

**An Investigation in to the Impact of Operational Read-
iness Factors on the Success of Airports Projects
in the UAE**

دراسة تأثير عوامل الجاهزية التشغيلية على نجاح مشاريع المطارات
في دولة الإمارات العربية المتحدة

by

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**A thesis submitted in fulfilment
of the requirements for the degree of
PhD IN PROJECT MANAGEMENT
at**

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Abstract

In traditional project management literature, we notice the absence of a dedicated phase for operations and maintenance preparation and support for the newly completed product. Consultants, contractors and project managers do not interfere with the operation phase or with how the project will run after completion, as their contractual scope is to deliver the project on time, on schedule and within budget. Operational problems may appear once the project is set for operations and these problems could be the results of mistakes that were made during the project life-cycle phases, which were not picked up during the commissioning phase of the project. Scholars in the literature further argue that in the initial phase of operations, problems may start to surface that result in a decline or low level of performance *vis-à-vis* the services provided, which results in a reputational and financial impact on the project's owner and other operational stakeholders.

This study explores the factors that impact upon the operational readiness success of complex multi-stakeholder airport projects. The study uses mixed methods (triangulation), comprising firstly a focus group categorisation assessment of operational readiness factors based on a study of the existing literature (enabling the design of a survey instrument). Emergent from this process were four readiness factors with 68 operational readiness items. To support the study, the Delphi method was employed for categorisation assessment of operational readiness. The second step of the methodology was to conduct a survey among 900 airport stakeholders and project managers working across four international airports based in the United Arab Emirates (Dubai International Airport, Al-Maktoum International Airport-Dubai, Abu Dhabi International Airport and Sharjah International Airport). Statistical tools of SPSS/AMOS are employed to analyse the quantitative data collected from the questionnaire. In particular, statistical analysis was undertaken

along with Structural Equation Modelling (SEM). The study finds a significant correlation between *operational readiness* and *project success*. The study also confirms that operational readiness is a second order variable consisting of four factors. These were *facilities readiness*, *people readiness*, *technology readiness* and *organisation readiness*.

Emergent from the study will be the development of a conceptual framework that can assist operations readiness practitioners to enhance the success of the transition of completed projects to fully operational endeavours, in particular on the first day of operation. The main contribution of the study is the development of the Airport's operational readiness framework and the list of confirmed items that can be used to support operational organizations to prepare for operating new airport's facilities within UAE. It is also noted that available studies explicitly contextualised within complex multi-stakeholder infrastructure projects (such as in the case of airports) remain sparse. Thus, it is argued that this doctoral study might serve as the basis for much wider empirical studies on the notion of 'operational readiness' within the context of operations and more specifically, project management.

في أدب إدارة المشاريع التقليدية ، نلاحظ عدم وجود مرحلة مخصصة لإعداد العمليات والصيانة والدعم للمشروع الذي أنجز حديثاً. ولا يهتم الاستشاريين والمقاولين ومديري المشاريع بمرحلة التشغيل أو كيف سيتم تشغيل المشروع بعد الانتهاء، لأن منظورهم التعاقدى هو تسليم المشروع في الوقت المحدد وفي الموعد المحدد وفي حدود الميزانية. قد تظهر المشاكل التشغيلية في بداية العمليات التشغيلية للمشروع، وهذه المشاكل يمكن أن تكون نتائج الأخطاء التي حدثت أثناء مراحل دورة تشغيل المشروع، والتي لم يتم التقاطها أثناء مرحلة تشغيل المشروع. ويؤكد العلماء في الأدب أيضاً أنه في المرحلة الأولى من العمليات، قد تبدأ المشاكل في التسبب في انخفاض أو تدني مستوى الأداء مقارنة بالخدمات المقدمة، مما يؤدي إلى تأثير سميعة المشروع والتأثير المالي على مالك المشروع وأصحاب المصلحة والجهات التنفيذية.

تستكشف هذه الدراسة العوامل التي تؤثر على نجاح عمليات الاستعداد لمشاريع المطارات المعقدة والمشاركة مع العديد من أصحاب المصلحة المشتركة في تشغيل المطارات. تستخدم الدراسة أساليب بحث مختلطة (التتالي)، تضم أولاً بتصنيف جميع عوامل الاستعداد والتجهيز التشغيلية استناداً إلى دراسة الأدب الموجودة (مما يتيح تصميم أداة البحث العلمي). كان من نتائج هذه العملية أربعة عوامل استعداد مع 68 من عناصر الاستعداد التشغيلي. لدعم هذه الدراسة، تم استخدام طريقة دلفي لتصنيف تقييم الاستعداد التشغيلي. وتمثلت الخطوة الثانية من المنهجية في إجراء دراسة استقصائية بين 900 من أصحاب المصلحة ومديري المشاريع العاملين عبر أربعة مطارات دولية مقرها في الإمارات العربية المتحدة (مطار دبي الدولي ومطار آل مكتوم الدولي - دبي ومطار أبوظبي الدولي ومطار الشارقة الدولي). وتستخدم الأدوات الإحصائية كبرامج التحليل الإحصائي لتحليل كمية البيانات التي تم جمعها من الاستطلاع. أجري تحليل إحصائي على وجه الخصوص، جنباً إلى جنب مع تصميم المعادلات الهيكلية. وتوصلت الدراسة إلى وجود ارتباط كبير بين الاستعداد التشغيلي ونجاح المشروع. كما تؤكد الدراسة أن الاستعداد التشغيلي متغير ثانٍ يتكون من أربعة عوامل. وكانت هذه الاستعدادات للمرافق، استعداد الناس، الاستعداد التكنولوجي واستعداد المنظمة.

