‘failure to manage staff priorities’, ‘failure to manage confidentiality (information disclosure)’, ‘failure to comply with legislative requirements, such as finance regulations’ and ‘misalignment of the project with organization’s standards and policies’.

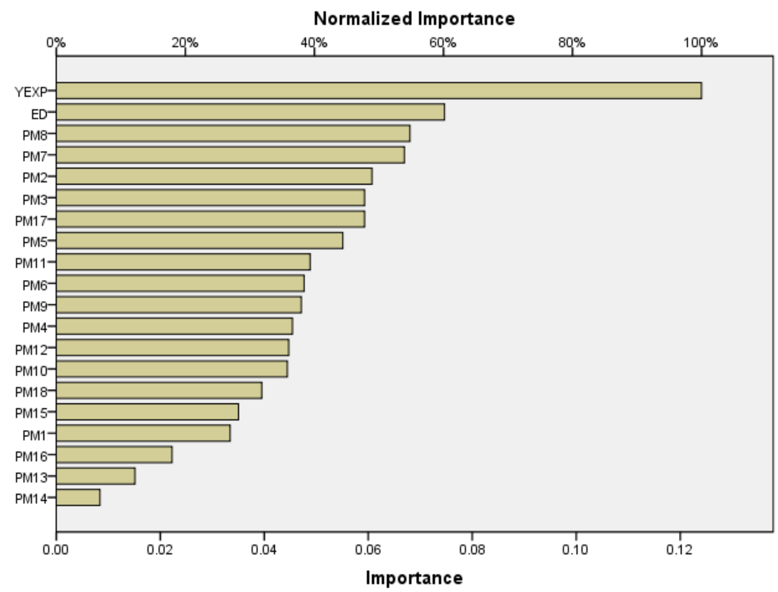

Figure 6.9: PMO Normalized Importance

Cost overrun associated with people and management categories was identified to be predicted by the staff’s years of experience and their education as well (based on importance categorization). Apart from this, the model indicated that, by effectively managing the staff goals, and building a regulatory framework that governs confidentiality and ensures implementation of standards and policies, cost overrun associated with people and management can be controlled and reduced. This will lead to effective implementation of ICT projects in the UAE.

6.3.3.3 Operation overrun

In this section, the neural network analysis was utilized to assess if it can accurately predict operation overrun associated with the adoption and implementation of ICT networks in the UAE.

Predicted by Observed Chart

The predicted pseudo probability for the dependent variable operations overrun (OPO) is shared in Figure 6.10 for the full dataset. As observed, the boxplot for PMO reflects the overrun probability in the predicted category low overrun (1 – 5%) for the observed category with the predicted overrun being moderate (6-10%). Similarly, for outcomes that have moderate overrun, the predicted probability is high (11 – 20%).

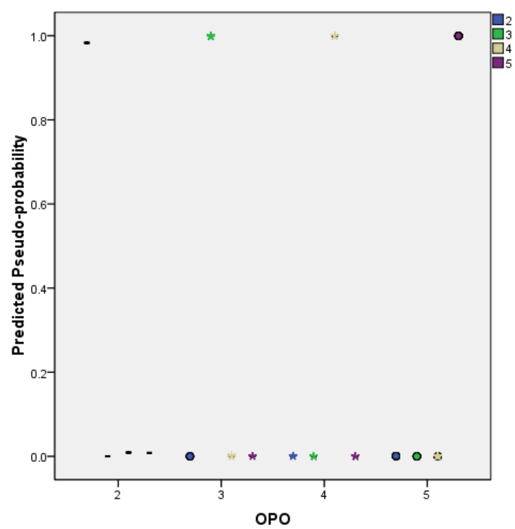

Figure 6.10: OPO Predicted by Observed Chart

Cumulative Gains Chart

Figure 6.11 displays the cumulative gain recorded for the OPO category for the correct prediction of the model application against the base prediction (without the model) in percentage. As seen, curves 5 and 4 are considered. For curve 5, 45% of the very high operational overrun costs predicts 92% of the cases whereas in curve 4, 33% of the high operational overrun costs predicts 68% of the cases.

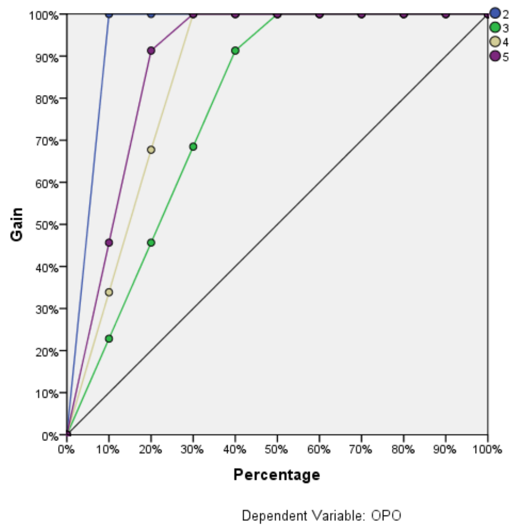

Figure 6.11: OPO Cumulative Gains Chart

Cumulative Lift Chart

The lift chart of OPO gives the benefit of the model in application against not being used (see Figure 6.12). The lift factor for the gain chart for a very high operational overrun prediction is 92%/45% = 2.04, which is derived through the artificial neural network by considering the impact of the independent variables used. Similarly, for high operational overrun prediction, the lift factor is found as 68%/33% = 2.06.

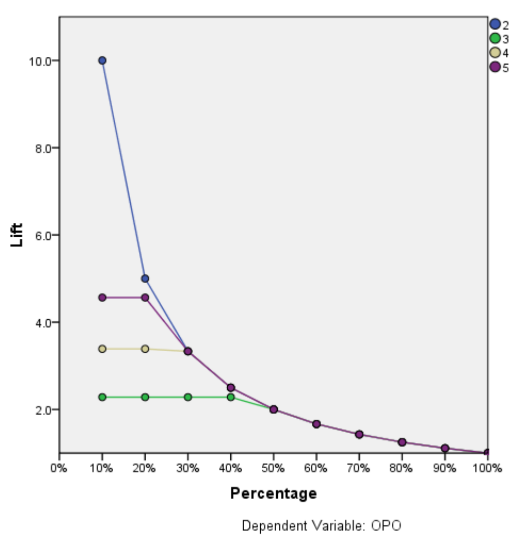

Figure 6.12: OPO Cumulative Lift Chart

Independent Variable Importance Chart

For operational overrun OPO, the normalized importance is shared in Figure 6.13 for the artificial neural network model. As seen, high normalized importance is associated with education, years of experience, ‘market development pace rendering products obsolete’, ‘inadequate testing leading to operational failure of the network’, ‘operational problems caused by poor implementation’ and ‘organizational changes leading to operational problems’.

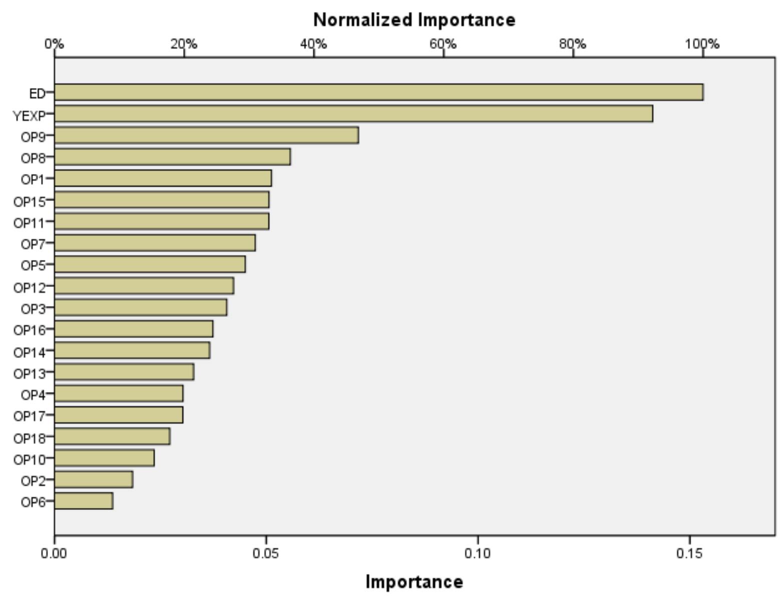

Figure 6.13: OPO Independent Variable Importance Chart

The prediction of overrun related to operations category is found to be higher with 92% cases associated with high overrun costs in operations. The neural network model indicated that, by effectively managing high importance risk factors which include education, years of experience, ‘market development pace rendering products obsolete’, ‘inadequate testing leading to operational failure of the network’, ‘operational problems caused by poor implementation’ and ‘organizational changes leading to operational problems’, the associated overrun costs can be controlled.

6.3.3.4 Technology and hardware overrun

In this section, the neural network analysis was utilized to assess if it can accurately predict technology and hardware overrun associated with the adoption and implementation of ICT networks in the UAE.

Predicted by Observed Chart

The predicted pseudo probability for the dependent variable technology and hardware overrun (THO) is shared in Figure 6.14 for the full dataset. As observed, the boxplot for PMO reflects only the overrun probability in the predicted category low overrun (1 – 5%) for the observed category predicted – moderate (6-10%). No other observations are identified.

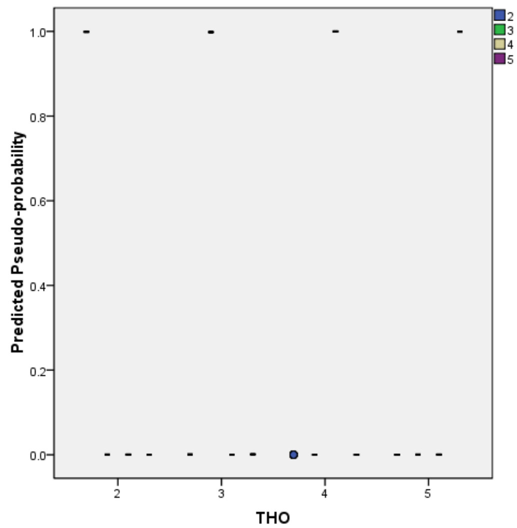

Figure 6.14: THO Predicted by Observed Chart

Cumulative Gains Chart

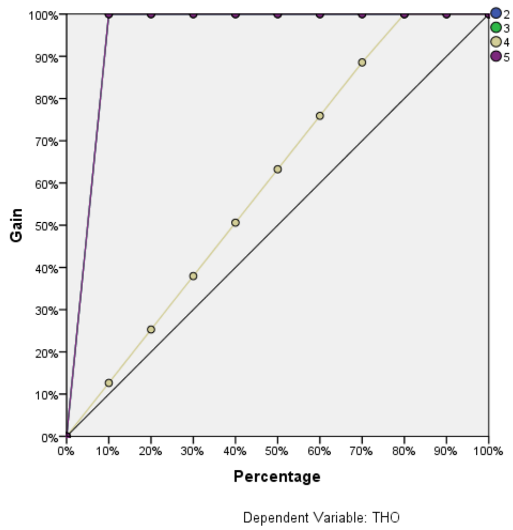

Figure 6.15: THO Cumulative Gains Chart

Figure 6.15 displays the cumulative gain recorded for the THO category for the correct prediction of the model application against the base prediction (without the model) in percentage. As seen, only curve 3 is considered. For curve 3, 12% of the moderate technology and hardware overrun costs predicts up to 89% of the cases.

Cumulative Lift Chart

The lift chart of THO gives the benefit of the model in application against not being used (see Figure 6.16). The lift factor for the gain chart for a moderate technology and hardware overrun prediction is 89%/12% = 7.41, which is derived through the artificial neural network by considering the impact of the independent variables used. The lift factor for the THO is found to be much higher in comparison with operational overrun, planning and development overrun and people/management overrun.

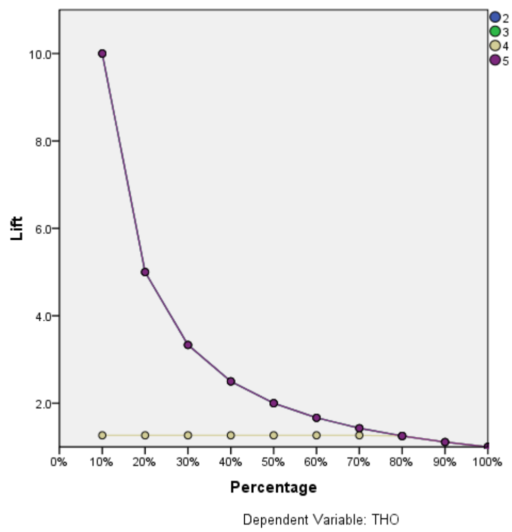

Figure 6.16: THO Cumulative Lift Chart

Independent Variable Importance Chart

For technology and hardware overrun, the normalized importance is shared in Figure 6.17 for the artificial neural network model. As seen, high normalized importance is associated with education, 'failure to address integration with existing technology', years of experience, 'inadequate or incorrect design', 'incompatibility of new with existing technology' and 'use of unproven technology'.

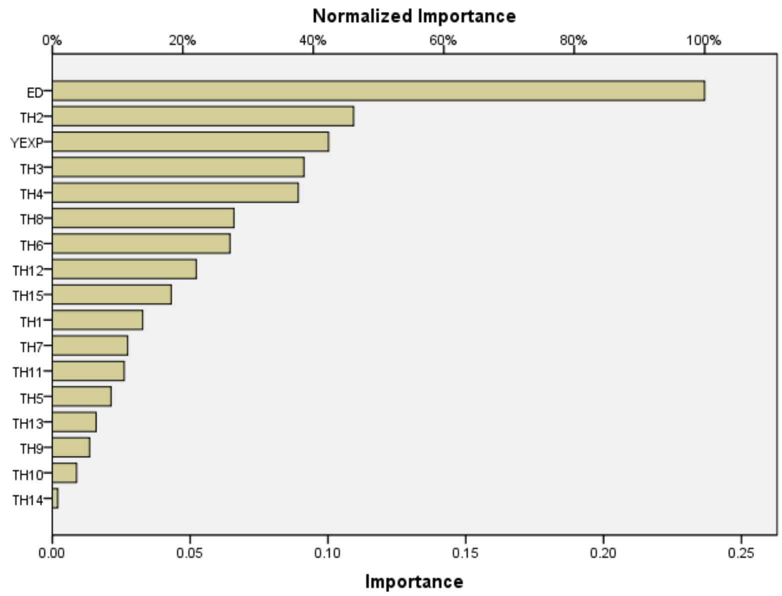

Figure 6.17: THO Independent Variable Importance Chart

Overrun costs prediction is found to be associated with education and years of experience of the project employees and also failure to address integration with existing technology. To reduce the cost overrun, focus should also be placed on reducing instances of inadequate or incorrect design and incompatibility of new with existing technology. Also, the usage of unproven technology can limit the overall project functionalities, thereby increasing the overrun costs associated with technology and hardware integrated in the ICT projects.

6.3.4 Conclusion

With the aim of studying the effect of four types of overrun on the implementation of ICT networks in the United Arab Emirates, this chapter presents the probabilities of the occurrence of the different overruns predicted through the neural network. The multi-layer perceptron (MLP) network was applied in order to predict the probability of the four types of overruns associated with influence ICT network implementation. The classification of the types of overruns influencing ICT network implementation was successful as the results of the artificial neural network model led to prediction of the risks up to 89%. However, the results need to be validated through the inclusion of a larger sample size. Chapter 6 presents the regression analysis conducted on the key variables, verifying the significance of the hypothesis as presented in Chapter 3.

7 ASSOCIATION ANALYSIS USING MULTIPLE REGRESSION

7.1 Introduction

In this chapter, the results of modelling the association between ICT and cost overrun are presented conducted through regression analysis. The findings of the regression are re-evaluated through the artificial neural network to validate the findings.

7.2 Modelling the Association

To model the relationship between ICT and cost overrun, this research proposes using multiple regression. It is a method by which one drives the magnitude and significant contribution of each of the independent variables. This method of modelling is widely used in developing predicting models (Boussabaine and Kirkham, 2005). The cost overrun due to ICT risks is modelled in a general input/output relationship as follows:

$Y = f(x)$

Where x is the m-dimensional input (risks) and y is the n-dimensional real output (percentage of cost overrun). The above equation allows the ICT risks to be mapped to project cost overrun. There are several methods for estimating the coefficients multiple regression equations, and this research experimented with a number of them. This study uses multiple linear regressions to determine the coefficients. In this study, a stepwise regression procedure was used in the SPSS to estimate the value of each of the regression coefficients. The method is selected because it is claimed it has *"an advantage over forward selection and stepwise regression because it is possible for a set of variables to have considerable predictive capability even though any subset of them does not. Forward selection and stepwise regression will fail to identify them. Because the variables don't predict well individually, they will never get to enter the model to have their joint behaviour noticed. Backwards elimination starts with everything in the model, so their joint predictive capability will be seen,"* The Little Handbook of Statistical Practice (2015).

In this research study, the application of multiple linear regression analysis is undertaken given the division of the independent variable into four sub-variables as follows: Planning and Development (PD), Technology/Hardware (TH), Operation (OP) and People/Management risks (PM). The aim of this research is to examine the factors (i.e. PD, TH, Op and PM) that influence the adoption and implementation of ICT networks in the UAE and lead to cost overruns. The hypotheses are as follows:

1. Planning and Development risks have a significant association with cost overrun.
2. Technology and Hardware risks have a significant association with cost overrun.
3. Operational risks have a significant association with cost overrun.
4. People and Management risks have a significant association with cost overrun.

Each of the above hypotheses are tested and examined in detail below.

7.2.1 Association between Planning & Development Risks and Cost Overrun

H1 - Planning and Development has a significant influence on overrun cost of ICT network projects

To test the association between the Planning and Development risks (PDO) and cost overrun, multiple regression analysis was conducted. The purpose of the regression test was to map the effect of PDO risks on cost overrun in ICT projects. The output of the regression test is illustrated below. As seen in Table 7.1, the simple correlation (R) for model 1 is presented as .999, which is an indicator of high positive correlation. Similarly, the R square which measures the variance associated with the dependent variable PDO and is explained by the independent variables is found to be 99.7%, which is very high. The adjusted R2 is equivalent to R2, which indicates no variation. This suggests the derived multiple regression equation is able to predict 99.7% of cost overrun due to development risks.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.999[a]	.997	.997	.039	.997	6268.006	12	196	.000

a. Predictors: (Constant), PD38, PD35, PD7, PD37, PD22, PD34, PD11, PD15, PD8, PD2, PD24, PD31

b. Dependent Variable: PDO

Table 7.1: Model Summary for PDO and Cost Overrun

As observed in Table 7.2 ANOVA, PDO risk was found to have a significant effect on the cost overrun, F(12, 196) = 6268.006, p = 0.000, R2 = .997. All sub-variables within the planning and development risks were found to be a significant predictor of cost overrun in ICT projects. The F change significance is also found to be significant, indicating that the variation identified in the model is not associated with chance and has a higher probability of predicting the cost overrun than through the mean change.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	116.309	12	9.692	6268.006	.000[b]
	Residual	.303	196	.002		
	Total	116.612	208			

a. Dependent Variable: PDO

b. Predictors: (Constant), PD38, PD35, PD7, PD37, PD22, PD34, PD11, PD15, PD8, PD2, PD24, PD31

Table 7.2: ANOVAa for PDO and Cost Overrun

Results of the dependent variable prediction towards the model are obtained from the coefficients table, as shown in Table 7.3. It is useful in identifying which of the predictor variables, i.e. planning and development sub-factors, contribute to be statistically significant in the overall model, with the other predictors held constant at 95% confidence interval. As observed in Table 7.3, all 12 variables within planning and development (included in the step wise regression) in ICT have a statistically significant effect (i.e. $p < 0.05$) on the PDO and are found to be a good predictor for cost overrun. These are: Business Requirements not understood, Budget not adequately estimated or planned, Budget not provided or budget withdrawn, Unclear project responsibilities, Inadequate project planning, Contractors/vendors mismanaged, Inadequate understanding of project benefits, Delayed on approval, Inadequate management of project development lifecycle/process, Delays in external approvals or decision making, Inadequate planning for migration from old to new system/network and Training not planned or conducted adequately. The highest Beta weight is associated with PD37, i.e. inadequate planning for migration from old to new system/network. As all predictors have a significant effect on the cost overrun caused by PDO, they are retained in the regression model. The table also conveys the variation contributing to the cost overrun to be both positive and negative. It can be concluded that the cost overrun can be controlled by identifying the variables within the PDO and managing the variation associated with them. Higher efforts need to be directed towards variables that have higher coefficient values, such as inadequate planning for migration from old to new system/network, as they contribute to higher variation towards cost overrun.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Corre	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	P
1	(Constant)	3.003	.069		43.538	.000	2.867	3.139		
	PD2	.142	.012	.120	12.113	.000	.119	.166	-.503	
	PD7	-.557	.007	-.665	-80.160	.000	-.571	-.544	-.687	
	PD8	-.184	.008	-.197	-23.346	.000	-.199	-.168	-.392	
	PD11	-.801	.012	-.856	-68.673	.000	-.824	-.778	-.142	
	PD15	-.222	.009	-.249	-25.758	.000	-.239	-.205	.717	
	PD22	.503	.007	.545	67.954	.000	.488	.518	.004	
	PD24	-.176	.010	-.180	-17.136	.000	-.196	-.156	.387	
	PD31	-2.460	.037	-.924	-66.835	.000	-2.533	-2.387	-.036	
	PD34	.900	.010	1.011	89.075	.000	.880	.920	.373	
	PD35	-.242	.007	-.240	-33.652	.000	-.256	-.228	-.150	
	PD37	3.044	.049	.827	62.499	.000	2.948	3.140	.117	
	PD38	.442	.007	.400	59.841	.000	.428	.457	.261	

a. Dependent Variable: PDO

Table 7.3: Results of Estimated Coefficients for PDO and Cost Overrun

The normality of the residuals for PDO and cost overrun is reviewed through the residual statistics. As seen in Table 7.4 and Figure 7.1, a normal distribution for the dependent variable PDO is observed. The residual mean is found to be zero, which confirms the linearity assumption of the dataset and normality. These conditions should be fulfilled by the dataset and should not be violated.

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.03	5.02	3.59	.748	209
Residual	-.091	.053	.000	.038	209
Std. Predicted Value	-2.086	1.910	.000	1.000	209
Std. Residual	-2.321	1.342	.000	.971	209

a. Dependent Variable: PDO

Table 7.4: Residuals Statistics for PDO and Cost Overrun

To visually review the normality of the residuals, the standardized residuals are consulted through the histogram. As seen in Figure 7.1, a normal curve is found for the standardized residual frequency, indicating acceptance of the normality assumption. Similarly, Figure 7.2 reflects the normal P-P plot wherein the values corresponding to the PDO follow the normality line, indicating the normality of the dataset.

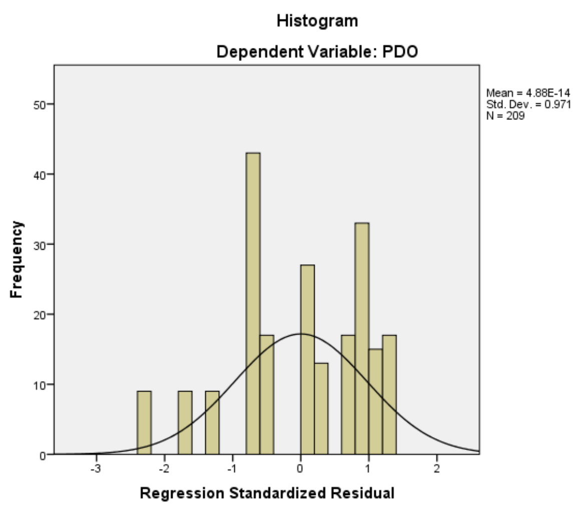

Figure 7.1: Histogram Plot

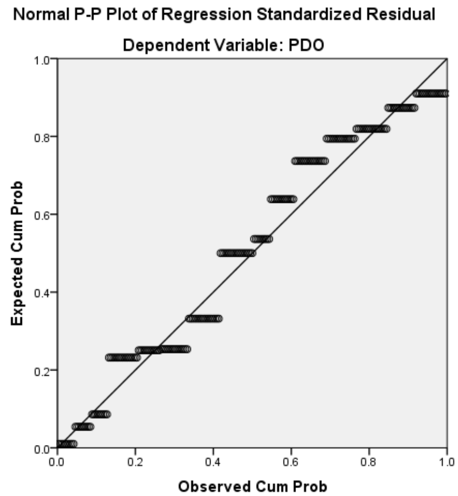

Figure 7.2: P Plot for PDO and Cost Overrun

The findings of the regression test are in support of hypothesis 1, i.e. Planning and Development risks have a significant association with cost overrun. An increase in the planning and development risks are associated with a significant rise in the cost overrun in ICT projects. The significance in this regression model is associated with Business requirements not understood, Budget not adequately estimated or planned, Budget not provided or budget withdrawn, Unclear project responsibilities, Inadequate project planning, Contractors/vendors mismanaged, Inadequate understanding of project benefits, Delayed on approval, Inadequate management of project development lifecycle/process, Delays in external approvals or decision making, Inadequate planning for migration from old to new system/network and Training not planned or conducted adequately. These factors contribute to the significance of the model.

To further test the acceptance of the regression results, the study also used the ANN algorithm in SPSS to identify the relative importance of each of the independent variables. Figure 7.3 shows the importance analysis of the independent variables by using ANN to map dependent variables. The figure depicts how sensitive the PDO model is to the change of each input variable. All the independent variables are assigned a value to indicate their level of importance in influencing the output. The relative influence ranges from 0%, representing 'no influence', to 100%, representing the independent variable that dominates the contribution to the explanation of the variation in the output.

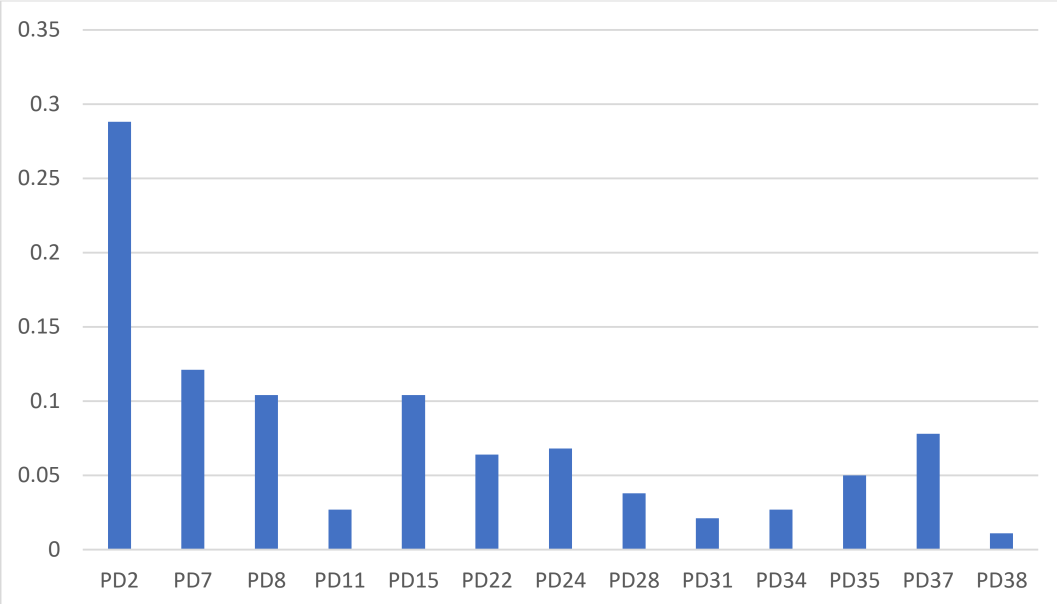

Figure 7.3: Normalized Importance for PDO and Cost Overrun

In the planning and development model, risk PD2 has been identified as the most important variable that contributes to cost overrun. This suggest that if "Business requirements [are] not understood" then the likelihood of cost overrun in IT network projects is very high. The second most important indicator is PD7 "budget not adequately estimated or planned". This signifies that if the project budget is based on assumptions that do not reflect the reality of the project then there may be consequences for the project. This finding is consistent with existing literature on IT project failure. The third most important indicator is PD8 "Budget not provided or budget withdrawn". This is similar to PD7 risk. Both of these risks are related to changes in project or budget resulting in delays.

The fourth most important indicator is P15 "Inadequate project planning". This is a primary risk in project management. It is well reported in the literature that a large number of IT projects are dogged by cost overruns due to poor planning and other risks. The fifth most important risk is P37 "Inadequate planning for migration from old to new system/network". This is like risk P15. However, transition from old to new IT system is always fraught with problems and many unknowns related to the operational problems and cost of migration.

The importance measures shown in Table 7.5 are an indicator for considering these risks for further strengths on cost impacts. The least contributors to cost overrun were PD38 "Training not planned or conducted adequately", PD31 "Delayed on approval", PD34 "Inadequate management of project development lifecycle/process" and PD11 "Unclear project responsibilities". These results appear to suggest these important lifecycle managerial issues are not important contributors to cost overrun at the development stage. These results probably are peculiar to the UAE context. For example, unclear roles in complex IT projects is one of the main causes of why projects have cost overruns. While the regression model was found to be a good fit and significant, all 12 variables considered under planning and development were found to contribute towards variation in cost overrun. However, the ANN identified that four variables (PD38, PD31, PD34 and PD11) are low contributors towards cost overrun, thereby eliminating them.

	Importance	Normalized Importance
PD2	.288	100.0%
PD7	.121	42.0%
PD8	.104	36.2%
PD11	.027	9.4%
PD15	.104	36.2%
PD22	.064	22.3%
PD24	.068	23.5%
PD28	.038	13.2%
PD31	.021	7.2%
PD34	.027	9.2%
PD35	.050	17.2%
PD37	.078	26.9%
PD38	.011	3.8%

Table 7.5: Independent Variable Importance

7.2.2 Association between Technology and Hardware Risks and Cost Overrun

H2 - Technology/Hardware has a significant influence on overrun cost of ICT network projects

For hypothesis 2, the regression test involved a linear regression analysis with the dependent variable as technology and hardware risks (THO) and independent variable as cost overrun in ICT projects. The results of the regression analysis are shared below. As seen in Table 7.6, the simple determination coefficient (R) between THO and cost overrun is presented as .246, which is an indicator of a weak positive correlation between the two variables. Similarly, the R square measuring the variance associated with the dependent variable PDO and explained by the independent variables is found as 6%, which is very low. Also, the unadjusted R2 is higher than the adjusted R2, which indicates a low number of causes concerning the small variation.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.246[a]	.060	.042	.647	.060	3.272	4	204	.013

a. Predictors: (Constant), TH8, TH2, TH1, TH6

b. Dependent Variable: THO

Table 7.6: Model Summary for THO and Cost Overrun

The result of the regression test for the model THO and cost overrun, as seen in Table 7.7 ANOVA was significant, F (4, 204) = 3.272, p = 0.013, R2 = 0.042. A limited set of technology and hardware predictors were found to be associated significantly with the overall model. To identify which predictors were associated with the statistical significant while other predictors are held constant, the coefficients table provided in Table 7.8 is referred to. As observed, only one out of four – (TH6), i.e. Technical complexity not understood – has a statistically significant effect towards the overall model at 95% confidence with the effect size (Beta) as .164. This confirms that technical complexity not being understood is a good predictor (under THO) of the cost overrun in ICT projects. Thus it can be concluded that the cost overrun in ICT projects can be reduced by controlling the technical complexities in the projects through efforts that are directed towards training and development.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.473	4	1.368	3.272	.013[b]
	Residual	85.293	204	.418		
	Total	90.766	208			

a. Dependent Variable: THO

b. Predictors: (Constant), TH8, TH2, TH1, TH6

Table 7.7: ANOVAa for THO and Cost Overrun

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.051	.474		6.436	.000	2.116	3.985					
	TH1	.092	.068	.112	1.363	.174	-.041	.226	.163	.095	.093	.680	1.470
	TH2	.125	.114	.078	1.096	.274	-.100	.350	.133	.077	.074	.911	1.098
	TH6	.164	.082	.184	2.002	.047	.003	.326	.171	.139	.136	.543	1.842
	TH8	-.183	.094	-.164	-1.954	.052	-.368	.002	-.001	-.136	-.133	.651	1.536

Coefficients[a]

a. Dependent Variable: THO

Table 7.8: Coefficients for THO and Cost Overrun

The normality of the residuals for THO and cost overrun is reviewed through the residual statistics. As seen in Table 7.9 and Figure 7.4, a normal distribution for the dependent variable THO is observed, which is a mandatory requirement for the dataset. The standardized residual frequency is found to follow the normal curve. The residual mean is found to be zero, indicating the acceptance of the condition of normality and independence. On the other hand, Figure 7.5 reflects the normal P-P plot wherein the values corresponding to the PDO follow the normality line, indicating the normality of the dataset.

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.46	4.23	3.88	.162	209
Residual	-1.772	1.228	.000	.640	209
Std. Predicted Value	-2.539	2.166	.000	1.000	209
Std. Residual	-2.740	1.900	.000	.990	209

a. Dependent Variable: THO

Table 7.9: Residuals Statistics for THO and Cost Overrun

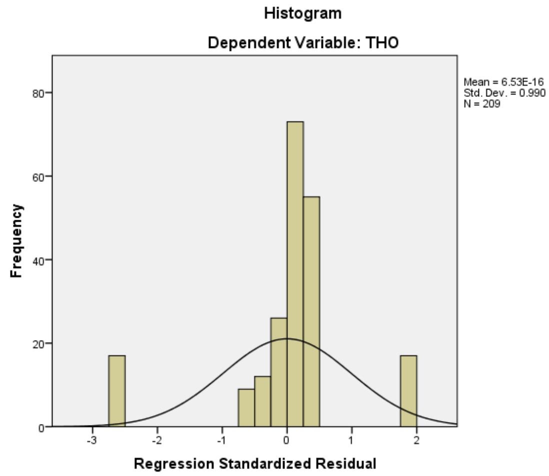

Figure 7.4: Histogram Plot

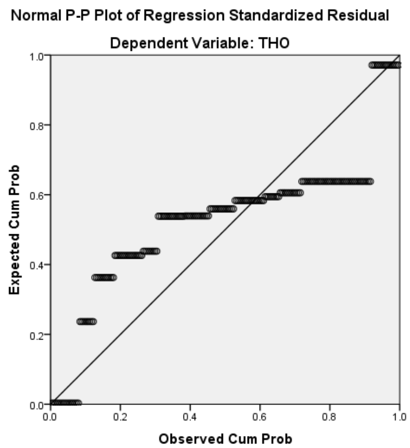

Figure 7.5: P-P Plot for THO and Cost Overrun

The findings of the regression test are in support of hypothesis 2, i.e. Technology and Hardware risks have a significant association with ICT cost overrun. This indicates that an increase in technology and hardware risks in the ICT projects can lead to a statistically significant increase in ICT cost overrun. However, only the technical complexities risk is found to be associated with the significance. To confirm the findings of the regression model executed for technology and hardware risks and its effect on cost overrun, an ANN is conducted.