ستكون الدراسة الناشئة عن وضع إطار مفاهيمي يمكن أن يساعد ممارسي عمليات الاستعداد لتعزيز نجاح انتقال المشاريع المؤهلة إلى مساعي تعمل بكامل طاقتها، وخاصة في اليوم الأول من العملية. وتتمثل المساهمة الرئيسية للدراسة في تطوير إطار استعداد التشغيل في المطار وقائمة العناصر المؤكدة التي يمكن استخدامها لدعم المنظمات التنفيذية من أجل البدء في تشغيل مرافق المطار الجديد داخل دولة الإمارات

العربية المتحدة. وبكل صراحة يلاحظ أن الدراسات المتاحة في سياق مشاريع البنية التحتية المعقدة لمتعددي المصالح (كما في حالة المطارات) لا تزال متفرقة. وهكذا، قيل ان هذه الدراسة قد تخدم كأساس لكثير من الدراسات التجريبية لأوسع نطاقا حول مفهوم "الأستعداد التشغيلي" في سياق العمليات، وإدارة المشاريع علي وجه التحديد.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

In the name of Allah, Most Gracious,

Most Merciful

{ وَقُلْ رَبِّ زِدْنِي عِلْمًا }

(طه: 114)

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List of Abbreviations

AGFI	Adjusted Goodness of Fit Index
AIMS	Asset Integrity Management System
AMOS	Analysis of a Moment Structures
APM	Association for Project Management
AVE	Average Variance Extracted
BA	British Airways
BAA	British Airports Authorities
BHS	Baggage Handling System
BIM	Building Information Management
BoK	Body of Knowledge
BP	British Petroleum
BS	British Standard
CAD	Computer-Aided Design
CAM	Computer-Aided Manufacturing
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CIOB	Chartered Institute of Building
CMB	Common Method Bias
CME	Construction Management and Economics
CR	Composite Reliability
DB	Design and Built
DBFO	Design Build Finance Operate
DBOM	Design Build Operate Maintain

DF	Degree of Freedom
DIA	Denver International Airport
DWC	Dubai World Central
ECAM	Engineering Construction and Architectural Management
ERP	Enterprise Resource Planning
GCC	Gulf Countries Cooperation
GDP	Gross Domestic Product
GFI	Goodness of Fit Index
HSE	Health, Safety and Environment
ICT	Information and Communications Technology
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Financial Corporation
IJOP	International Journal of Projects
IJOPM	International Journal of Operations & Production Management
IJPM	International Journal of Project Management
IPMA	International Project Management Association
IRAP	Integrated Readiness Assurance Process
JCEM	Journal of Construction Engineering and Management
JME	Journal of Management in Engineering
JOM	Journal of Operations Management
JORS	Journal of the Operational Research Society
KPI	Key Performance Indicators
MENA	Middle East and North Africa
MoD	Ministry of Defence

MRB	Material Review Board
MRP	Material and Requirements Planning
MS	Management Science
MVN	Multi-Variant Normality
NASA	National Aeronautics and Space Administration
NIF	National Igniting Facility
OM	Operations Management
OPM	Organisational Project Management
OR	Operations Research
OR	Operational Readiness
PEM	Project Excellence Model
PM	Project Management
PMI	Project Management Institute
PMJ	Project Management Journal
RIX	Relative Importance Index
RMSEA	Root Mean Squared Error of Approximation
ROI	Return on Investment
SBIA	Second Bangkok International Airport
SCM	Supply Chain Management
SEM	Structural Equation Modelling
SHARE	System for Human Factors Assessment and Readiness Evaluation
SOP	Standard Operating Procedures development
SPSS	Statistical Package for the Social Sciences
SRMR	Standardised Root Mean Squared Residual

T5	Terminal 5
TLI	Tucker–Lewis Index
TQM	Total Quality Management
UAE	United Arab Emirates
UK	United Kingdom

List of Publications

Al-Mazrouie, J. and Bajracharya, A. (2013). A study on the Operational Readiness of a Mega Construction Project. In M. Hadju and M. J. Skibniewski (Eds.) Creative Construction Conference 2013. Budapest: Diamond Congress Ltd., p. 14.

Al-Mazrouie, J. (2015). Review of the Operational Readiness Concept in Project Management. In Eden Doctoral Seminar on Perspectives on Projects Novel Approaches to Project Management Research 2015. Lille.

Al-Mazrouie, J. (2016). Literature Review of the Operational Readiness Concept in Project Management. In BUID Doctoral Research 2016. Dubai.

Al-Mazrouie, J. (2016). Development of an operational readiness conceptual model from the literature. In Eden Doctoral Seminar on Perspectives on Projects Novel Approaches to Project Management Research 2016. Lille.

Chapter 1

Introduction

1.1 Introduction to the Research

In the last three decades, the demand for large infrastructure projects such as airports, railways and seaports has increased rapidly (Nahyan et al. 2012; Flyvbjerg 2014; Zeng et al. 2015) to accommodate the increasing need for high quality public services in both the public sector (Fox & Miller 2006; Winch & Leiringer 2015) the private sector (Flyvbjerg et al. 2009), as projects should be intended to deliver value that derives benefits from its operations (Hjelmbrekke et al. 2017). Some of these infrastructure projects, including airport projects, have been fast-tracked to the operations stage to enable governments to benefit quickly from the services and facilities; one such case was Suvarnabhumi Airport in Thailand (Croes 2007), but problems have beset the airport since its opening.

Whether a large infrastructure project experiences success or failure, it will have a great impact not only on the participants of the project but also on the economy of the society that it emerged from (Flyvbjerg 2009; Nahyan et al. 2012; Dunović et al. 2014). Therefore, it is important to ensure the successful implementation and delivery of such large projects by adopting new management approaches to deal with the unique characteristics of infrastructure projects on this scale (Dunović et al. 2014; Guo et al. 2014). A study carried out by Cicmil et al. (2006) suggest that conventional project management methods and processes are inappropriate for large infrastructure projects due to the size, complexity, uncertainty and time. It is recommended that new approaches and processes are needed to deal with these cases.

Characteristics of large infrastructure projects include high numbers of stakeholders (Gil et al. 2012; Nahyan et al. 2012; Guo et al. 2014), high levels of complexity (Nahyan et al. 2012; Dunović et al. 2014; Guo et al. 2014) and high risks (Guo et al. 2014). Each of these, if not properly managed properly, can lead to the failure of large infrastructure projects and cost overrun (Flyvbjerg et al. 2003; Flyvbjerg 2007a; Cantarelli et al. 2010; Love et al. 2015), which could also result in early terminations of the projects. From the point of view of the organisation's reputation, media and press usually focus more on unsuccessful projects than on successful ones and focus particularly on cost overrun and time delays on these projects (Samset & Volden 2015).

Traditionally, success criteria for projects were limited to time, cost and quality (Atkinson 1999) but now these have been expanded to include product and organisational success (Shenhar et al. 2001; Dvir et al. 2003; Ojiako et al. 2008b; Hjelmbrække et al. 2017). As stated by Herazo et al. (2012 p.70), "*Project success criteria that focus beyond the project management process constitute behavioural, business, and strategic dimensions*". It has also been asserted by Al-Bidaiwi et al. (2012 p.1), that "*a project's success criteria not only depend on completion to schedule and budget but also on implementation with adequate safety, reliability and operational flexibility*". These ideas imply that we need to seek more collaborative actions from project managers of large infrastructure projects to ensure additional success criteria are achieved to deliver successful projects for public use.

Some questions now arise: At what stage does the project manager have to ensure other success criteria are met? Who shall participate from among the stakeholders in ensuring additional success criteria, and when? What other success factors shall be managed and achieved? These needs to be addressed to maintain the success of the additional criteria

in large infrastructure projects, and finally, what is the impact of operational readiness factors on large infrastructure projects?

According to the Association for Project Management (APM), project management is *“the application of processes, methods, knowledge, skills and experience to achieve the project objectives”* (Association for Project Management 2012 p. 12). Project management is employed across different industries, taking the form of a set of tools, methods and applications to carry out activities not effectively doable using traditional organisational structures (Bellini & Canonico 2008). Many organisations have used project management as a means of staying competitive and achieving strategic change in a highly demanding business environment (Demir & Kocabaş 2010; Ward & Daniel 2013). Continuous improvement in project management competency (Divine Kwaku Ahadzie et al. 2008) is considered a vital and strategic step to achieve better results for both private organisations and government agencies (Takey & Carvalho 2015). According to Havila, *“the managerial skills and competences needed during a project closure may be significantly different to the skills and competences needed during the project implementation phase* (Havila et al. 2013 p.92). However, it seems clear that the evidence for operational readiness and the factors for the operations of the capital projects such as airports have not attracted much attention in APM competencies documents.

In traditional project management literature, we notice the absence of a dedicated phase for operations and maintenance preparation and support for the newly completed product (Brady et al. 2005; Archibald et al. 2012). As stated by De Wit (1988 p.166), *“Project management books usually omit the operational phase because they tend to be written from a consultant’s or contractor’s perspective”*. Consultants, contractors and project managers do not interfere with the operation phase or with how the project will run after

completion, as their contractual scope is to deliver the project on time, on schedule and within budget (Artto et al. 2015). Operational problems may appear once the project is set for operations and these problems could be the results of mistakes that were made during the project life-cycle phases, which were not picked up during the commissioning phase of the project (Al-Bidaiwi et al. 2012). Dvir et al. (2003) further argue that in the initial phase of operations, problems may start to surface that result in a decline or low level of performance *vis-à-vis* the services provided, which results in a reputational and financial impact on the project's owner and other operational stakeholders.

The available project management literature focuses heavily on competencies of the early and middle stages of the project, while only a small number of studies and models are concerned with the last stages of the project, for example, closure planning. As pointed out by Havila et al.,

“While project management literature covers the entire life cycle, the front end, i.e., the initiation, development and implementation of the project still tends to be stressed. Only a small fraction of the discussion in the literature is devoted to the termination phase of a project” (Havila et al. 2013, p. 90).

This is also evident from the recent research attention paid to the front-end of the project phase (before operations), it is also called the decision-making phase in securing projects' long-term success and has been increasingly recognised (Samset & Volden 2015).

To deliver a project successfully, the advice given by the various project management bodies is to follow standard administrative procedure (Association for Project Management 2012; Project Management Institute 2013; The Chartered Institute of Building 2014). ‘Standard administrative procedure’ refers to the administrative methods

and formal procedures used in projects, e.g., project structuring, planning, performance measurement, quality management, and coordination (Engwall 2003). As project managers are required to be competent in design, scheduling and procuring to deliver projects successfully, there is also a need for competency in project closure and operations.

In the past, project management literature provided few insights into the challenges and benefits of proper planning and preparation for operating/transferring the project to the operations stage (Avots 1969). De (2001) indicated that project managers have overlooked planning for the termination phase and that this omission has caused severe financial and reputational losses. This is reiterated by Brito et al. (2015) and by Dvir, who states, “*Nevertheless, planning of the termination phase, especially planning for commissioning, has not received proper attention.... most studies on project termination focus on premature termination*” (Dvir 2005, p. 262). Later it was highlighted by Thi and Swierczek (2010) that the project manager’s competence becomes more critical at the planning and termination stages to ensure project success. Havila et al. (2013) have also indicated that the focus to date has been more on premature termination of projects rather than the termination of matured projects.

Most project management theoretical works contain references to different project lifecycles (e.g., Bourque et al. 1999; Morris et al. 2000; Morris 2001; Ameri, F. & Dutta 2005). A project lifecycle is an analogy used to describe the different phases or stages a project can go through such as the idea, design, creation of and subsequent demise of a product or outcome (Cleden 2009). It is useful to define stages so it can be seen where activities take place and the relationships between activities (Ward & Chapman 1995). The descriptive phrase of “termination” is used now at the end of the *product* lifecycle model rather

than the *project* life cycle with the introduction of extended project life cycle as shown in Figure (1).