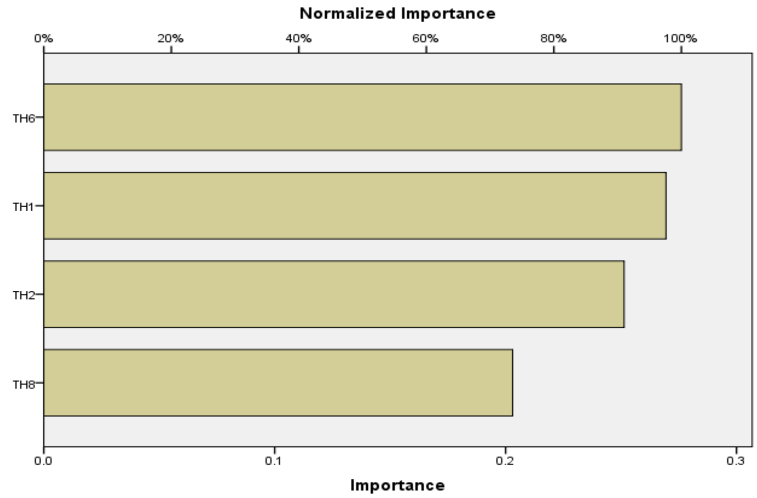

Figure 7.6: Normalized Importance for THO and Cost Overrun

The relative importance of TH risk factors is shown in Figure 7.6. From this figure as well as Table 7.10, it appears that TH6 "Technical complexity not understood" has the greatest influence on the cost overrun of IT network projects. It is well understood in the literature that an increase in project complexity will lead to an increase in project risk profile. Technological complexity is usually associated with risks that might emerge from the unknown flaws in the technology and staff's lack of familiarity in using the technology. Problems in modern technologies are normally associated with scheduling problems. This phenomenon is cited as one of the leading causes of project cost increase.

TH1 "Failure to address integration of components within the project" is also a major determinant of cost overrun. The synchronization between project management and integration of project components to accomplish project goals is an essential ingredient for successful projects. Hence, is not surprising to see here that the failure of integration is deemed an important contributor to project overrun. The third most important risk indicator is TH8 "Use of unproven technology", which is deemed to be less influential than the other risks in this cluster. TH2 "Failure to address integration with existing technology" is also believed to be an important cause of cost overrun. The challenge of effectively integrating new technology with existing technology is well described in the literature. The problems cited in the literature including complexity of data migration, processes, functionality, etc., are all attributed to cost overrun.

The results from ANN mapping confirm that TH6 is a reliable predictor for cost overrun due to its high influence on the cost overrun in IT network projects. The ANN findings coordinate with the findings of the stepwise regression model that indicate the role of technical complexities in increasing the cost overrun. Technical complexities management requires a streamlined approach that connects various facets of technology integration and execution. Any breakage in this link leads to technical challenges, resulting in re-evaluation and re-implementation and additional costs.

	Importance	Normalized Importance
TH1	.269	97.6%
TH2	.251	91.0%
TH6	.276	100.0%
TH8	.203	73.5%

Table 7.10: Independent Variable Importance for THO and Cost Overrun

7.2.3 Association between Operational Risks and Cost Overrun

H3 - Operation has a significant influence on overrun cost of ICT network projects

To examine the association between operational risks (OP) and cost overrun in ICT projects, multiple regression analysis was conducted with the results shared in the tables below. The test was conducted to discover if operational risks can predict ICT cost overrun. The output of the regression is presented in six models, as observed in Table 7.11, with model 1 holding only one variable and model 6 holding six variables. As seen in Table 7.11, coefficient of determination (R) is found to be higher in model 6, presented as .860, which is an indicator of high positive correlation. Similarly, the R square which predicts the variance associated with the dependent variable PDO and is explained by the independent variables is found to be 74%, which is very high. The 26% variation which is not accounted for by the independent variable can be due to random variations or variation factors missing from the model.

Model Summary[g]									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.405[a]	.164	.160	.789	.164	40.729	1	207	.000
2	.539[b]	.291	.284	.729	.126	36.684	1	206	.000
3	.657[c]	.431	.423	.655	.140	50.571	1	205	.000
4	.819[d]	.671	.664	.499	.240	148.560	1	204	.000
5	.842[e]	.710	.702	.470	.039	27.053	1	203	.000
6	.860[f]	.740	.732	.446	.030	23.299	1	202	.000

a. Predictors: (Constant), OP18

b. Predictors: (Constant), OP18, OP2

c. Predictors: (Constant), OP18, OP2, OP6

d. Predictors: (Constant), OP18, OP2, OP6, OP8

e. Predictors: (Constant), OP18, OP2, OP6, OP8, OP17

f. Predictors: (Constant), OP18, OP2, OP6, OP8, OP17, OP1

g. Dependent Variable: OPO

Table 7.11: Model Summary for OP and Cost Overrun

The regression model 6 was found significant, F (6, 202) = 95.598, p = .000, R2 = .732). These findings indicate that there is a statistical association between operational risks and cost overrun in ICT projects, thereby accepting the hypothesis. The dependent variable OPO prediction on the independent variable is obtained from the coefficients table, as shown in Table 7.13. As observed, all variables within model 6 regression in planning and development have a statistically significant effect on the PDO-based cost overrun (significance tested through $p \leq 0.05$ as a point of reliable intercept point). These are: OP18 (Failure to address environmental impact on network), OP2 (Instability of delivered network), OP6 (Failure to properly migrate from old to new network), OP8 (Inadequate testing leading to operational failure of the network), OP17 (Inadequate operational processes), and OP1 (Operational problems caused by poor implementation). From these results, it can be concluded that the cost overrun in ICT projects is significantly influenced by operational risks that arise from instable network, poor migration, testing failures, poor operational processes and poor implementation. Developing a streamlined approach to manage and implement operations can lead to elimination or at least reduction in operational risks, thereby improving the overall efficiency of the operations.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.385	1	25.385	40.729	.000[b]
	Residual	129.017	207	.623		
	Total	154.402	208			
2	Regression	44.887	2	22.444	42.217	.000[c]
	Residual	109.515	206	.532		
	Total	154.402	208			
3	Regression	66.557	3	22.186	51.774	.000[d]
	Residual	87.844	205	.429		
	Total	154.402	208			
4	Regression	103.573	4	25.893	103.921	.000[e]
	Residual	50.829	204	.249		
	Total	154.402	208			
5	Regression	109.550	5	21.910	99.165	.000[f]
	Residual	44.852	203	.221		
	Total	154.402	208			
6	Regression	114.188	6	19.031	95.598	.000[g]
	Residual	40.213	202	.199		
	Total	154.402	208			

a. Dependent Variable: OPO

b. Predictors: (Constant), OP18

c. Predictors: (Constant), OP18, OP2

d. Predictors: (Constant), OP18, OP2, OP6

e. Predictors: (Constant), OP18, OP2, OP6, OP8

f. Predictors: (Constant), OP18, OP2, OP6, OP8, OP17

g. Predictors: (Constant), OP18, OP2, OP6, OP8, OP17, OP1

Table 7.12: ANOVAa for OP and Cost Overrun

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	6.106	.382		15.987	.000	5.353	6.860					
	OP18	-.586	.092	-.405	-6.382	.000	-.767	-.405	-.405	-.405	-.405	1.000	1.000
2	(Constant)	1.982	.767		2.584	.010	.470	3.494					
	OP18	-.560	.085	-.388	-6.601	.000	-.727	-.393	-.405	-.418	-.387	.998	1.002
	OP2	1.315	.217	.356	6.057	.000	.887	1.743	.375	.389	.355	.998	1.002
3	(Constant)	-.174	.752		-.232	.817	-1.658	1.309					
	OP18	-.692	.078	-.479	-8.825	.000	-.847	-.537	-.405	-.525	-.465	.942	1.062
	OP2	1.664	.201	.450	8.279	.000	1.268	2.060	.375	.501	.436	.938	1.066
	OP6	.429	.060	.398	7.111	.000	.310	.548	.171	.445	.375	.886	1.129
4	(Constant)	.810	.579		1.399	.163	-.332	1.953					
	OP18	-.681	.060	-.471	-11.381	.000	-.798	-.563	-.405	-.623	-.457	.942	1.062
	OP2	1.846	.154	.500	11.987	.000	1.542	2.149	.375	.643	.482	.929	1.076
	OP6	.809	.056	.750	14.555	.000	.699	.918	.171	.714	.585	.607	1.646
	OP8	-.724	.059	-.599	-12.189	.000	-.841	-.607	-.274	-.649	-.490	.668	1.497
5	(Constant)	-.398	.593		-.671	.503	-1.567	.771					
	OP18	-.676	.056	-.468	-12.012	.000	-.787	-.565	-.405	-.645	-.454	.941	1.062
	OP2	2.356	.175	.638	13.458	.000	2.011	2.701	.375	.687	.509	.638	1.569
	OP6	.918	.056	.852	16.282	.000	.807	1.029	.171	.753	.616	.523	1.912
	OP8	-.678	.057	-.561	-11.974	.000	-.790	-.566	-.274	-.643	-.453	.652	1.535
	OP17	-.272	.052	-.258	-5.201	.000	-.375	-.169	.073	-.343	-.197	.583	1.715
6	(Constant)	-.606	.565		-1.074	.284	-1.720	.507					
	OP18	-.733	.055	-.507	-13.395	.000	-.841	-.625	-.405	-.686	-.481	.898	1.113
	OP2	2.644	.177	.716	14.975	.000	2.296	2.993	.375	.725	.538	.564	1.772
	OP6	1.029	.058	.955	17.662	.000	.914	1.144	.171	.779	.634	.441	2.268
	OP8	-.614	.055	-.508	-11.076	.000	-.723	-.504	-.274	-.615	-.398	.614	1.630
	OP17	-.366	.053	-.347	-6.867	.000	-.471	-.261	.073	-.435	-.247	.505	1.981
	OP1	-.210	.044	-.209	-4.827	.000	-.296	-.124	.056	-.322	-.173	.687	1.456

a. Dependent Variable: OPO

Table 7.13: Coefficients for OP and Cost Overrun

The normality of the residuals for OP and cost overrun is reviewed through the residual statistics. The residual mean as seen in Table 7.14 is zero, which leads to acceptance of the linearity condition. Also, as seen in Figure 7.7, a normal distribution for the dependent variable OP is observed through the normality plot of the residuals, obtained through the regression simulation. Figure 7.8 reflects the normal P-P plot wherein the values corresponding to the OP follow the normality line, which indicates the normality of the dataset.

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.47	5.00	3.69	.741	209
Residual	-.912	.672	.000	.440	209
Std. Predicted Value	-1.645	1.763	.000	1.000	209
Std. Residual	-2.044	1.507	.000	.985	209

a. Dependent Variable: OPO

Table 7.14: Residuals Statistics for OP and Cost Overrun

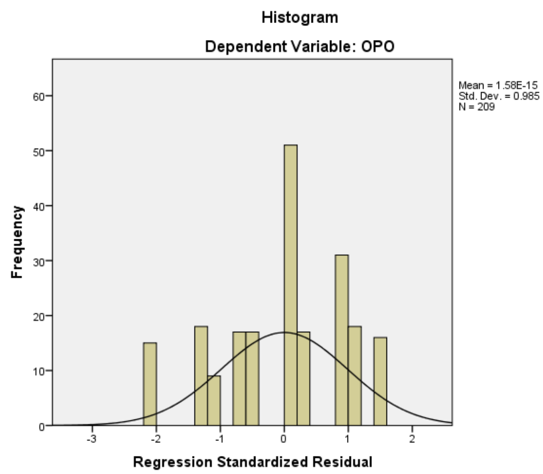

Figure 7.7: Histogram Plot

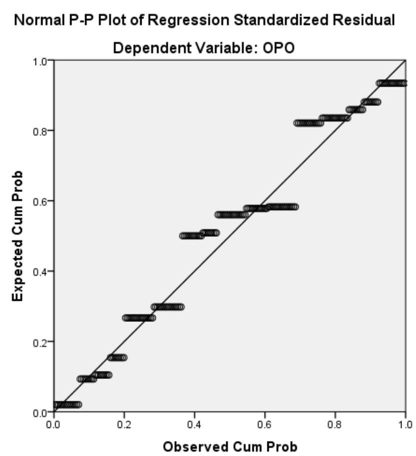

Figure 7.8: P-P Plot for OP and Cost Overrun

The typical relative importance of the Operational Risks in predicating cost overrun is presented Figure 7.9 and Table 7.15. It is found that OP18 “Failure to address environmental impact on network (harsh conditions, vermin damage etc.)” and OP6 “Failure to properly migrate from old to new network” have the greatest influence on cost overrun, by far more important than OP4 “Inadequate requirements management leading to operational failure of the network”, OP1 “Operational problems caused by poor implementation” and OP2 “Instability of delivered network”. The results also demonstrated that OP8 “Inadequate testing leading to operational failure of the network” is a major contributor to cost overrun. Similarly, OP15 “Organizational changes leading to operational problems” and OP17 “Inadequate operational processes” have some influence on cost overrun but not to the extent of OP18.

The results from ANN mapping indicate the importance of managing environmental impact on the network and network migration on the cost overrun in ICT network projects. While the other factors – i.e. instable network, testing failures, poor operational processes and poor implementation – are also important, there are not associated as a priority. The regression modelling confirms the findings of the ANN, indicating the need to manage operational risks (as per the priority indicated in the ANN mapping) and control the cost overrun.

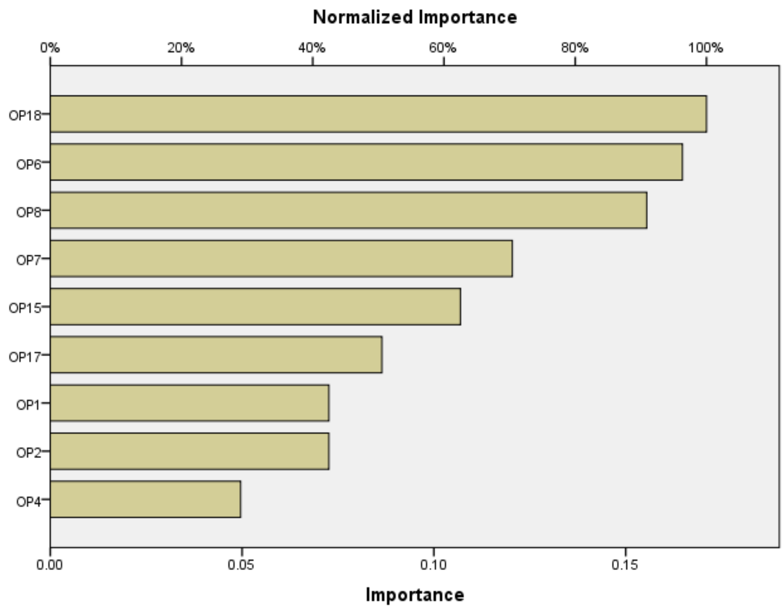

Figure 7.9: Normalized importance for OP and Cost Overrun

	Importance	Normalized Importance
OP1	.073	42.5%
OP2	.073	42.4%
OP4	.050	29.0%
OP6	.165	96.3%
OP7	.120	70.4%
OP8	.155	90.9%
OP15	.107	62.5%
OP17	.086	50.5%
OP18	.171	100.0%

Table 7.15: Independent Variable Importance for OP and Cost Overrun

7.2.4 Association between People/Management Risks and Cost Overrun

H4 - People/Management risks has a significant influence on overrun cost of ICT network projects

For testing hypothesis 4, a multiple stepwise regression model is applied with the results of the regression tests shared below. The aim was to discover whether or not people and management risks have a significant association with cost overrun in ICT projects. As seen in Table 7.16, there are nine regression models presented with the highest coefficient of determination (R) .744, which is an indicator of high positive correlation found for model 9. Similarly, the R square, which predicts the variance associated with the dependent variable PDO and is explained by the independent variables, is found to be highest in model 9 as 75.5%, which is very high. The 24.5% missing variance which is not accounted for by the independent variable can be due to random variations or variation factors missing from the model.