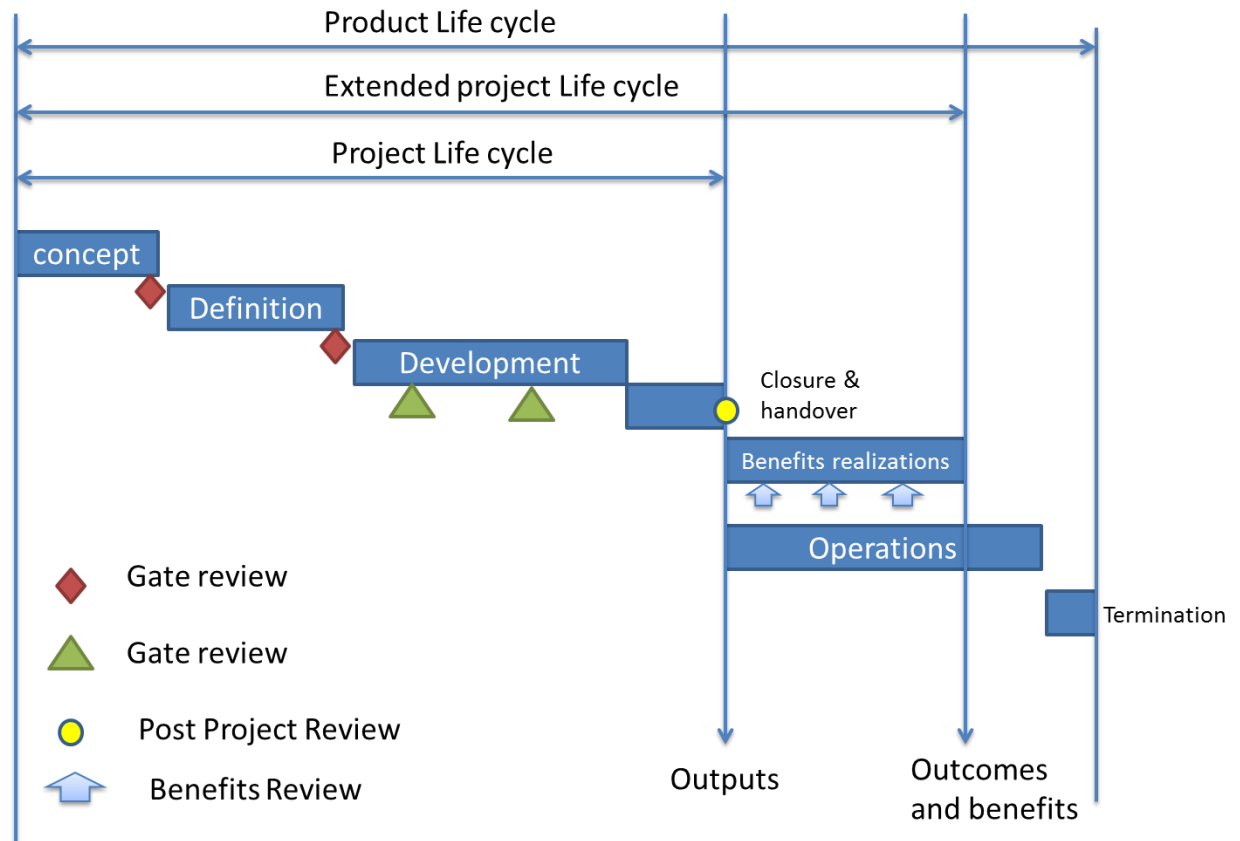


Figure (1) Extended Life Cycle (Association for Project Management 2012).

The current consensus, including the position of the Association for Project Management Body of Knowledge (APM-BoK), is to use an extended project life cycle that includes operational and termination phases of the project (Association for Project Management 2012). It has been suggested that even in the handover and closeout phases of the extended life cycle, it is important during closeout phase to transform the project and prepare for it to become operational (Prabhakar 2009; Kidd & Howe 2014). Some project management scholars have even suggested that the project manager should provide the operational manager with a project termination checklist (Havila et al. 2013).

Previously, there was no clear view on how a project would move to the operation phase, or what activities need to take place to ensure its readiness (De 2001; Dvir 2005), but more recently, this situation has changed quite considerably. For instance, there now exist models of operational preparations and readiness such as the Integrated Readiness Assurance Process (IRAP) (Nossair et al. 2012), which has been adopted to ensure large oil and gas projects are delivered and operated successfully.

There are many different criteria affecting project success such as user satisfaction, return on investment, and market competitiveness. These criteria can be divided into firstly project success criteria, which represent a combination of standards to assess the project success, such as budget, time and quality. The second type of criteria is called critical success criteria, which refer to a detailed measurement or condition that is needed by the organisation or the project to be considered successful (Pinto & Prescott 1988; Ika et al. 2012; Müller & Jugdev 2012). Merrow (2011) has directly related the success of large projects to smooth start-up operations and production, as organisations may spend years managing a large infrastructure project, which may still have a disastrous outcome due to poor start-up processes and operations. In his study of 110 projects, Dvir (2005) found a strong correlation between end user's preparation for operations and user's satisfaction and benefits, which is a major factor in a project's success. This observation was also supported by Tribe and Johnson (2008), who indicated that effective commissioning of capital projects would ensure the reduction of safety incidents, a high return on investments (ROI) based on stable and continuous operations, and the satisfaction and reputation of the project's end-users. As the process of commissioning will prepare the system to operate as designed and to be reliable from its first start-up to its final operation. Peled

and Dvir (2012) also investigated the effect of early and continuous involvement of customers on the success of defence system development projects. This can be described as enabling the end-user who will be using and operating the project after handover to be part of the project through building confidence and gaining cognitive experience, which, in return, shall ensure project success.

1.1.1 Definitions of Terms

In this section, the main terminology that will be used in the study are listed with their definitions.

Operational readiness

This study draws upon the literature (Gardner 2001; Dvir 2005; Torlutter et al. 2012; Brereton & Papp 2013; Krauss 2014; Emerson 2014a; Hendershot 2015) to define the term “operational readiness” as the list of activities and plans, which can be considered enabling factors, and which should be planned for and executed by the project’s stakeholders to prepare for the successful takeover and smooth operation of large infrastructure projects. With many large projects in general, and airports specifically, at the conceptual stage for construction in the UAE (Faridi & El-Sayegh 2006; O’Connell 2011; Ponzini 2011; Kardes et al. 2013), the need for this research cannot be over-emphasised.

Large infrastructure projects

Drawing upon the literature (Nahyan et al. 2012; Flyvbjerg 2014), ‘large infrastructure projects’ are defined as large-scale physical investment projects and facilities that cost more than US \$1 billion. Such projects are usually for national governments and most

frequently relate to urban development, facilities and structures. Large infrastructure projects are typically built for multiple stakeholders and government entities. Examples include metro lines, seaports, airports, roads and bridges.

Commissioning, Termination, Close out and Handover

The available project management literature defined many terminologies and concept that are similar in nature such as commissioning, termination, close out and handover. Differences will emerge between industries, time and authors.

The terminology of “commissioning”, as it is currently defined “... *the disciplined activity involving careful testing, calibration, and proving of all systems, software, and networks within the project boundary*” (Lawry & Pons 2013, p.1). It was also referred earlier by Kats et al. (2008) as the systematic process to ensure that building’s systems are designed, installed and operated as planned, which we notice that commissioning is terms connected to the systems regardless of who are going to operate it and other surrounding operational factors. Current literature recognises that commissioning activity is critical to the success of any project (Lawry & Pons 2013) and considered by others as a major phase of the product lifecycle in the Oil and Gas and IT projects (Archibald et al. 2012). While the term ‘termination’ is used in this research to refer to the sudden end of the project before completion and the subsequent withdrawing resources from unfitting projects effectively (Brockhoff 1994; Hormozi et al. 2000; Boehm 2000; Unger et al. 2012)

And the terms ‘close out’ and ‘handover’ are used in research according to the definitions set by the Association for Project Management Body of Knowledge (APM-BoK) as, “*the point in the life cycle where deliverables are handed over to the sponsor and users*” (Association for Project Management 2012, p. 237), while the CIOB recognize this

as, “*handover and operation stage which is when the client takes over the practically completed building or other facility*” (Chartered Institute of Building (CIOB) 2014, p. 9). While we acknowledge various terminology for the ending process and transferring the project to the operation, in this research study, we shall refer to “commissioning” throughout the thesis document.

Having provided a brief introduction to the topic and also defined core terminology to be discussed in this research. In the next sections, a theoretical background will be presented; background on large infrastructure projects will also be discussed followed by research’s problem, aims, and objectives. Then the research rationale, justification of the research, research scope and contribution to knowledge will be presented. Finally, an overview of the research study will be presented with details of the steps that will be taken and related chapters.

1.2 Theoretical Background

Before proceeding further with the research, it is important to highlight in this section, the theoretical underpinnings of the operational readiness concept and the theoretical strategies/methods used in creating readiness, are explored to understand the foundation of this research. We are looking at the theories to help us make sense of the world around us (Walker et al. 2015). These theories serve as function beyond mere description, which helps us predict the nature of relationships between phenomena (Binder & Edwards 2010). The area of interest in this research is *operational readiness*, which can be examined through related topics of interest such as readiness to change, readiness concept and readiness creation to achieve a better understanding of the subject.

Due to dynamic environments, organisations are faced with challenges that requires a continuous improvement through changes in many areas such as strategy, structure, process and buildings (Armenakis et al. 1993; Eby et al. 2000; Armenakis & Harris 2002; Vakola 2013; Waziri et al. 2014). So, readiness for change is required to take into account and incorporate new emerging changes and many other factors contributing to the success of the organisational changes needed. Armenakis et al. (1993) introduced the key concept of “readiness” defined as “...*the cognitive precursor to the behaviours of either resistance to, or support for, a change effort*” (Armenakis et al. 1993, p.682) and examining how it can be implemented in organisations to avoid failure and address resistance to new changes.

Readiness as a method for reducing resistance to change was used in a classic research study by Coch and French (1948), which demonstrated the value of allowing an organisation’s members to participate in planned changes. Lewin’s (1951) notion of “unfreezing” is also relevant as it can be utilised as a readiness creation strategy. According to Lewin (1951), the fundamental idea was to use a concept of change as unfreezing to develop new behaviours, values and attitudes among an organisation’s members.

Later others such as Bartlem and Locke (1981) and Gardner (1977) identified other factors that have contributed to the readiness-creating literature. In principle, the readiness’s preparation for the change in the organisation will act to prevent the likelihood of resistance to change from employees, which in turn will increase the possibility for change efforts to be more efficient (Armenakis et al. 1993; Armenakis & Harris 2002). This implies that operational readiness does on occasion focus on preparing the operations team for new operational procedures and operating new systems, where we need to prevent the resistance to change to the new products or systems (Hickey 2008; Nossair et al. 2012).

An early example of some strategies for dealing with readiness and resistance to change was provided by Kotter and Schlesinger (1979). It includes education and communication and the desired changes and reasons for them; participation and involvement in the organisation may provide opportunities for employees to participate in the decision-making, facilitation and support with skills training and emotional support, negotiation and agreement for offering incentives for making the change. Such strategies will support organisations in creating readiness among employees by reducing resistance to change (Armenakis et al. 1993; Armenakis & Harris 2002).

At this point, we also draw attention to the theory and research on “organisational readiness” (Weiner et al. 2008; Weiner 2009), which focuses on organisational change often initiated by management to provide the organisation with competitive advantages. Such change moves the organisation from its present state to some desired future state to increase organisational effectiveness and productivity. Armenakis et al. (1993) developed a creating readiness for change model, which considers creating readiness for change so that resistance is minimised. The model is needed to clarify the readiness concept and examine how external and internal factors could have an influence on the organisational members’ readiness for change as shown in Figure (2).