Table 7.16: Model Summary for PM and cost overrun

Model Summary[j]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.208[a]	.043	.039	.770	.043	9.395	1	207	.002
2	.398[b]	.158	.150	.724	.115	28.146	1	206	.000
3	.537[c]	.289	.278	.667	.130	37.587	1	205	.000
4	.566[d]	.320	.307	.654	.031	9.376	1	204	.002
5	.644[e]	.415	.401	.608	.095	33.037	1	203	.000
6	.747[f]	.558	.545	.530	.143	65.244	1	202	.000
7	.809[g]	.655	.643	.469	.097	56.717	1	201	.000
8	.830[h]	.689	.676	.447	.034	21.575	1	200	.000
9	.869[i]	.755	.744	.397	.066	54.034	1	199	.000

a. Predictors: (Constant), PM5
b. Predictors: (Constant), PM5, PM8
c. Predictors: (Constant), PM5, PM8, PM10
d. Predictors: (Constant), PM5, PM8, PM10, PM1
e. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16
f. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16, PM14
g. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16, PM14, PM18
h. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16, PM14, PM18, PM12
i. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16, PM14, PM18, PM12, PM9
j. Dependent Variable: PMO

A statistically significant relationship was observed across all regression models i associated with people and management (PMO) risks influencing the cost overrun in ICT projects, see Table 7.17 ANOVA. The regression model i with its variation variables was statistically significant, F(9, 199) = 68.242, p = 0.000, R2 =.744). Also, the significance attributed by the F statistics indicates that the variation found in the model is better than the mean prediction or assumption of chance. The contribution of the variables on the estimation of the dependent variable is identified through the estimated coefficients table. As observed in Table 7.18 coefficients output, all sub-factors within the people and management in ICT have a statistically significant effect (i.e. $p \leq 0.05$) on the cost overrun associated with PMO. For the Beta value, model 9 indicates that the highest Beta value corresponds to PM8 – i.e. Failure to manage staff priorities – followed by PM12 – i.e. Mismanagement of project schedule.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.568	1	5.568	9.395	.002[b]
	Residual	122.681	207	.593		
	Total	128.249	208			
2	Regression	20.315	2	10.157	19.386	.000[c]
	Residual	107.934	206	.524		
	Total	128.249	208			
3	Regression	37.038	3	12.346	27.748	.000[d]
	Residual	91.210	205	.445		
	Total	128.249	208			
4	Regression	41.046	4	10.262	24.006	.000[e]
	Residual	87.202	204	.427		
	Total	128.249	208			
5	Regression	53.252	5	10.650	28.828	.000[f]
	Residual	74.997	203	.369		
	Total	128.249	208			
6	Regression	71.561	6	11.927	42.500	.000[g]
	Residual	56.688	202	.281		
	Total	128.249	208			
7	Regression	84.037	7	12.005	54.579	.000[h]
	Residual	44.212	201	.220		
	Total	128.249	208			
8	Regression	88.342	8	11.043	55.342	.000[i]
	Residual	39.907	200	.200		
	Total	128.249	208			
9	Regression	96.864	9	10.763	68.242	.000[j]
	Residual	31.385	199	.158		
	Total	128.249	208			

a. Dependent Variable: PMO
b. Predictors: (Constant), PM5
c. Predictors: (Constant), PM5, PM8
d. Predictors: (Constant), PM5, PM8, PM10
e. Predictors: (Constant), PM5, PM8, PM10, PM1
f. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16
g. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16, PM14
h. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16, PM14, PM18
i. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16, PM14, PM18, PM12
j. Predictors: (Constant), PM5, PM8, PM10, PM1, PM16, PM14, PM18, PM12, PM9

Table 7.17: ANOVAa for PM and cost overrun

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.457	.318		10.887	.000	2.831	4.083					
	PM5	-.318	.104	-.208	-3.065	.002	-.523	-.114	-.208	-.208	-.208	1.000	1.000
2	(Constant)	3.125	.305		10.245	.000	2.524	3.727					
	PM5	-.630	.114	-.412	-5.528	.000	-.854	-.405	-.208	-.359	-.353	.734	1.362
	PM8	.361	.068	.396	5.305	.000	.227	.495	.183	.347	.339	.734	1.362
3	(Constant)	4.939	.408		12.102	.000	4.135	5.744					
	PM5	-.846	.111	-.554	-7.637	.000	-1.064	-.627	-.208	-.471	-.450	.660	1.515
	PM8	.610	.075	.668	8.164	.000	.462	.757	.183	.495	.481	.518	1.932
	PM10	-.504	.082	-.430	-6.131	.000	-.666	-.342	-.118	-.394	-.361	.705	1.419
4	(Constant)	5.688	.469		12.132	.000	4.764	6.613					
	PM5	-.832	.109	-.545	-7.656	.000	-1.046	-.618	-.208	-.472	-.442	.659	1.518
	PM8	.660	.075	.723	8.796	.000	.512	.807	.183	.524	.508	.493	2.028
	PM10	-.563	.083	-.481	-6.799	.000	-.727	-.400	-.118	-.430	-.393	.666	1.502
	PM1	-.213	.070	-.187	-3.062	.002	-.350	-.076	-.092	-.210	-.177	.897	1.115
5	(Constant)	5.096	.448		11.379	.000	4.213	5.979					
	PM5	-1.015	.106	-.664	-9.583	.000	-1.224	-.806	-.208	-.558	-.514	.599	1.669
	PM8	.805	.074	.883	10.856	.000	.659	.952	.183	.606	.583	.435	2.296
	PM10	-.612	.077	-.523	-7.903	.000	-.765	-.460	-.118	-.485	-.424	.658	1.520
	PM1	-.499	.082	-.437	-6.112	.000	-.659	-.338	-.092	-.394	-.328	.564	1.772
	PM16	.511	.089	.409	5.748	.000	.336	.686	.032	.374	.308	.569	1.757
6	(Constant)	8.248	.552		14.944	.000	7.160	9.337					
	PM5	-1.135	.093	-.743	-12.136	.000	-1.319	-.950	-.208	-.649	-.568	.584	1.712
	PM8	.908	.066	.996	13.784	.000	.778	1.038	.183	.696	.645	.419	2.386
	PM10	-.409	.072	-.349	-5.678	.000	-.551	-.267	-.118	-.371	-.266	.578	1.731
	PM1	-.784	.079	-.687	-9.874	.000	-.940	-.627	-.092	-.571	-.462	.453	2.209
	PM16	.899	.091	.719	9.859	.000	.719	1.078	.032	.570	.461	.411	2.430
	PM14	-1.419	.176	-.495	-8.077	.000	-1.765	-1.072	-.189	-.494	-.378	.583	1.716
7	(Constant)	9.463	.515		18.390	.000	8.448	10.477					
	PM5	-1.468	.094	-.961	-15.640	.000	-1.654	-1.283	-.208	-.741	-.648	.454	2.202
	PM8	.926	.058	1.015	15.852	.000	.810	1.041	.183	.745	.657	.419	2.389
	PM10	-.558	.067	-.476	-8.351	.000	-.689	-.426	-.118	-.508	-.346	.527	1.896
	PM1	-.977	.075	-.856	-13.062	.000	-1.125	-.830	-.092	-.678	-.541	.399	2.505
	PM16	1.023	.082	.818	12.419	.000	.860	1.185	.032	.659	.514	.395	2.532
	PM14	-2.205	.187	-.770	-11.773	.000	-2.574	-1.836	-.189	-.639	-.488	.401	2.491
	PM18	.738	.098	.500	7.531	.000	.545	.931	-.075	.469	.312	.390	2.565
8	(Constant)	9.609	.491		19.567	.000	8.641	10.578					
	PM5	-1.464	.089	-.959	-16.375	.000	-1.641	-1.288	-.208	-.757	-.646	.454	2.203
	PM8	.947	.056	1.038	16.965	.000	.837	1.057	.183	.768	.669	.416	2.405
	PM10	-.583	.064	-.498	-9.132	.000	-.709	-.457	-.118	-.542	-.360	.524	1.910
	PM1	-1.092	.075	-.957	-14.479	.000	-1.241	-.944	-.092	-.715	-.571	.356	2.808
	PM16	.686	.107	.549	6.429	.000	.476	.897	.032	.414	.254	.213	4.690
	PM14	-2.389	.183	-.834	-13.073	.000	-2.749	-2.029	-.189	-.679	-.516	.383	2.613
	PM18	.861	.097	.583	8.876	.000	.670	1.053	-.075	.532	.350	.361	2.773
	PM12	.423	.091	.383	4.645	.000	.244	.603	.054	.312	.183	.229	4.363
9	(Constant)	9.703	.437		22.213	.000	8.841	10.564					
	PM5	-1.360	.081	-.890	-16.834	.000	-1.519	-1.200	-.208	-.766	-.590	.440	2.273
	PM8	.871	.051	.955	17.187	.000	.771	.971	.183	.773	.603	.399	2.509
	PM10	-.522	.057	-.446	-9.109	.000	-.636	-.409	-.118	-.542	-.319	.513	1.950
	PM1	-1.217	.069	-1.066	-17.588	.000	-1.353	-1.080	-.092	-.780	-.617	.335	2.987
	PM16	.508	.098	.406	5.181	.000	.314	.701	.032	.345	.182	.200	4.998
	PM14	-2.682	.167	-.936	-16.032	.000	-3.011	-2.352	-.189	-.751	-.562	.361	2.770
	PM18	.653	.091	.442	7.195	.000	.474	.832	-.075	.454	.252	.326	3.071
	PM12	.673	.088	.609	7.661	.000	.500	.847	.054	.477	.269	.195	5.131
	PM9	.378	.051	.368	7.351	.000	.277	.480	.148	.462	.258	.492	2.033

a. Dependent Variable: PMO

Table 7.18: Coefficients for PM and cost overrun

The normality of the residuals for PMO and cost overrun is reviewed through the residual statistics. As seen in Table 7.19 and Figure 7.10, a normal distribution for the dependent variable PM is observed. Figure 7.11 reflects the normal P-P plot wherein the values corresponding to the PMO follow the normality line, indicating the normality of the dataset.

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.76	3.72	2.50	.682	209
Residual	-.718	.502	.000	.388	209
Std. Predicted Value	-2.545	1.789	.000	1.000	209
Std. Residual	-1.808	1.263	.000	.978	209

a. Dependent Variable: PMO

Table 7.19: Residuals Statistics for PM and cost overrun

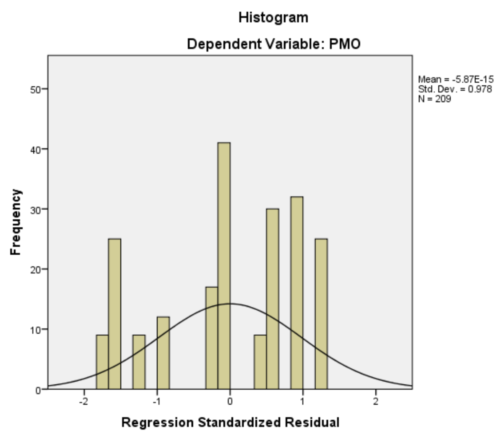

Figure 7.10: Histogram Plot

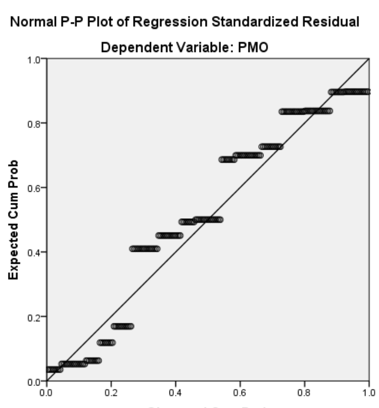

Figure 7.11: P-P Plot for PM and cost overrun

The regression test indicates that all factors considered under people and management contribute significantly towards cost overrun in ICT project, thereby validating hypothesis 4. It can be concluded that cost overrun is significantly impacted by people and management risks that include contractual issues, staff priorities management, compatibility with business strategy, management of organizational changes, external issues and time management. Efforts should be focused towards effective management of people and improving management operations, thereby controlling cost overrun associated with them, as these risks add to the variation in cost overrun.

To confirm the findings of the regression model, ANN mapping is executed. The typical relative importance of the People & Management Risks in predicating cost overrun is presented in Figure 7.12 and Table 7.20. It is found that PM5 “Contractual issues”, PM8 “Failure to manage staff priorities” and PM1 “Failure to achieve compatibility with the strategic business direction of the organization” were considered to have the greatest influence on cost overrun. However, PM16 “Inadequate management of budget needed for training and support” and PM14 “Organizational changes not properly managed” were deemed to have the least influence. Risks PM10 “Failure to provide enough project staff at the required time” and PM18 “Issues caused by external agencies, on which the project depends” have a similar effect on cost overrun. The importance of risk PM12 “Mismanagement of project schedule” in explaining the cost overrun is also not very high.

The ANN association confirms the importance of people and management risks (contractual issues, staff priorities management and compatibility with business strategy) in effectively managing cost overrun in ICT network projects. The results of the ANN are in line with the regression modelling that confirms that people and management risks have a significant impact on cost overrun; however, not all variables (as found in the regression model) are associated with the significant effect.

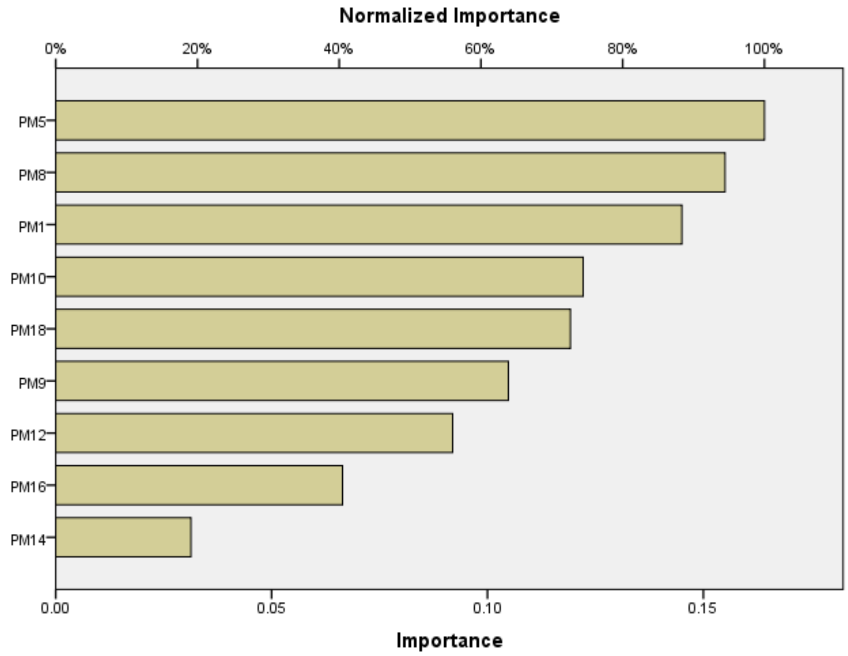

Figure 7.12: Normalized importance for PM and cost overrun

	Importance	Normalized Importance
PM1	.182	100.0%
PM5	.159	87.6%
PM8	.108	59.4%
PM9	.120	66.2%
PM10	.158	86.9%
PM12	.087	47.7%
PM14	.050	27.2%
PM16	.050	27.2%
PM18	.086	47.4%

Table 7.20: Independent Variable Importance for PM and cost overrun

7.3 Summary

Cost overruns in ICT network projects have been identified as being associated with various risks in the form of Planning and Development (PD), Technology/Hardware (TH), Operation (OP) and People/Management risks (PM). In this chapter, these risks were examined to see if they lead to a significant effect on the cost overrun, thereby influencing the adoption and implementation of ICT network projects. The results of the regression modelling and the ANN mapping indicate that Planning and Development, Technology/Hardware, Operation and People/Management risks are significant predictors of cost overrun. In planning and development, planning of training, approval delays, inadequate management of project development lifecycle/process and unclear project responsibilities were found to be significant predictors of variation in the cost overrun. In technology/hardware, only the technical complexities risk was found to be a significant predictor of variation to cost overrun. In operations, managing environmental impact on network and network migration were identified to have a significant effect on the cost overrun in ICT network projects, and in people/management, contractual issues, management of staff priorities and compatibility with business strategy were identified to significantly impact cost overrun.

8 DISCUSSION

8.1 Introduction

ICT plays a major role in modern organizations as it forms the core of the business process. According to Jorgenson and Vu (2016), ICT helps organizations to function effectively as well as efficiently, making it easy to integrate all the processes within the business. However, in order to ensure that the application of ICT networks occurs throughout the organization, the researcher has aimed to identify various factors that affect its delivery. This section further aims to conduct an in-depth discussion regarding the findings of the questionnaire presented to 209 participants in the UAE. For successful implementation of ICT networks it is vital to identify those factors that can pose major risks. These factors may either impede ICT implementation or in many cases cause complete failure in the adoption and implementation of ICT projects. It thus becomes vital to first identify the core factors that would have an impact on the ICT network implementation process. The main aim of this discussion is to verify the literature review as well as the framework that has been based on the identified factors that may influence the implementation of ICT network components.

8.2 Planning and Development Risk Factors

What are the Planning and Development risks that influence the ICT network projects' cost overrun?

The purpose of this research question was to extract from the literature and identify from the survey the most influential development risks on ICT network projects' cost overrun. The study extracted from the literature 38 risks that were deemed to have an influence. Reliability testing confirmed that only 13 risks were deemed to fulfil the scale measurement internal consistency criterion. The summary of the results of how respondents viewed the influence of these risks is shown in the following figure.

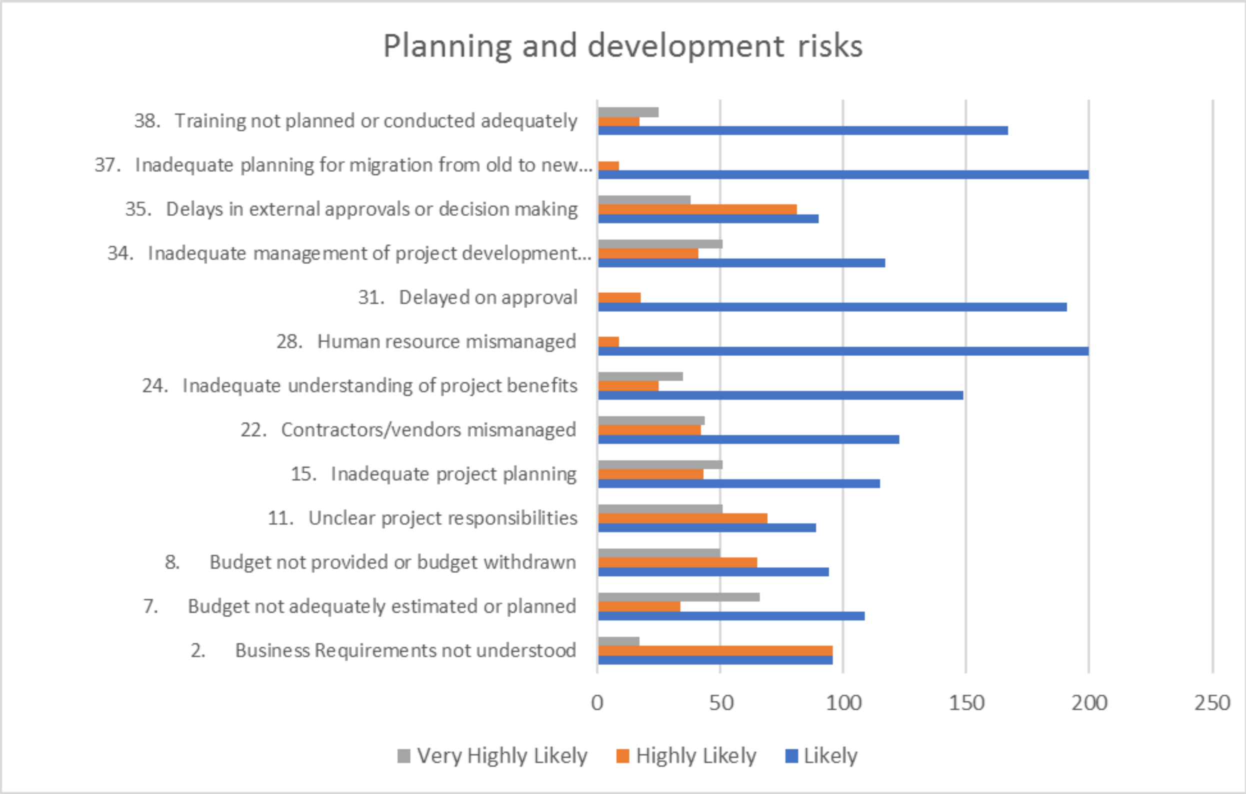

Figure 8.1: Key elements contributing to the planning and development risks

The summary of the results shown in the above figure is consistent with what has been discussed in the literature and descriptive statistics chapters. The literature stressed the importance of information and communications technology offering transformational opportunities to not just businesses but also the city where it is being implemented by improving the competitiveness, productivity, wealth creation and growth, and by development of a knowledge-based economy. It is a mighty tool for the government to improve public services and also enhance the relationship between the citizens and the state (Nawi, Rahman and Ibrahim, 2012).