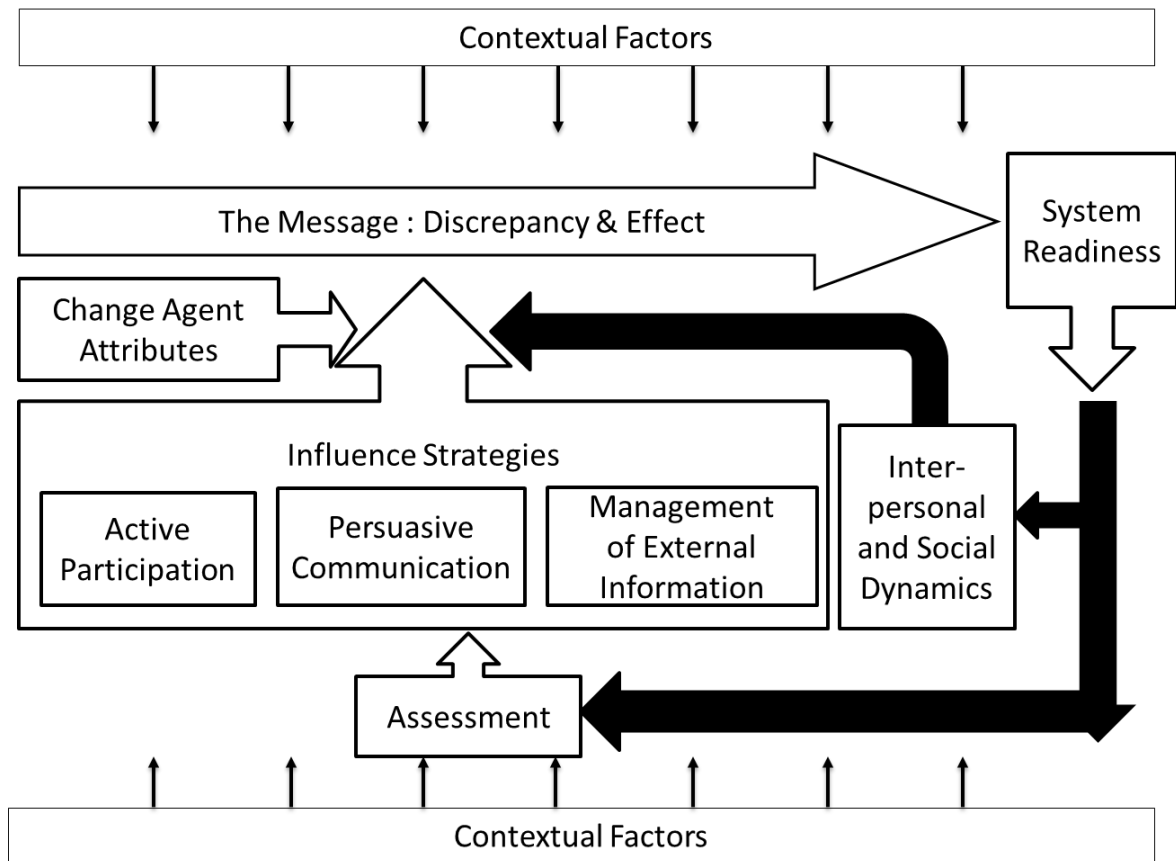


Figure (2) Creating readiness model (Armenakis et al. 1993).

In the model presented in **Figure (2)**, the message is considered the important element in creating readiness for change in the organisation. It needs to be addressed to all the members who will be affected by this change in the organisation. The model has five components that detail the internal and external factors to create the readiness for change, including the message, interpersonal and social dynamics, change agent attributes, influence strategies and assessment, which will be briefly described below:

1. **The message:** the organisation provides details on the need for change and its requirements. The message contains two items (a) discrepancy and (b) efficacy described briefly here:

(a) **Discrepancy:** organisation will need to engage a change agent in explaining the change from current state to the desired state for the organisation.

(b) **Efficacy:** which refers to the ability of the affected organisation's employees to accept and adopt this change through motivational support from the organisation's leadership.

2. **Interpersonal and social dynamics:** the contributing factor that is needed by the change agent as there are different groups within the organisation, and ensuring the network of relationship and the social dynamics of the organisation will have an effect on the adoption of the change, as well as realising the outcome from the change.

3. **Influence strategies:** Three strategies were suggested by the model to convey the message to the organisation members and create the readiness for change, these are:

(a) **Persuasive communication:** usually carried out by the agent directly, either verbal or written memo and conducted in-person, which produces the most efficient results because of the individual focus.

(b) **Active participation:** involving people in preparing for the change. This is designed to have them learn directly and allow for a participant to give their opinions on the decision-making.

(c) **Managing internal and external information:** in this strategy, the organisation can use other's views and opinions to support the change.

4. **Change agent attributes:** the organisation is required to employ a change agent who is required to have credible attributes that will significantly impact the outcome of the change and the readiness of the members.

5. **Assessment:** this is needed to evaluate the organisation's readiness to change, which can be carried out using survey research as a viable assessment with investigation tools such as questionnaire and interview as appropriate evaluation tools.

The readiness creating model designed by Armenakis et al. (1993) was used as the starting theoretical ground for this research to investigate the operational readiness factors for airports project. The model has been developed further by other researchers (Armenakis et al. 1999; Holt, Achilles A Armenakis, et al. 2007; Holt, A. A. Armenakis, et al. 2007; Rafferty et al. 2012). Evaluation of this model will be discussed in Chapter 3 to enable the development of a conceptual operational readiness model for the airport project.

According to Stevens (2013), *"... the theoretical foundations of this model stem largely from the recognition of the process of "creating readiness" as a proactive and positive alternative to traditional views of organizational change in which "resistance reduction" was typically the primary focus"* (Stevens 2013, p. 3). Stevens makes an important point here. Therefore, the theoretical background of this research will take into account the proactive and positive approaches that can be taken to facilitate operational readiness. Other researchers have considered the concept of readiness, and how it can be created. For example, Holt et al. (2007) argued the possibility of measuring it by assessing different components such as the change contents, change process and the individual's attributes and behaviours relating to the changes.

In this research, the focus is on operational readiness of infrastructure projects such as airports, where airports need to be operationally ready to take newly completed assets for full operations and provide best services for its passengers. We also argue that earlier readiness assessments such as e-government's readiness (Khan et al. 2010) is one of the

key performance measurement tools for successfully managing organisational resources for e-Government (Potnis & Pardo 2011). This can also be used and extended to the operational readiness assessment of large infrastructure projects, to assess the readiness of the organisation to receive and operate the facility effectively from day one.

In summary, we note here the contribution of creating readiness model by (Armenakis et al. 1993) and the theory of readiness by (Weiner 2009) in providing a theoretical foundation for this study, wherein the next sections, more details will be provided on the large infrastructure projects that are the focus and context of this study.

1.3 Research Problem / Rational

Recent cases of newly completed airport projects suggest that on the first day of operation (after completion and sign off of construction phase), airport services are unlikely to run smoothly. In numerous cases, airport services and operations have failed due to the poor or inadequate ‘readiness’.