A study by Heeks and Bhatnagar (1999) identified seven dimensions responsible for the success or failure of ICT projects. In their opinion, improper alignment and integration of the existing systems with the new processes to achieve the desired objectives play a major role in the unsuccessful implementation of ICT. Mueller-Jacobs and Tuckwell (2012) have also emphasized that it is vital that people have the necessary skills along with a reference model to relate to the competency standards expected for successful implementation of ICT networks.

This was also observed in the replies provided by the participants when a majority of respondents were of the opinion that inadequate resource and project planning are two of the causes for increasing the cost of development and implementation of ICT networks. Dhadwal (2015) also pointed out that accurate and appropriate budgeting as well as forecasting are necessary for enabling managers as well as executives to make necessary investments in the ICT networking. Questionnaire respondents also agreed with this factor, stating that inadequate budget planning was a factor that hampered successful implementation of ICT technologies. Well-calculated budgeting and forecasting is vital for effective ICT networking.

It is thus vital that cost estimates are based on realistic assumptions in order to develop an action plan addressing the requirements. Another very important aspect that has a major impact on the implementation of ICT networks is the project staffing. Abazian (2005) stresses the importance of strategic staffing in order to accurately allocate the resources. The author's view is consistent with this study's findings. If the right people are not involved in the ICT networks, it can cause a major risk to the successful implementation. Survey participants are of a similar view, as a majority of them considered 'human resource mismanaged' and 'procurement mismanaged' as leading risks that influence the cost of ICT network development. Thus, it is vital to have a strong emphasis on implementing simple steps in the procurement process in order to ensure there is successful project delivery.

Transition to new technology takes time and can be fraught with many hindrances; it is thus important to develop frameworks that aid in the easy transition from old to new systems. Transition may be from one piece of hardware or software and also the replacement of paper and documents with digital records. Thus, Salman (2010) insists that organizations will have to determine the right ways in which to manage the transition. Migrating data and information into new formats can be challenging, and therefore it is vital that correct measures, including staff training and hiring of personnel well-versed with the technology, are taken (Salman, 2010).

During the survey, a high number of respondents agreed that inadequate planning for migration from old to new system/network can be a major risk factor contributing to the inadequate adoption of ICT. One major reason that was identified by respondents was 'inadequate project charter/project initiation document'; project charter refers to the project vision and objectives. This enables direction to be provided to the project and the confidence of key stakeholders gained. Inadequacy in the preparation of such a charter can be detrimental to the development of ICT networks (Morris, 2009). A well-established project charter is essential for the proper framing of ICT networks and ensuring that its implementation is equal throughout the networks.

8.3 Technology and Hardware Risk Factors

What are the Technology and Hardware risks that influence the ICT network projects?

The objective of this research question was to extract from the literature and identify from the survey the most influential Technology and Hardware risks on ICT network projects' cost overrun. The study extracted from the literature 15 risks that were deemed to have an influence. Reliability testing confirmed that only four risks were deemed to fulfil the scale measurement internal consistency criterion. The summary of the results of how respondents viewed the influence of these risks is shown in the following figure.

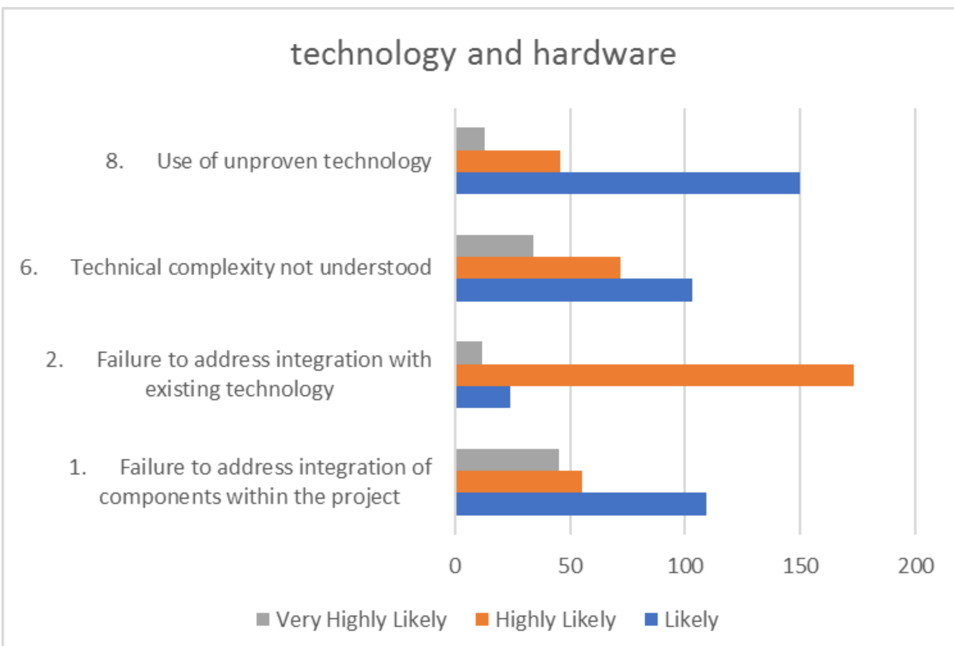

Figure 8.2: Key elements contributing to the technology and hardware risks

The core of any ICT network is accurate and up-to-date technology; in the absence of this technology, ICT implementation can be severely affected. It covers not just the hardware and software but also those technologies which are responsible for transmission of processes or information that would help in the effectiveness of the ICT-enabled organization. There are a number of influencing factors, as has been observed in the literature review; however, technology factors have a major impact on the successful implementation of ICT networks. When there is no flexibility between the ICT systems and organizational processes, it leads to a failure in ICT network implementation (Leydesdorff and Wijsman, 2007).

One of the major factors identified by respondents as well as the literature review suggested that often there is no alignment between the system design and the new technology that is being implemented (Nawi, Rahman and Ibrahim, 2012). This results in the development of inapt systems with old and obsolete technologies. Another complicating factor that has been identified through literature review and interview is the fact that ICT systems have to be attached to those systems that are already in operation; this creates problems as there is no compatibility (Nawi, Rahman and Ibrahim, 2012; Leydesdorff and Wijsman, 2007), and is also largely associated with projects being overextended (Leydesdorff and Wijsman, 2007).

It is vital to note that ICT tends to develop and evolve at a steady pace, thus rendering technologies obsolete very soon (Fuchs, 2008). Expertise and know-how of the technologies become outdated and personnel are forced to keep up with the fast-changing technologies. In certain organizations this might be problematic as they may not have the required expertise to keep pace with the changing technology. For the success of an ICT network, it is also extremely vital that the systems that are chosen are not just compatible but that there also exists interoperability that can be adopted by existing systems. According to Montequín et al. (2016), when there is insufficient hardware to interact with the new ICT systems, there is little integration, leading to difficulty in the implementation of ICT networks. Furthermore, as suggested by Mueller-Jacobs and Tuckwell (2012), the low quality of end products causes difficulty in the integration process while also compromising the end-user experience. In order to lower the budget, management may not use the best quality of products, which results in high failure rates and thus ultimately in increased costs of the overall ICT project (Montequín et al., 2016).

8.4 Operational Risk Factors

What are the operational risks that influence the ICT network projects' cost overrun?

The objective this research question was to extract from the literature and identify from the survey the most influential operational risks on ICT network projects' cost overrun. They study extracted from the literature 18 risks that were deemed to have an influence. Reliability testing confirmed that only nine risks were deemed to fulfil the scale measurement internal consistency criterion. The summary of the results of how respondents viewed the influence of these risks is shown in the following figure.

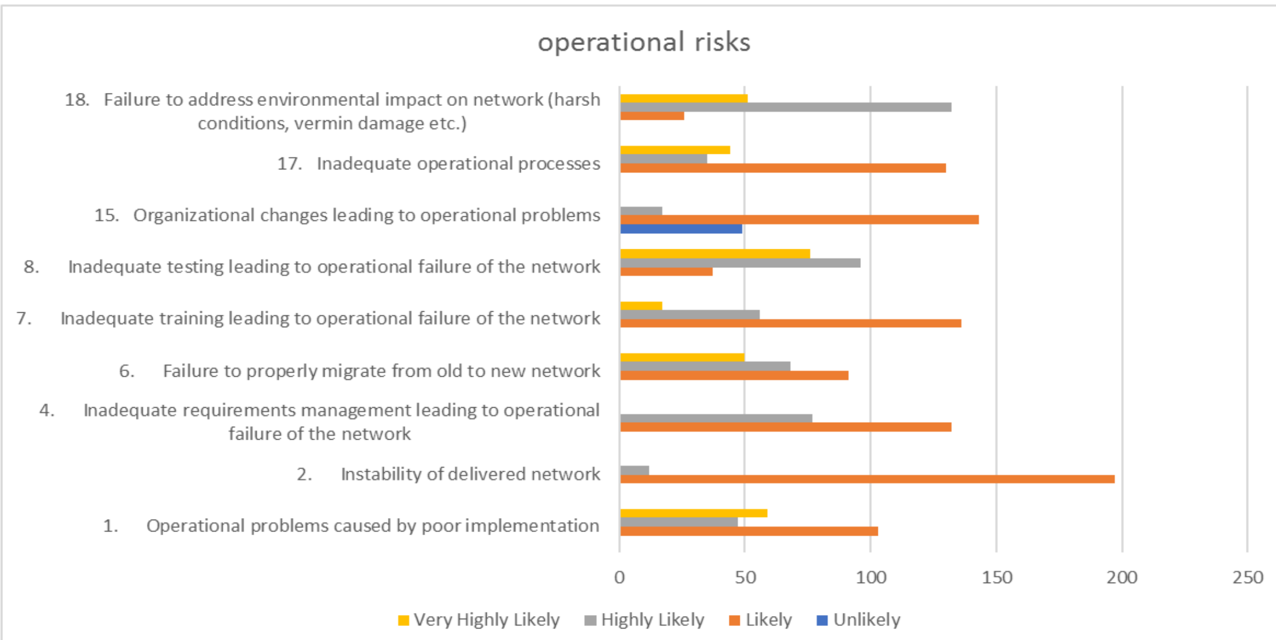

Figure 8.3: Key elements contributing to the operational risks

ICT processes have an influence on every other process within the organization, significantly affecting the productivity and leading to increased business competitiveness. According to Barki et al. (1993), there are a number of operational risk factors that impede the implementation of ICT networks; these include factors such as organizational environment, complexity of tasks, insufficient resources allocated to ICT networks and improper designing, which all lead to failure. In the opinion of Kiel et al. (1998), these operational risks are mainly out of the reach of the project manager since the scope and objectives are changing continuously.

Organizational complexity, which involves the participation of more than one entity, also plays a major role in the failure of ICT processes (Mueller-Jacobs and Tuckwell, 2012). Where there are third parties involved, it becomes essential to communicate the responsibilities and the expected outcome; when there is poor management of these third parties, it leads to the failed implementation of ICT networks (Mueller-Jacobs and Tuckwell, 2012; Ritchie and Brindley, 2005). One important risk factor that was identified during the survey as well as literature review was inadequate knowledge and training in ICT (Ndou, 2004).

When there is inadequate training, it leads to frequent operational failures and this can be detrimental to the effective implementation of ICT. Organizations looking to adopt ICT need to ready their staff for the changes and impart the necessary training. This will enable them to perform in a better and more cohesive manner. Improper training and lack of skills can cause operational failures and thus lead to improper implementation of ICT networks. During the survey, respondents also identified inadequate and improper design leading to operational failure of the network. This is an important and often ignored factor that should be addressed. Past literature indicates that many complex ICT projects lack a design that would be easy to adopt; this makes their adoption very difficult for the organizations, resulting in improper implementation of ICT networks (Tidd, Bessant and Pavitt, 2005).

Prior research has indicated a number of organizational risk factors that have proven to be detrimental for the adoption of ICT networks, these include organizational strategies, industry type, size of the organization, technological maturity and organizational culture (Caldeira and Ward, 2003; Drew, 2003; Love et al., 2005). Furthermore, Nguyen (2009) suggests that, when there is no absolute strategy or definition of the purpose of adopting ICT, it will result in project failure. An important factor which is largely ignored in previous studies is the physical environmental factors which may impede the implementation process. The physical environment causes many difficulties which need to be taken into consideration while developing ICT networks. In many settings, the environmental condition consists of a combination of dust, heat and humidity (Chapman, Azevedo and Prieto-Lopez, 2013). These conditions pose a considerable challenge for standard computers; for example, the standard CPUs generate heat and thus in hot climates they may overheat, leading to systems being rendered useless.

Vermin and other pests can pose other challenges for the wires and cables. When these aspects are not considered and arrangements to combat these issues are not developed, it causes in ICT adoption failure (Chapman, Azevedo and Prieto-Lopez, 2013). It has been observed by researchers Mueller-Jacobs and Tuckwell (2012) that, prior to ICT network integration, feasibility studies are not carried out by managers, which leads to managerial issues later on. Furthermore, it is also vital that there is a standardized practice and methodology in place so that it is possible to implement the ICT project at a regular pace with expected results. User requirements should be the core of the ICT network and thus it is important to take that into consideration during the implementation process. All these process factors should be addressed; if they are not, it may prove to be difficult to successfully implement ICT networks across the UAE.

It would be beneficial for organizations if standardized and consistent project and program management methodologies are developed which will help in building the capabilities of the ICT workforce. Nawi, Rahman and Ibrahim (2012) have noted that effective program management is vital for the organizational change and to maintain a balance with the organizational operations. Furthermore, such program management will also aid in taking key decisions with respect to prioritization of the investments across the business and ICT processes, especially when there are multiple projects and programs in the process.

8.5 People and Management Risk Factors

What are the people and management risks that influence the ICT network projects' cost overrun?

The purpose of this research question was to extract from the literature and identify from the survey the most influential people and management risks on ICT network projects' cost overrun. The study extracted from the literature 18 risks that were deemed to have an influence. Reliability testing confirmed that only 10 risks were deemed to fulfil the scale measurement internal consistency criterion. The summary of the results of how respondents viewed the influence of these risks is shown in the following figure.

Figure 8.4: Key elements contributing to the people and management risks

In any organization, adoption of an ICT network is directly affected by the management since all the decisions, future directions and finances are undertaken by them (Nguyes, 2009). A shortage of skilled management with the relevant experience in ICT processes and implementation means that inexperienced managers will be hired (Mueller-Jacobs and Tuckwell, 2012). Such lack of expertise acts as a major risk factor, as was echoed in the participants' responses when a high number of participants considered 'failure to manage and deliver necessary training' as a risk factor. In the opinion of Mueller-Jacobs and Tuckwell (2012), success of an ICT project is not just about delivering the outputs on time within a stipulated time limit, but also confirming that benefits are received. Compatibility with the organization's IT direction is critical for the implementation of ICT. The difficulty in integrating the diverse IT systems in an organization with ICT networks is a major risk factor identified by the respondents. While ICT systems are complex, they are developed with a futuristic outlook, aiming to make all processes simple for organizations and customers; however, these efforts may be rendered useless when the organization's IT direction is not aligned with the ICT network's (National Research Council, 2000).

Respondents also pointed to the factor 'organizational changes not properly managed' as a risk factor. It has been proven in past literature that organizations need to adapt to many changes especially while integrating ICT networks (Alreemy et al., 2016; De Waal et al., 2014). The development of ICT represents the profound change that it will bring about in the organizational processes and methodologies (De Waal et al., 2014). When these changes are not managed adequately, it results in the failure to adopt the ICT network. To drive an ICT network in any organization or for its adoption in a country like the UAE, a number of external agencies become part of the process influence the outcome of the ICT network, which includes financial institutes, technological partners and human resource providers (Kunyenje and Chigona, 2016).

When these external agencies are not adequately managed, it results in dissatisfaction and thus disruption in the adoption of the ICT network. These stakeholders play an important part and therefore management must take steps to undertake their involvement in an effective manner (Kunyenje and Chigona, 2016). Montequín et al. (2016) and Mueller-Jacobs and Tuckwell (2012) also noted that, when projects are solely dependent on the vendors, it becomes difficult to monitor the project execution. Furthermore, such external agencies fail to acquire full user involvement which results in a failure in ICT network deployment (Mueller-Jacobs and Tuckwell, 2012). Digital continuity is vital or else it may result in the information becoming obsolete and being rendered useless (Gelderman, Semeijn and de Bruijn, 2015). To maintain this continuity, contracts have to be drawn up that favour the continuity; in the absence of proper processes and contracts, there is the chance of technology and information becoming obsolete. There is a risk of losing data and information due to change in the IT environment, business processes and contractual changes (Gelderman, Semeijn and de Bruijn, 2015). Thus, as observed by respondents as well as the literature review, contractual issues may cause difficulty in the ICT implementation.

Based on the above discussion, the researcher is of the opinion that, if the organizations had better top management support, it would result in a more synchronized implementation process that is devoid of any risk factors associated with people and management. Furthermore, it is not just the management – there also needs to be more commitment by the end user as well as the stakeholders who are a part of the process (Montequín et al., 2016). Authorities should gain more power and decision-making authority, which would result in a more streamlined approach. Furthermore, there should also be increased flexibility in the financial control so that the budget can be tweaked according to the requirements of the process. It has been observed that many high-profile ICT implementation projects tend to fail as there is no consensus regarding the flexibility of the budget and thus it becomes imperative to add more of that flexibility to projects undertaken in the UAE.