The research rationale is based on a number of propositions:

First, as will be shown in the literature review section, relatively little has been written about operational readiness and specifically, about the operations readiness of the main infrastructure projects. This is supported by the needs of operational readiness to provide asset data early enough as reported by Emerson (2014). In 2001, Gardner (2001) noticed that there was insufficient research on the operational readiness of projects, and this situation has not changed in the intervening 16 years. Gardner (2001) has called for more

research on the operational readiness of projects, and questioned whether the actual project might, in fact, be more 'Ready' than its environment and designation. Krauss (2014) has clearly identified the lack of operational readiness in the project delivery phase of the project and recommended that operational readiness activity is present to ensure smooth operations and project success.

Second, there is a need to identify and group operational readiness factors for future use in projects. Del et al. (2015) created a System for Human Factors Assessment and Readiness Evaluation (SHARE). SHARE is a conceptual framework that includes a method for standardising human factors readiness assessment to be able to fully consider human factor issues at all stages of system development, which in turn could increase costs and delay system deployment. SHARE conceptual framework looks at one aspect of readiness for the operational readiness, whereas this study looks at it from all aspects. Others such as Cosenzo et al. (2007) have tried to enhance operational effectiveness through the use of readiness measures and factors.

Third, there is a need to investigate the impact of operational readiness factors on project success, to be able to create a framework that can be used in the future for large infrastructure projects. Krauss (2014) asserted that project delivery shortfalls such as prolonged start-up periods and capacity shortfalls are often not identified until projects are handed over and operations commence. He consequently recommended the inclusion of operational readiness in the project delivery plan, which will require the project manager to think differently. It thus improves the project success, and this study identifies this and others as a gap in the research and literature that no framework or studies examined the overall operational readiness in projects and its impact on project success.

In summary, and based on the three propositions above, it is suggested that this research is timely and relevant given the large airport projects planned for construction in the UAE. The research will provide empirical evidence and support for their successful delivery and operations.

1.4 Research Questions

For the last two decades, the Gulf Cooperation Council (GCC) states have witnessed a boom in the construction industry. This applies in particular to the UAE, which has aimed to provide increased government services, as well as boost its economic growth and reduce its dependency on oil returns (El-Sayegh 2008; Nahyan et al. 2012; Desai 2013). Many large infrastructure projects have taken place in UAE, including airports, seaports and rail systems, as well as megastructures (e.g., the Burj Khalifa, which was built at a total cost of US \$ 1.5 billion). The need to ensure that these large infrastructure projects are operationally ready from day one is vital and as important as building them in the first place. However, due to a lack or unavailability of resources, capabilities and new operation methods, some of these projects often face the risks of delays or suffer from first operational flaws (Faridi & El-Sayegh 2006; El-Sayegh 2014). Thus, the need for improvements in project management/operations management techniques, tools and competencies are critical for successfully delivering and operating projects in general and large infrastructure projects specifically (Chang et al. 2013; Ahola & Davies 2012) in the UAE.

Previous studies on the start-up operational failure of large infrastructure projects suggest that pre-operational readiness of the organisation, as well as unique project management tools and techniques are needed to avoid failure of operations after the completion of the

construction stage of large infrastructure projects (Hickey 2008; Al-Bidaiwi et al. 2012; Nossair et al. 2012). An example of a vast completed infrastructure is the Eurotunnel, where the project management team was replaced mid-project, and the construction experienced high revenue losses. Anguera commented that, *“The delays in the construction imposed additional financing and labour costs. Furthermore, the unforeseen problems in the works programme required costly modifications and delayed the start of operations which led to the loss of associated operational revenues”* (Anguera 2006, p. 302).

In the case of airport projects, Heathrow Airport’s fifth terminal (T5) was opened for business on 27 March 2008 at a cost of around £4.3 billion, taking six years to construct. However, multiple problems were faced from the first day of operations, and The House of Commons Transport Committee concluded that *“what should have been an occasion of national pride was in fact an occasion of national embarrassment”* (House of Commons Transport Committee 2008, p. 3). Brady and Davies (2010) suggested that projects and operations management should not have forgotten about the human factor involved in the successful functioning of any large technical and infrastructure projects. In the case of Heathrow T5, more attention should have been paid to preparedness for operations, and factors for operational success on the first day should have been addressed and fully place to achieve operational readiness and avoid such financial and reputational damages to the project and its stakeholders (Davies & Gann 2009). Generally, new asset integration to the existing asset after project completion has become increasingly challenging with large system development for infrastructure. Projects such as airports, require pre-operational preparations and readiness to integrate and ensure a smooth transition of the new extension to the existing system (Winch & Leiringer 2015).

Another example of a large airport project is the Bangkok's Suvarnabhumi airport, which was opened in 2006 and cost the government US \$3.9 billion. Croes commented that, "*the new airport has been mired by problems since its opening, including more than 100 cracks on taxiways and runways, corruption claims, inadequate toilets and facilities, and complaints about hygiene standards*" (Croes 2007, p. 1). The problems faced are a result of a combination of project management and operational aspects that could have been avoided to save the government money and reputational damage.

The issues and problems discussed relating to both the Heathrow's T5 project, and Thailand's Suvarnabhumi airports indicate the need for both scholars and practitioners to have an understanding of the impact of operational readiness factors on the success of large infrastructure projects. They also suggest the need for greater attention on the part of both scholars and practitioners to the required preparation that will enable the project to be delivered on time and to operate safely and smoothly from the first day of operations. According to Davies and Brady (2015) researchers rarely study how dynamic and project capabilities are deployed to manage large-scale projects such as airports, where dynamic capabilities are referred to as the "*... identifiable management and organisational processes required to implement strategies, create innovation and adapt to an evolving environment*" (Davies & Brady 2015, p. 3). Sarkis (2000) noted that most of the relevant studies focus on the technical aspects of airport developments such as design, planning and construction, and failed to consider the management of operational efficiencies after the handover. There is also an absence of studies on UAE's airport projects in general and on operational readiness and efficiencies in particular. This research study seeks to address the gap in the literature concerning operational readiness and its role in enabling organisations to be operationally ready before operating newly constructed airports. The

aim is that the study will increase the chances of project success, customer satisfaction and thus, help develop world-class airport services.