8.6 Overrun Costs Due to Risk Factors of ICT Networks

How much risks contributes to the overrun cost of ICT network projects cost overrun?

The purpose of this question is to estimate the magnitude of the cost overrun due to each of the risk categories. The summary of the results is shown in the following figure:

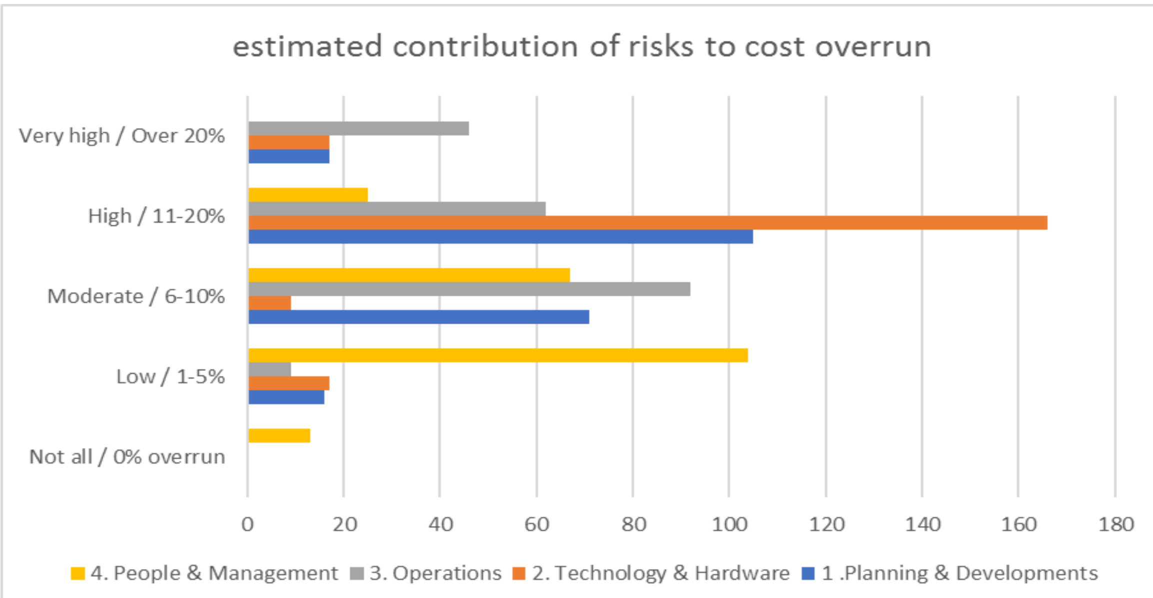

Figure 8.5: Estimated contribution of risks to cost overrun

For ICT network implementation in the UAE, the infrastructure has to be on a large scale and the management has to put in resources to ensure that the ICT networks keep functioning accurately with the changing technology. According to Kostka (2016), finished ICT projects indicate cost overruns of nearly 131%. Furthermore, according to an article in Harvard Business Review (Flyvbjerg & Budzier, 2011), it was noted that one in every six ICT projects face a 200% cost overrun. The above-discussed risk factors are also responsible for cost overruns not just during the implementation of ICT networks but also after the projects have been completed.

Large ICT projects have a number of factors that are responsible for their smooth functioning; when these factors result in increased costing, they collectively cause cost overruns. It has been observed that, when the focus is simply on managing the budget while ignoring other aspects of project implementation, it eventually leads to cost overrun (Whitfield, 2007). Furthermore, one of the biggest causes for cost overruns is the changing technology and hardware requirements for ICT projects to function smoothly (Acquah, 2011).

The interview respondents had a similar outlook as a majority of them considered it to be a major factor that increased the cost overruns by 11-20%. A high number of ICT projects go overboard with the budgets and do not stick to the designated time-table. Both these factors further add to the cost overruns. Along with technology and hardware, another factor identified by the respondents was operations, which caused the cost overruns to go as high as over 20%. Thus, when the organization’s operations are not handled accurately by the management, it leads to delays and consequent overrun costs. Even lack of planning and lack of resource planning, both factors which form a part of operations, cause cost overruns (Ameh, Soyingbe and Odusami, 2010). It was also noted that agencies, internal as well as external, can fail to develop a business case with respect to ICT network implementation (Dekkers and Forselius, 2007).

Rather than considering development of business case as a mere administrative task, it is vital that it be considered as an important tool for ICT operations to be on schedule and avoid failures and cost overruns. It is also important for the management to gain a proper understanding of the current conditions of the business processes and operations that could be affected by the ICT networks (Abazian, 2005). When these are not defined properly, it leads to delays and increased costs as more than the anticipated amount of work is required to develop the processes according to the ICT network requirements and for training personnel. Lastly, the findings indicate that, when the roles and responsibilities are not accurately spelled out, it leads to delays in operations which in turn cause increased costs and delay in implementation of ICT networks. These identified factors for cost overruns should not just be identified but also worked upon from the start of the project to ensure there are no delays and project cost overruns.

8.7 Evaluating the Criteria for ICT Network Project Success

Findings of the survey and literature review indicate that there are a number of factors that affect the success of ICT network project adoption and implementation. The risk factors as discussed above can greatly hamper the ICT network implementation process while also causing cost overruns. These risk factors are also responsible for affecting the smooth functioning of various ICT project success criteria, which ultimately leads to failure of the ICT projects. Findings from the survey revealed that the criteria which would be majorly affected by these risk factors include operational availability and reliability, efficient functioning of the networks, vulnerability management of the networks and security controls. When the risks are not evaluated during the planning stage, these ICT network success criteria are impacted at various levels (Mueller-Jacobs and Tuckwell, 2012). Thus, the top management along with other stakeholders are responsible for the management of the risk factors.

According to Acquah (2011), when there is insufficient involvement by the management in the development of a plan for the project implementation, it causes many barriers. Furthermore, Caldeira and Ward (2003) highlighted the fact that ICT projects are not mere technology projects but are projects that will bring about total business transformation; thus, there needs to be co-ordination not just amongst all the business processes but also between the management and the processes. Security controls, one of the important criteria for success, can be affected severely due to the above risk factors, as witnessed from the responses to the questionnaire. Security control refers to the security protocol of the project to ensure that privacy is always maintained at every step of the implementation process. Under the ICT framework, a number of gadgets are connected to each other, processing an amount of data and information, and this thus poses a major threat to maintaining privacy (Skopik, Friedberg and Fiedler, 2014).

Steventon and Wright (2010) further point out that the integrated ICT network that will be established will consist of a number of participants with exposed access points, and thus they will always be under threat to their privacy and security, as is the case with the internet. Thus, in such dynamic ICT networks, modern security protocols need to be applied and maintained, and these risk factors will compromise the security controls, and exposing security threats to the collected data and information (Skopik, Friedberg and Fiedler, 2014).

Respondents also noted that the ICT risk factors identified previously will also pose a major threat to meeting the budget and acquisition goals. This is especially important since only when organizations are able to meet these goals is it possible to achieve ICT integration completely. For any company to grow, knowledge acquisition plays a vital role (Simonin, 1997); when these risk factors cause impediments, it delays the ICT integration. Similarly, it is vital for organizations to adhere to the budget plan developed prior to the ICT integration process to ensure that there is no inflation in the budget during the implementation process.

Lastly, user satisfaction is an important part of any business proposition, and when it is under threat due to the risk factors discussed previously, it leads to dissatisfaction and the delivery of the ICT network suffers (Tarafdar, Tu and Ragu-Nathan, 2010). Furthermore, Tarafdar, Tu and Ragu-Nathan (2010) state that the use of ICT is resulting in the development of negative perceptions such as overload of information and regular interruptions and disruption. This thus leads to stress amongst users and there is decreasing user satisfaction. Therefore, it is vital for managers and ICT implementers to address this issue as it is one of the criteria for successful implementation of ICT networks.

Researchers have criticized management for undertaking overambitious complex ICT projects without making arrangements to ensure that customized systems are developed to ensure the adoption and implementation of ICT networks (Heeks and Bhatnagar, 1999; Leydesdorff and Wijsman, 2007). It is important that risk factors are identified before the beginning of an ICT project as it will help to mitigate risk and also aid in the successful adoption. This is especially true for a region like the UAE which is still in the nascent stages of ICT adoption and thus gathering data regarding the risk factors is vital. Based on this data, an action plan and a framework can be developed that will ensure that the UAE organizations, whether public or private, can successfully adopt and implement ICT networks.

8.8 Discussion of the Associated Results

The primary aim of this investigation was to expand the ICT risk literature in relation to several risk constructs and magnitude of cost of overrun. Consequently, it was hypothesized that ICT risks' influence on cost overrun will vary according to the lifecycle of the ICT network projects. To prove the research hypotheses and questions, correlation, multiple regression and ANN were employed. The results from statistical testing of the relationship between risks and cost overrun are discussed in detail in the following sections.

8.8.1 Discussion of the Associated Planning and Development Risks and Cost Overrun

The results of correlational and regression analyses indicated that 13 planning and development risks significantly predict cost overrun at this stage of an ICT network project. The influence of each on cost overruns is summarized in the following figure.

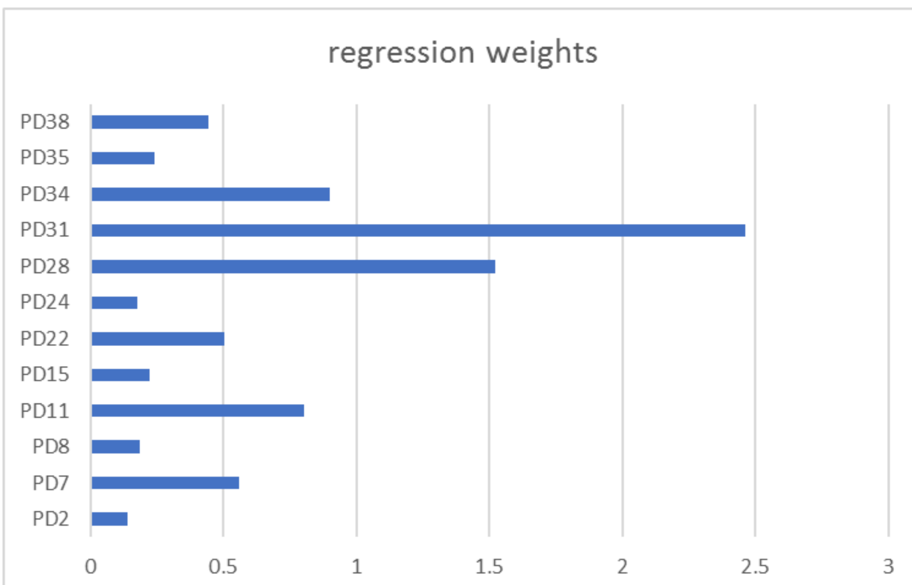

Figure 8.6: Regression weights reported for Planning and Development Risks and Cost Overrun in ICT Projects

The result of the regression analysis confirmed that planning and development risks are a significant predictor of cost overrun in ICT projects, which confirmed hypothesis 1, as shown in the table below. Also, the results shows that P31 (i.e. Delayed on approval) has the most influential impact on cost overrun. Comparable results were reported by Anthopoulos et al. (2016), noting that understanding the project scope by the stakeholders allow in the determination of project cost and budget, thereby eliminating any delays in project-related approvals. This result of this hypothesis also confirms the view expressed by Malik, Dhillon and Verma (2014), who emphasized the importance of factors such as project scope, resource pool and resource requirement based on the objective to control cost overrun thereby controlling delays in approvals. The second most influential risk is PD28 (i.e. Human resource mismanaged), which is inconsistent with past literature that examined the effect of HR management and cost overrun (Ab Razak and Zakaria, 2015; Weiss and Anderson, 2004). Similarly, the third most influential risk was noted as P14 (Unsuitable system development lifecycle/process) which, as confirmed by Matavire et al. (2010) and Hanseth and Bygstad (2015), can lead to additional expenditure for the company if not managed properly during the planning and development stage. Unlike the regression analysis, the ANN analysis indicated the following planning and development sub-factors, PD2 (Business Requirements not understood), PD7 (budget not adequately estimated or planned) and PD8 (Budget not provided or budget withdraw), of highest importance in contributing to cost overrun in ICT projects.

The fundamental linkage found between planning and development risks and ICT cost overrun can be explained by the importance of various elements such as people, technology and processes that lead to effective project implementation. For successful project implementation, there is a need for interoperability and compatibility across all elements of an ICT project, which leads to high-quality service delivery and minimizing the risks leading to additional costs. For instance, the gap between procurement of IT and its effective integration and transition determines whether the step was value for money or an additional expense for the company.

Hypothesis	Testing outcome	P value
Planning and Development risks have a significant influence on ICT network project cost overrun	Hypothesis supported for risks related to planning and development PD2 PD7 PD8 PD11 PD15 PD22 PD24 PD28 PD31 PD34 PD35 PD37 PD38	*$p < 0.05$*

Table 8.1: The results of the regression analysis confirmed hypothesis 1

8.8.2 Discussion of the Associated Technology and Hardware Risks and Cost Overrun

The results of correlational and regression analyses indicated that only four Technology and Hardware risks significantly predict cost overrun of ICT network project. The influence of each on cost overruns is summarized in the following figure.

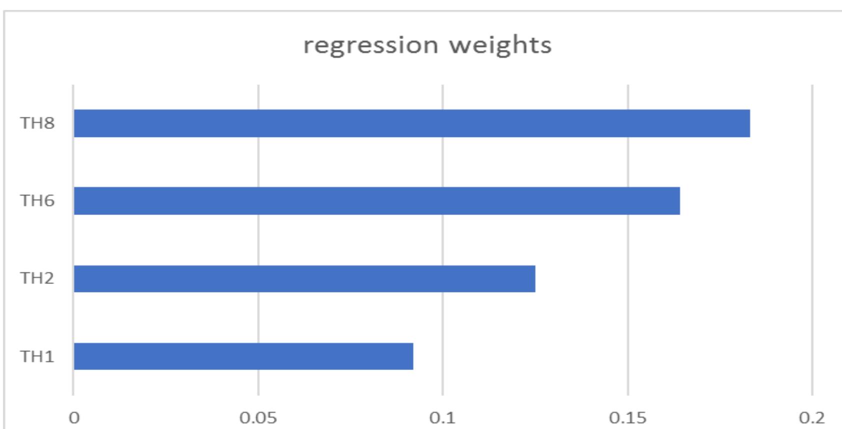

Figure 8.7: Regression weights reported for Technology and Hardware Risks and Cost Overrun

The highest regression weight was found to be associated with TH8 (i.e. Use of unproven technology) and TH6 (Technical complexity not understood). Consistent with the observation of Skryabin et al. (2015), higher cost overrun is associated with the firms' inability to utilize the technology to its full potential. For successful implementation of technology in ICT projects, it is imperative to gather the right resources from the design stage that leads to effective implementation. Involving users right from the design stage can lead to lower technology and hardware bottlenecks such as inability of staff to apply the technology correctly, as evident from the past literature on technology and hardware risks (Yaacob et al., 2014; Nawi, Rahman, and Ibrahim, 2011).

The past literature assessing the influence of cost overrun in ICT projects and its association with technology and hardware risks has not studied the relationship from a statistical perspective but rather from a theoretical one (Alkalbani et al., 2013; Yaacob et al. 2014; Taylor, 2015). However, the extensive research conducted in this area revealed the importance of technology transition in improving the project implementation chances, thereby lowering inconsistencies that lead to cost overrun. The inclusion of users from various groups within the company can lead to effective identification of issues that may arise relevant to technology and hardware integration, thereby reducing related risks. Also, the ANN observation conducted revealed the role of technology complexities and failure to effective integrate technology, adding to the technology and hardware risks and leading to cost overrun. The regression findings in the current study indicate that an increase in technology and hardware risks in the ICT projects can lead to a statistically significant increase in ICT cost overrun, as shown in the table below.

Hypothesis	**Testing outcome**	**P value**
Technology/Hardware risks have a significant influence on the overrun cost in ICT network projects	Hypothesis supported for risks related to technology and hardware TH1 TH2 TH6 TH8	*p <0.05*

Table 8.2: The results of the regression analysis confirmed hypothesis 2

8.8.3 Discussion of the Associated Operational Risks and Cost Overrun

The results of correlational and regression analyses indicated that only nine operational risks significantly predict cost overrun of ICT network projects. The influence of each on cost overruns is summarized in the following figure.

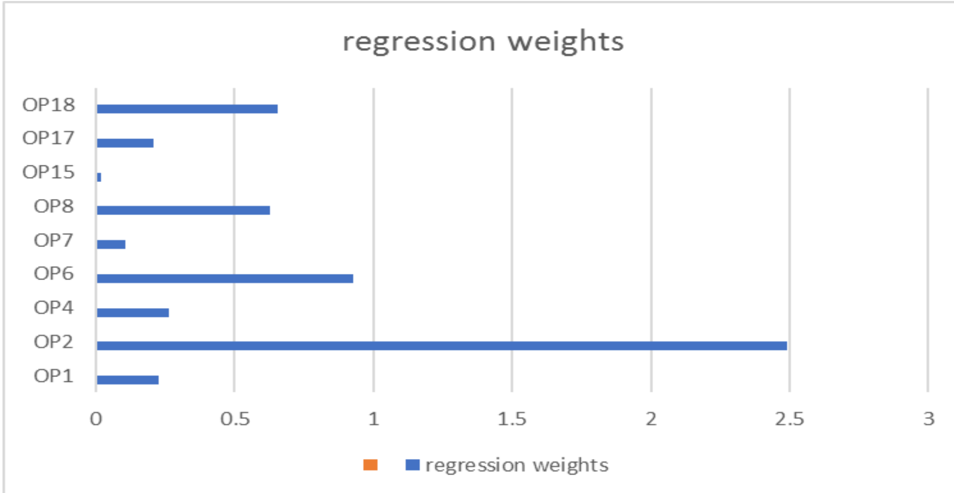

Figure 8.8: Regression weights reported for Operational Risks and Cost Overrun

Operational risks in ICT projects are linked with technology and hardware risks, arising primarily from failure to achieve effective technology transition. As indicated in past literature, various factors contribute to operations risks, which include effectiveness of ICT infrastructure, technology transition, technology testing, network instabilities and service disruptions (Touray, Salminen and Mursu, 2013; Meijer, 2015; Bekkers and Thaens, 2005).

The findings of the regression analysis for hypothesis 3 indicate a significant association between operations risks and cost overrun, as shown in the table below. In operational risks, the highest regression weight was found to be associated with OP2 (Instability of delivered network), OP6 (Failure to properly migrate from old to new network), OP8 (Inadequate testing leading to operational failure of the network) and OP18 (Failure to address environmental impact on network (harsh conditions, vermin damage, etc.). All sub-variables under operational risks were found to hold a significant association with cost overrun; however, only four sub-variables (as identified above) were found to have the highest effect. These sub-variables of operational risks are also confirmed by Adu, Adelabu and Adjogri (2014) and Kaba et al. (2014), who found that technology implementation has economic and technical aspects for appraisal that strengthen its performance and leads to lower associated costs. Delays in ICT project implemented, as confirmed by Qader, Hassan and Saeed (2017), also lead to increased operational maintenance which ultimately affects the overall cost overrun. Amongst the four sub-variables identified through the regression weights, the ANN confirmed the highest importance in operational risks is associated with P18 (Failure to address environmental impact on network), OP6 (Failure to properly migrate from old to new network) and OP8 (Inadequate testing leading to operational failure of the network).

Hypothesis	Testing outcome	P value
Operational risks have a significant influence on cost overrun ICT network projects	Hypothesis supported for risks related to operations OP1 OP2 OP4 OP6 OP7 OP8 OP15 OP17 OP18	$p < 0.05$

Table 8.3: The results of the regression analysis confirmed hypothesis 3

8.8.4 Discussion of the Associated People and Management Risks and Cost Overrun

The people and management risks in ICT network projects are found to link with successful adoption and implementation of ICT networks. Accountability for the ICT project implementation rests with the people and management involved, thereby ensuring that the organizational objectives and goals are met. The results of correlational and regression analyses indicated that 10 People and Management risks significantly predict cost overrun of ICT network projects. The influence of each on cost overruns is summarized in the following figure. As observed in the figure, the highest regression weights in people and management risks are associated with PM14 (Organizational changes not properly managed), PM5 (Contractual issues), PM1 (Failure to achieve compatibility with the strategic business direction of the organization) and PM8 (Failure to manage staff priorities).

The ANN analysis also confirmed that PM5 (Contractual issues) and PM1 (Failure to achieve compatibility with the strategic business direction of the organization) had the highest importance, whereas PM14 (Organizational changes not properly managed) was found to be of lower importance. The results of the regression analysis confirmed hypothesis 4, as shown in the table below, i.e. people and management contribute significantly towards cost overrun in ICT projects. The findings of this research indicate that people and management risks have a significant association with cost overrun in ICT network projects. Past literature in this area highlighted that misalignment between ICT networks, business communication and the leads to poor ICT implementation (Loukis et al., 2016; Bin-Abbas and Bakry, 2014; Balocco, Ciappini and Rangone, 2013; De Vries, 2011). The lack of ICT governance was also found to play a crucial role in poor ICT implementation, leading to misalignment of technology goals and organizational objectives, poor strategic direction, and implementation issues related to contracts issued and managed.

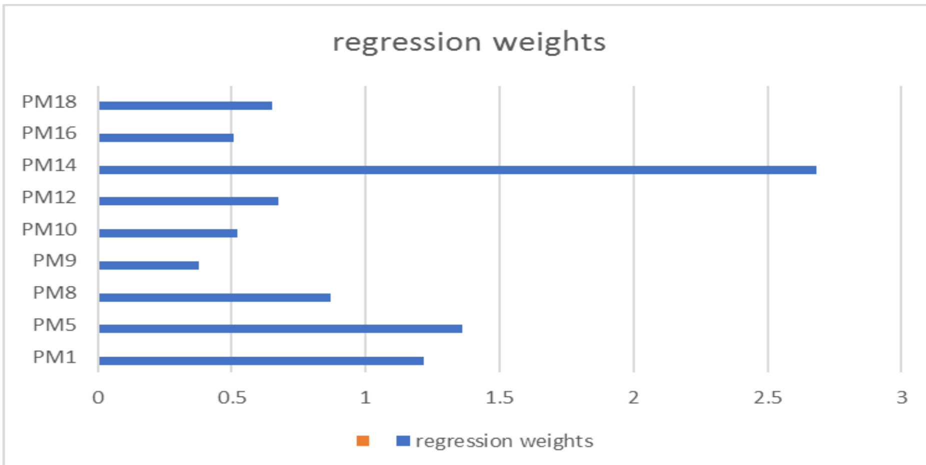

Figure 8.9: Regression weights reported for People and Management Risks and Cost Overrun

Hypothesis	Testing outcome	P value
People / Management risks have a significant influence on cost overrun of ICT network projects	Hypothesis Supported for risks related to people and management List the risks PM1 PM5 PM8 PM9 PM10 PM12 PM14 PM16 PM18	$p < 0.05$

Table 8.4: The results of the regression analysis confirmed hypothesis 4

8.9 Achieving the Research Hypothesis

The research hypothesis as developed in Chapter 1 was:

Planning and Development, Technology/Hardware, Operation and People/Management risks have a significant influence on overrun cost of ICT network projects.

In order to validate the above research hypothesis, an in-depth study was conducted. After the evaluation of risk factors with 209 study participants, it was found that each of the following factors, Planning and Development, Technology/Hardware, Operation, and People/Management risks had a varying but significant effect on cost overrun. The research hypotheses that has been accepted at $p < 0.05$ are reported in tables 8.1 to 8.4. Future research should take these risk factors into consideration to develop appropriate risk management strategies.

8.10 Research Novelty

The research is geared towards understanding the effect of cost overrun and risk on the adoption and implementation of ICT projects. No previous studies have studied the effect of both these factors on ICT projects. Furthermore, the methodology adopted in this research adds a novelty factor since a regression method has been used to test the hypothesis developed regarding ICT project adoption and implementation and the cost overrun factors along with risk factors affecting it. Thus, this research presents a novel approach to finding the correlation.

8.11 Conclusion

Amongst the Arab nations, the UAE has shown a great affinity towards the adoption of ICT networks as it readies itself for the technology boom that is gripping the world. For a few years, the UAE government has streamlined all its operations and made the most of the public functions available online and through e-services. This change in outlook has bought about a revolution in the region as increasing numbers of organizations are looking to develop ICT networks. Most companies in the UAE are becoming more technology inclined. The government itself supports such ICT network implementation projects and thus most organizations are looking to bring about a change technologically within their office culture. While the outlook is futuristic, there are many problems in the implementation of the ICT networks. In this research, the researcher has sought to identify those risk factors that influence the ICT network implementation in the UAE. By identifying these factors, the aim is to help future researchers to act on the collected data and for implementers to bring about the required change.

The results of the survey indicated that there are several risk factors, which have been identified and then corroborated by the survey respondents. These factors were categorized into four main types, namely: People and Management, Operational, Technology and Hardware, and Planning and Development risk factors. The findings revealed that a number of variables within these categories contributed to the risk factors that may influence ICT implementation and may also influence the cost of ICT adoption and implementation in the UAE. The researcher also sought to know if the identified risk factors had any effect on the ICT success criteria. The findings revealed that there were a number of criteria which were affected by these risk factors. To further investigate, the research was directed to learn how much these risk factors would contribute to the cost overrun of the ICT project implementation. The results revealed that these factors would have a significant effect on the cost overrun. Based on the findings, an in-depth discussion was carried out that addressed each of the identified factors and their impact on the implementation process of ICT. The gathered results were compared with the previous literature review to bring out the parallels and thus verify the findings.

From the findings and the discussion it can be concluded that there are a number of risk factors that can act as barriers to the adoption and implementation of ICT networks in the UAE. It was observed that all the identified risk factors pose a certain amount of threat to the adoption and implementation of ICT networks, wherein certain ones have a stronger effect while others have a less effect. When developing ICT networks, it is vital that these factors are addressed so that there is a smooth transition to these networks without any delays. In the opinion of Mueller-Jacobs and Tuckwell (2012), it is important that leaders or managers participate in the project right from the beginning; these projects are not just technology focused, rather they are projects that will bring about business transformation. Furthermore, it is vital that the technology of the ICT networks is adopted fully and that there is an integration of the old systems to the new networks for a smooth transition.

Based on the identified risk factors, it is vital to build a framework that addresses these factors and enables experts to refer to the framework during the adoption and implementation of ICT networks in the UAE. The framework will not just address the discussed risk factors bust also offer the right direction for achieving successful ICT network implementation in the UAE. This framework will take into consideration the identified risk factors, evaluate the solutions based on the literature review, and provide simple techniques that could help in the easy and successful ICT network adoption and implementation in the UAE. In the next chapter, the aim is to discuss these factors and draw out the framework for future research as well as to assist experts during implementation of ICT networks.

9 CONCLUSION & RECOMMENDATIONS

9.1 Introduction

In this chapter the researcher provides an overview of all the chapters in the research study and also draws important conclusions from the research objectives, literature review, findings and the conceptual framework chapters that have been presented earlier. This chapter furthermore also presents an overview of the findings, while elaborating on the theoretical as well as practical contribution the study will make to the body of knowledge within the sphere of ICT implementation in the UAE. The researcher has also highlighted the research limitations and made recommendations accordingly for future research on ICT development and implementation in the UAE.

9.2 Robustness of the Research

The Conceptual Framework was developed for identifying the risk factors in ICT network development, adoption and implementation in the UAE. The framework consists of four main categories: Planning and Development, People and Management, Operations, Technology and Hardware. The researcher then identified the major risk factors under each of these categories and, based on the same, the conceptual framework was suggested which in turn identified the ways in which these factors can be dealt with during the adoption and implementation of ICT networks in the UAE. In utilization, the literature review as well as results from the survey was made to develop the said framework in order to ensure a theoretical construct was developed to address the factors affecting ICT network adoption and implementation in the UAE. Furthermore, for the sake of clarity, additional factors were added under each category was made and for cost overrun factors so that all aspects were covered within this framework

Chapter 3 of the study delves into the research methodology that has been utilized. For the purpose of this study, after conducting a literature review, the researcher carried out a survey with closed-ended questions administered to 209 participants within the UAE. The questionnaire was prepared to address the various risk factors in the fields of planning and development, operations, technology and hardware, and people and management. This chapter summarizes the validity of choosing a survey tool for the quantitative research methodology. In this very chapter, an explanation of the research strategy and dimensions and the research deign was made. The data collection method for the research was explained, which consisted of a closed-ended survey.

9.3 Accomplishing the Research Objectives

9.3.1 Objective: To Review Existing Literature and Extract Risks that Influence Cost Overruns of ICT Network Projects

This research objective was achieved through the review of existing literature related to ICT network projects. With the advent of an increasingly pervasive internet, which is being facilitated through a number of disruptive technologies, it has become mandatory for the government sector to operate in such a technologically advanced environment. In this new landscape, the UAE government has identified the need to adapt and therefore has undertaken the process of transforming all its official processes into technologically-charged online processes. The implementation of Information and Communications Technology (ICT) helps the government to transform into a more effective, accessible and accountable government. The concept thus relates to making government ICT processes available online for the citizens, businesses and employees to have easy access and making it more transparent and accessible to the public.

1. What are the components influencing the delivery of ICT (Information Communications Technology) networking projects in the UAE?
2. What is the association between risks and cost overrun of ICT networking projects in the UAE?
3. What are the success factors that might encourage successful enactment and implementation of new opportunities, ideas and technology that can add value to the ICT networking project in the UAE?

Chapter 2 is the literature review, which builds on the aim of the study and reviews the existing literature regarding ICT and the various factors which affect ICT implementation. Furthermore, it also studies the various factors that affect the implementation of ICT in governmental outfits. In this section stress was applied in the opinion of Tapscott (1995), the application of ICT in government leads to a shift in paradigm, wherein there is the introduction of an age of invention, such that it causes a reinvention of organizations, businesses and government. Later in the chapter, drivers and enablers for success were outlined; these included: Governmental support, Vision and strategy, Donor support (external), Consumer expectations, Globalization and technological change, Good practices, Effective project management and Change management. The researcher has dedicated the study to these factors as they help to understand what the public organizations within the UAE need to change and implement. These factors are vital for implementation of ICT in any sector and they help to understand what changes need to be adopted. The importance of the ICT vision was also stressed, stating it is vital that the government is aware of the key technologies, trends and challenges and monitors them to ensure that it will be able to respond to ensuing changes effectively (Cordella and Tempini, 2015). In order to do so, an ICT vision must be developed that would help in easy adoption and implementation.

After discussing the drivers of ICT implementation, the researcher focused on elaborating the risk factors of ICT adoption and implementation. Risk factors are those occurrences which present constraints to the smooth adoption and implementation of ICT projects in the government. These factors may be considered as barriers as well as inhibitors, as identified by Heeks (2003) and Guha and Chakrabarti, (2014). A number of barriers and inhibitors were identified: Financial constraints, Poor infrastructure, Lack of compatibility and integration, Lack of skilled personnel, Poor data systems, Leadership styles, culture and attitudes, Technology and hardware, User needs and requirements, ICT Policy adoption and Operational issues. For the purpose of this study, these risk factors were divided into four main categories: Planning and Development, People and Management, Operations, Technology and Hardware. Risk factors in each category were then discussed to assess their impact on the adoption and implementation of ICT networks.

Within Chapter 2, many factors that cause cost overrun in ICT projects were listed. Cost overruns have plagued the ICT systems industry for a long time, even after in-depth knowledge about project management has been acquired. Focus was on the fact that, due to project delays, cost overruns were expected. The reasons for such project delays were further elaborated on in the chapter. Additionally, leadership was highlighted and how it needs to evolve with the changing business landscape, and there was also a focus on the importance of developing new leaders who will help in ICT implementation efforts.

9.3.2 Objective: To Evaluate the Influence of Risks on the Cost Overrun of ICT Network Projects

This research objective was accomplished by administering an online survey. Detailed results of the survey conducted for the purpose of identifying those risk factors that influence the delivery of ICT networking projects in the UAE were provided. All the participants chosen for this study were in the field of technology and were associated with ICT programs and thus had a better understanding of the risk factors that affect the adoption and implementation of ICT projects in the UAE. The results helped to identify a number of factors that cause difficulties in the adoption and implementation of ICT projects in the UAE. This section not only studies the risk factors but also finds relationships between risks, cost overrun and success of ICT networking projects.

9.3.3 Research Findings

The important outcomes with respect to the findings and novel contributions are explained below:

The review of literature regarding those factors which affect the adoption and implementation of ICT projects is mainly generalized and there are no theoretical models in the literature that address the implementation of ICT initiatives. This study has thus examined several factors in detail to identify those that have a profound effect on the implementation and adoption of ICT projects. Along with identifying the factors, this study has also adopted an approach to understanding as well as classifying the various concepts as well as characteristics of ICT project implementation, which include barriers, benefits and risks from multiple points of view. There is very little literature regarding the best practice guidelines which have been a part of the framework. There is therefore a need to validate these factors that have been developed from limited literature.

From the literature review and the proposed framework, it is vital to identify the key actors, especially the stakeholders. Additional key actors also need to be identified who play a vital role in the implementation process; this includes enforcement agencies, law makers, government agencies, etc. Change management is an extremely important concept which needs to be understood, especially resistance to change. The developed framework does not include the change management concept and therefore it should be studied further as an extension of the proposed framework.

9.4 Research Outcomes

As is evident from chapters 4 and 5, the researcher was able to examine and investigate the research findings and analyze the data, based on which the conceptual framework was developed. One of the biggest outcomes of this study has been addressing the fact that there are no concentrated studies in literature that address the ICT implementation in governmental sectors of the UAE and what are the major facts which affect the implementation process. Moreover, the conceptual framework has important components that can be identified and ranked. The outcome of this research has greatly broadened the understanding of ICT factors, drivers, barriers and crucial factors for implementation via theoretical and practical contribution made.

9.5 Research Contribution

By conducting the literature review the researcher was able to identify the crucial factors, barriers and risks with respect to the UAE. Based on the research analysis and findings, various factors were validated while new factors were identified. For example, under the cost overrun factors, the ones that were identified which were not part of the literature review were:

- Overambitious and complex projects
- Outsourcing of ICT components
- Absence of required skills in commissioners
- Lack of technical staff
- Improper resource management
- Ill-planned decision-making process

Furthermore, as was evident from the research discussion, the researcher was also able to identify the criteria for ICT network project success. This was an important contribution to the knowledge as it has not been studied previously in the context of the UAE. The researcher was thus able to contribute new knowledge to the ICT implementation and adoption literature as this research identified new factors. Cost overrun factors were also discussed at length during the analysis that helped to provide a new dimension to the study which was otherwise not covered in past literature. The key contributions of this research are identified below:

- The theories of risk and cost overrun have been explored previously by academicians and researchers; however, they have not been inter-related nor have they been discussed in relation to ICT project implementation and adoption. While these factors present major challenges for successful implementation of ICT networks in an organization, there is scarcity of knowledge in this field. On the other hand, by conducting research with participants, this study was also able to understand what risk management practices are deemed important for the implementation of ICT network projects.

- Documented and categorized ICT network project risks.
- Developed a measurement scale for assessing risks of ICT network projects.
- Extracted the risks that are associated with cost overruns of ICT network projects.
- After testing and validating the various factors that were identified in the literature review, the researcher was able to develop a conceptual framework after the research survey and data collection. This would help to have a better understanding of the various factors and characteristics such as the drivers, barriers and cost overrun factors that have an effect on the ICT implementation and adoption process. This research also enables the identification and ranking of these factors which impact the adoption and implementation of ICT project in the UAE. By mapping the framework, implementers and decision makers will be able to have a more holistic view of all those factors that influence the implementation of ICT projects. This will also enable them to plan effectively for the change that will be caused as a result of implementation of ICT components within the organization.
- Within the literature review, the researcher was able to identify a number of barriers which make it difficult for implementation of ICT components in public organizations. Furthermore, even during the data analysis, the researcher noticed that the respondents considered many factors as nothing but barriers to ICT implementation. This included governmental and organizational policies which caused barriers in the adoption and implementation process.
- One of the study's other novel contributions is the fact that the researcher was able to identify several risks that influence ICT network projects. Although these risks were identified within the literature review and thus they made a major contribution for implementers and strategic decision makers to take decisions with respect to adoption of ICT in a more enhanced manner.
- While there is very little literature with respect to ICT network project implementation within the context of the UAE, this research adds to the literature. The study further extends

it by linking the various barriers, factors and best practices to the adoption of ICT while also shedding important light on the various actors who play a crucial role. This will help implementers to determine which actors play a crucial role and therefore the duties can be distributed accordingly. Mapping of the factors has been confirmed through the data analysis and framework; however, best practices and change management theories are not linked to the framework.

- In the case of novel contribution to knowledge, no studies have analyzed the impact of risk and cost overrun of ICT network projects. The research has identified important risk factors under each of the main factors, which are: People and Management Risk Factors, Operational Risk Factors, Technology and Hardware Risk Factors, and Planning and Development Risk Factors, while also identifying the cost overrun factors. This is a novel contribution based on the fact that there are no such conceptual models available in the literature. Therefore, this model will be useful for scholars and practitioners as well as ICT network project implementers.

9.6 Research Limitations

The researcher has based the study entirely in the UAE and therefore the framework is unique to the UAE. While conducting the research, the researcher faced a number of limitations. Firstly, the time factor was a major limitation. While the time to complete the research was adequate, because public organizations were involved, it was difficult to gain access to the employees. There were delays in securing approval from the necessary authorities. Furthermore, the researcher also faced difficulties in gaining any information pertaining to the public organizations.

The researcher had administered a web-based questionnaire to a larger sample set; however, not all of the participants replied or filled in the questionnaire. Since it was a web-based questionnaire, not everyone was diligent in their replies, and most of them preferred a physical copy over the web-based one. The researcher also noticed that many of the questionnaires were either half-filled in or not filled in at all. The half-filled ones had to be eliminated since their inclusion would not present an accurate sample size.

The researcher also had to get back to many of the respondents and explain to them the meaning of the presented questions so that they could fill in the remaining parts of the questionnaire accurately. Due to bureaucracy and permission issues, the researcher was not able to visit the organizations personally. After collecting the data, the researcher experienced inconsistencies in the answers regarding the same subject. This therefore meant the researcher had to spend extra time in understanding and re-confirming the data. While the conceptual framework developed has been validated with respect to ICT adoption and implementation in the UAE, it might prove to be difficult to generalize it completely given that the e-readiness of different countries is different.

9.7 Further Research Recommendations

Based on the limitations of the study and the findings of the research, the researcher makes some important recommendations for future studies by academicians, implementers and decision makers. Since ICT implementation is an important concept within the scope of management, there is a need to look at this topic from the management perspective. There is a need to study the topic at great depths in order to ensure all the factors that influence the adoption of ICT networks are addressed.

There is a need to develop more practical guidelines based on the study for the adoption of ICT networks not just in the UAE but across the globe. There is also a need to conduct more research regarding the role change management plays in the implementation of ICT networks. While change management has been addressed in the literature review, it is largely absent from the conceptual framework and thus it is important to address it in a more systematic manner with respect to ICT network adoption and implementation. The implications that change has are worrisome for many employees and thus they need to be addressed effectively.

While the study was mainly for the UAE networks, the framework had been generalized so that it may be utilized as a frame of reference. However, it is required that the data be gathered by other researchers and to ensure that the present suggested model is applicable universally. The researcher also suggests that academicians identify the potential risks and challenges that are involved in the implementation of ICT networks. By identifying these challenges, including the risks and barriers, the given framework can be further improved and enhanced to make it universally applicable.

Infrastructure is a crucial element of any ICT network and therefore it is important that the necessary infrastructure be developed by the UAE government before the adoption and implementation of ICT networks. The government must also encourage technologically advanced countries and companies to get involved in the implementation of ICT networks in the UAE and develop important strategies. By striking such relations, all parties are set to benefit.

The researcher had to face a few limitations while conducting the research such as difficulties in gaining information pertaining to the public organizations, difficulty in gaining access to the employees and delays in securing approval from necessary authorities. It is vital to study this topic further through a management perspective, develop more practical guidelines based on the study for the adoption of ICT networks and conduct more research regarding the role change management plays in the implementation of ICT networks. Thus, this study and the framework developed can be utilized by academicians, researchers and implementers alike to enable easy ICT network implementation and adoption.

9.8 Summary

The researcher in this study was able to identify all the crucial factors that influence the ICT network implementation and adoption process. While there is limited literature on the topic, the researcher was able to build on it with the help of the findings and analysis of the data. The discussion that was carried out also helped to identify several additional factors, which were otherwise not identified in the literature review.

The conceptual framework that was presented after the data analysis is nothing but a reference frame that can be adopted by implementers as well as decision makers prior to the implementation of the ICT networks. The researcher has however suggested that the various factors need to be looked at in depth to further add to the framework.

Good practices should be added to the framework to make it more robust; however, there is little literature in this regard and therefore, by additional research and data collection, best practices can be identified. Despite all the limitations, important recommendations for further research that can be conducted in this aspect of study were made. Further studies will explore the possibility of developing mitigating risk strategies for managing such projects.

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11 APPENDIX

Questionnaire

Dear Participant,

The networking component of ICT (Information Communications Technology) is essential for any organization to survive in current highly competitive markets. To support this, modern project management practices encourage successful adoption and implementation of new ideas and opportunities that can add value. The primary aim of our research is to critically investigate the risks that influence the delivery of ICT (Information Communications Technology) networking projects performed in the UAE.

In particular, your input can help us find relationships between risks, cost overrun and success of ICT networking projects. We estimate that it will take you approximately 20-25 minutes to complete the survey.

All individual responses will remain confidential and study data will be integrated and analyzed as a whole. The research outcome will be reported in a summary form to protect confidentiality.

However, if you have any concerns or questions about the questionnaire or about participating in this research, you may contact me on 2014132046@buid.ac.ae.

Alternatively, you may communicate with my director of studies, Professor H. Boussabaine on 04 279 1437 (halim@buid.ac.ae).

Thank you for your time and support and I look forward to sharing the results of this survey with all of the participants.

Yours faithfully

Hamad Khalifa Al Nuaimi
PhD Candidate
British university in Dubai
Mobile: +971 509992002
E-mail: 2014132065@students.buid.ac.ae

The research directed by:
Professor H. Boussabaine
British University in Dubai
Tel: 04 279 1437

THE QUESTIONNAIRE

PART-1: Rating the likelihood influence for risk factors in the ICT (Information Communication Technology) of network life cycle project.

1.Planning and Development

Please rate the likelihood of Planning/development risks influence on the cost of the ICT networks development

Planning / development risks	**None**	**Unlikely**	**Likely**	**Highly Likely**	**Very Highly Likely**
	1	**2**	**3**	**4**	**5**
1. Project scope not understood	☐	☐	☐	☐	☒
2. Business Requirements not understood	☐	☐	☒	☒	☐
3. Missing or inadequate Project Charter/Project initiation document (PID)	☐	☐	☐	☐	☒
4. Inadequate management of or missing business case	☐	☐	☒	☐	☐
5. Failure to align project scope with organization or business strategy	☐	☐	☒	☐	☐
6. Initial Current state not understood	☐	☐	☒	☐	☐
7. Budget not adequately estimated or planned	☐	☐	☐	☒	☐
8. Budget not provided or budget withdrawn	☐	☐	☒	☐	☐
9. Risks not properly analyzed or mitigated	☐	☐	☒	☐	☐
10. Unrealistic schedule at start of project	☐	☐	☒	☐	☐
11. Unclear project responsibilities	☐	☐	☒	☐	☐

Planning / development risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	2	3	4	5
12. Contractual or Legal risk not understood	☐	☐	☐	☐	☐
13. Technical risks not analyzed or mitigated	☐	☐	☒	☐	☐
14. Unsuitable system development lifecycle/process	☐	☐	☒	☐	☐
15. Inadequate project planning	☐	☐	☒	☒	☐
16. Inadequate resource planning	☐	☐	☐	☒	☐
17. Inadequate project communication plan	☐	☐	☒	☐	☐
18. Testing not planned properly	☐	☐	☐	☐	☐
19. Project rejected because of inadequate business continuity planning	☐	☐	☒	☐	☐
20. Unable to secure an implementation partner	☐	☐	☒	☐	☐
21. Stakeholders mismanaged or not identified	☐	☐	☐	☐	☐
22. Contractors/vendors mismanaged	☐	☐	☒	☐	☐
23. Plan rejected by business	☐	☐	☒	☐	☐
24. Inadequate understanding of project benefits	☐	☐	☒	☐	☐
25. Changes to business requirements during the project	☐	☐	☒	☐	☐
26. Changes to scope during the project	☐	☐	☒	☐	☐
27. Quality mismanaged	☐	☐	☒	☐	☐
28. Human resource mismanaged	☐	☐	☐	☐	☒
29. Procurement mismanaged	☐	☐	☒	☐	☐
30. Time/schedule mismanaged	☐	☐	☐	☒	☐

Planning / development risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	**2**	**3**	**4**	**5**
31. Delayed on approval	☐	☐	☒	☐	☐
32. Inadequate project management	☐	☐	☒	☐	☐
33. Insufficient human and financial resources	☐	☐	☒	☐	☐
34. Inadequate management of project development lifecycle/process	☐	☐	☐	☒	☐
35. Delays in external approvals or decision making	☐	☐	☐	☐	☐
36. Inadequate testing	☐	☐	☐	☐	☒
37. Inadequate planning for migration from old to new system/network	☐	☐	☐	☐	☒
38. Training not planned or conducted adequately	☐	☐	☒	☐	☐

2. Technology / Hardware

Please rate the likelihood of technology/hardware risks influence on the cost of the ICT procurement

Technology & Hardware Risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	**2**	**3**	**4**	**5**
1. Failure to address integration of components within the project	☐	☐	☒	☐	☐
2. Failure to address integration with existing technology	☐	☐	☐	☒	☐
3. Inadequate or incorrect design	☐	☐	☒	☐	☐
4. Incompatibility of new with existing technology	☐	☐	☒	☐	☐

Technology & Hardware Risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	2	3	4	5
5. Information Security not properly addressed or understood	☐	☐	☒	☐	☐
6. Technical complexity not understood	☐	☐	☒	☐	☐
7. Technology not meeting the business requirements	☐	☐	☒	☐	☐
8. Use of unproven technology	☐	☐	☐	☒	☐
9. Inadequate or missing development tools or environment	☐	☐	☒	☐	☐
10. No support from manufacturer	☐	☐	☐	☒	☐
11. Technical failures caused by quality mismanagement	☐	☐	☒	☐	☐
12. Unexpected technology failures	☐	☐	☒	☐	☐
13. Technology failures caused by unstable project team	☐	☐	☒	☐	☐
14. Failure to provide supporting infrastructure on time (e.g. power)	☐	☐	☒	☐	☐
15. Failure to take account of operating conditions (harsh physical environment)	☐	☐	☐	☒	☐

3. Operation

Please rate the likelihood of operation risks influence on the cost of the ICT networks operation

Operational Risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	2	3	4	5
1. Operational problems caused by poor implementation	☐	☐	☒	☐	☐
2. Instability of delivered network	☐	☐	☒	☐	☐
3. Inadequate budgeting for maintenance and support	☐	☐	☒	☐	☐
4. Inadequate requirements management leading to operational failure of the network	☐	☐	☐	☒	☐
5. Inadequate design leading to operational failure of the network	☐	☐	☒	☐	☐
6. Failure to properly migrate from old to new network	☐	☐	☐	☒	☐
7. Inadequate training leading to operational failure of the network	☐	☐	☐	☐	☒
8. Inadequate testing leading to operational failure of the network	☐	☐	☒	☐	☐
9. Market development pace rendering products obsolete	☐	☐	☒	☐	☐
10. Changes to business requirements after network delivery	☐	☐	☒	☐	☐
11. Inadequate monitoring of the network/system.	☐	☐	☒	☐	☐
12. Changes in operation process and policy	☐	☐	☐	☒	☐
13. Poor management of third parties necessary for network operation	☐	☐	☒	☐	☐
14. Failure of third parties to deliver necessary services for network operation	☐	☐	☒	☐	☐

Operational Risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	2	3	4	5
15. Organizational changes leading to operational problems	☐	☐	☒	☐	☐
16. Inadequate change control after delivery	☐	☒	☐	☐	☐
17. Inadequate operational processes	☐	☐	☒	☐	☐
18. Failure to address environmental impact on network (harsh conditions, vermin damage etc.)	☐	☐	☐	☒	☐

4 .People / Management

Please rate the likelihood of people and management risks influence on cost of the ICT networks management

People & Management Risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	2	3	4	5
1. Failure to achieve compatibility with the strategic business direction of the organization	☐	☐	☒	☐	☐
2. Failure to comply with legislative requirements, such as finance regulations.	☐	☐	☒	☐	☐
3. Misalignment of the project with organizations standards and policies	☐	☐	☒	☐	☐
4. Mismanagement of scope and requirements changes during the project	☐	☐	☒	☐	☐
5. Contractual issues	☐	☐	☐	☒	☐

People & Management Risks	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	2	3	4	5
6. Failure to ensure project staff have the necessary skills	☐	☐	☒	☐	☐
7. Failure to manage confidentiality (Information disclosure)	☐	☐	☐	☒	☐
8. Failure to manage staff priorities	☐	☐	☒	☐	☐
9. Failure to manage the budget	☐	☐	☒	☐	☐
10. Failure to provide enough project staff at the required time	☐	☐	☒	☐	☐
11. Inadequate management of budget needed for staff	☐	☐	☒	☐	☐
12. Mismanagement of project schedule	☐	☐	☒	☐	☐
13. Failure to achieve compatibility with the organization's IT strategic direction.	☐	☐	☒	☐	☐
14. Organizational changes not properly managed	☐	☐	☒	☐	☐
15. Failure to manage and deliver necessary training	☐	☐	☒	☐	☐
16. Inadequate management of budget needed for training and support	☐	☐	☒	☐	☐
17. Inadequate management of changes to operational processes and policies	☐	☐	☐	☒	☐
18. Issues caused by external agencies, on which the project depends	☐	☐	☒	☐	☐

PART-2: Estimating the overrun cost for risk factors in ICT (Information Communication Technology)

1 .Planning & Developments

Please estimate the overrun cost due to Planning / development risks of the ICT networks projects

Not all	Low	Moderate	High	Very high
0% overrun	1-5%	6-10%	11-20%	Over 20%
1	2	3	4	5

2. Technology & Hardware

Please estimate the overrun cost due Technology / Hardware risks of the ICT networks projects

Not all	Low	Moderate	High	Very high
0% overrun	1-5%	6-10%	11-20%	Over 20%
1	2	3	4	5

3. Operations

Please estimate the overrun cost due to operations risks of the ICT networks projects

Not all	Low	Moderate	High	Very high
0% overrun	1-5%	6-10%	11-20%	Over 20%
1	2	3	4	5

4. People & Management

Please estimate the overrun cost due to People / Management risks of the ICT networks projects

Not all	low	Moderate	High	Very high
0% overrun	1-5%	6-10%	11-20%	Over 20%
1	2	3	4	5

PART-3: Evaluating the criteria for ICT network project success

Please rate how likely the ICT network risks will influence the following ICT projects success criteria

ICT Criteria	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	2	3	4	5
1. Vulnerability management of the network	☐	☐	☒	☐	☐
2. Incident management of the network	☐	☐	☒	☐	☐
3. Configuration management of the network	☐	☐	☒	☐	☐
4. Effectiveness of the mobility of the net	☒	☐	☒	☒	☐
5. Effectiveness of the traffic	☐	☐	☒	☐	☐
6. Security controls	☐	☐	☐	☐	☒
7. Efficiency recovery	☐	☐	☒	☐	☐
8. Operation tolerance (delays, connectivity)	☐	☐	☒	☐	☐
9. Maintainability	☐	☐	☒	☐	☐
10. Integrity of the net	☐	☐	☒	☐	☐
11. Operational availability	☐	☐	☒	☐	☐
12. Operational reliability	☐	☐	☒	☐	☐
13. Efficient functioning of the network	☐	☐	☐	☒	☐
14. Coordination and change management	☐	☐	☒	☐	☐
15. Improved access to information	☐	☐	☒	☐	☐
16. User satisfaction	☐	☐	☒	☐	☐
17. Meeting functional specifications	☐	☐	☒	☐	☐
18. Meeting technical specifications	☐	☐	☒	☐	☐

ICT Criteria	None	Unlikely	Likely	Highly Likely	Very Highly Likely
	1	2	3	4	5
19. Meeting schedule goals	☐	☐	☒	☐	☐
20. Meeting budget goals	☐	☐	☒	☐	☐
21. Meeting acquisition goals	☐	☐	☒	☐	☐

PART-4: Demographic

Please provide the required personal details through marking a tick next to the answer of your choice

Title	**□ IT Manager**	**□ Systems manager**	**□ Systems Engineer**	**□ Operations Manager**	**□ Others**
Gender	□ Male	□ Female			
Total years of experience	□8-10yrs □ 11-15yrs □16-20yrs □21yrs and above		**Years of experience in current position**	□2-4yrs □5-6yrs □7-9yrs □10yrs above	
Qualifications level					
High School □	Diploma □	Bachelor □	Master □	PhD □	

PART-5: Suggestions and Feedback

Please mention any feedback or suggestion which you have for the presented survey.

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

The End
Thanks for participating this Survey