Some studies have called for more efficient and effective handover and preparations processes for project operations (Dvir 2005; Khan & Kajko-Mattsson 2010; Al-bidaiwi et al. 2012; Nossair et al. 2012; Whyte et al. 2012; Lesmana et al. 2014), however improving the handover process alone is not enough to ensure operability of the projects after handing over. Other studies have looked at the benefits of early stakeholder involvements and participation in all the phases of new product projects (Condit 1994; Lizarralde 2011; Nasir & Sahibuddin 2011; Al-bidaiwi et al. 2012; Nossair et al. 2012; Li et al. 2013). The participation of stakeholders in the projects and in large projects, in particular, have been found to correlate with the project success (Diallo & Thuillier 2005; Wang & Huang 2006; Peled & Dvir 2012; Assudani & Kloppenborg 2010).

Finally, as projects grow bigger in size, the financial problems related to cost overruns also increase, which could, in turn, affect the national economies of the countries or regions. An example of this was when the cost of the Athens Olympics project in 2004 had a billion-dollar overrun in cost that affected the country of Greece financially, also when operational problems affected Hong Kong's new airport in 1998, financial losses hit the country. Therefore, avoiding financial risks by managing the project efficiently is not enough on its own; running that project efficiently after handing over is also key. The need to avoid national financial distress has recently become important, highlighting a need for different ways of managing and supporting large infrastructure projects such as airports, including planning the operations of large infrastructure projects (Flyvbjerg 2007c). Similarly, Winch and Leiringer (2015) identified a gap in the research on asset integration capabilities and called for studies of project literature on benefits realisation

with emphasis being placed on researching and investigating the issues pertaining to commissioning, human resources and start-up.

To date, however, the researcher is not aware of studies that have explored the impact of operational readiness factors on the success of large infrastructure projects, and specifically in the UAE. A project's clients and relevant stakeholders need to ensure operational readiness to identify and minimise the risks of operational failure once large infrastructure projects have been turned on for operations (Alessandri et al. 2004). It is also recognised by Merrow (2011) that production and operation shortfalls in a large project would result in significant costs and destroy the reputational image of project-related stakeholders. It is suggested that such operational readiness plans are run in parallel with all other stages of the project lifecycle as demonstrated in **Figure (3)**, as this will enable the operational team to prepare to operate the project in advance. It has also been recognised by Hickey (2008) that operational readiness plans should plan functions early in the project life cycle and continues through the construction and closing until the project becomes operational. Thus, readiness activities will be progressively implemented in parallel with the original project stages.

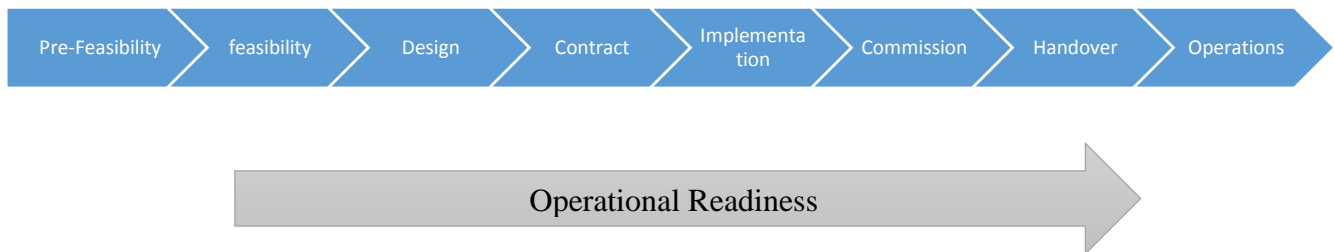


Figure (3) Operational readiness plan.

Consequently, and based on the research problem, the following research questions have been developed for this study:

RQ1: Within the context of project management, what is operational readiness?

RQ2: How do scholars and practitioners perceive operational readiness and contributing factors?

RQ3: What is the relationship between operational readiness and project success?

1.5 Research Aims and Objectives

Based on the stated problem of this research, two aims have been developed for this study:

1. To critically examine, discern and synthesise the notion of operational readiness within the context of operations and project management.

2. To support organisations to ensure that on the first day of operation (after completion and sign off of construction phase), airport service run smoothly. In effect, the study seeks to ensure that airport services and operations do not fail due to poor or inadequate 'readiness'. Therefore, the development of an operational readiness framework for airport services is proposed for the UAE consultants. By having such a readiness framework, the operations managers are able to analyse, evaluate and develop an awareness of their readiness in term of the implementation of airport services.

The two aims of this research guided the development of the four objectives of this research study:

Objective 1: Explore, define and review relevant literature related to the operational readiness with a focus on large infrastructure projects (Airports).

Objective 2: Identify and categorise factors from existing literature that constitute the major theory behind operations readiness.

Objective 3: Identify and characterise key elements of operational readiness in the context of large infrastructure projects (Airports).

Objective 4: Develop a conceptual framework that can improve project success in large infrastructure projects (Airports).

A research-mapping diagram is provided to guide the understanding of the reader on the key research elements, starting with the research problems. From this, it is evident that two aims of this study have been identified, and, following on from the research aim and

problem, three research objectives, three research questions with rationales and the underlying theory, as shown in **Table (1)**.

Table (1) Research Mapping Elements.

Research Problem	Research Aim	Research Objectives	Research Questions	Research rationale	Underlying theory
1	Critically examine, discern and synthesize the notion of operational readiness within the context of operations and project management.	Explore , define and review relevant literature related to operational readiness with focus on large infrastructure projects (Airports)	Within the context of project management, What is operational readiness ?	There seems to be sparse literature on operations readiness and specifically in the context of operations and project management.	Readiness (Organization) Theory (Weiner 2009) Transactional theory (Lazarus & Folkman, 1987) Readiness Concept (Armenakis et al. (1993) (Coch and French, Jr. (1948))
2	Recent cases of newly completed airports projects suggest that on first day of operation (after completion and signoff of construction phase), airport service are unlikely to run smoothly, in effect. In numerous cases, airport services and operations have failed due to poor or inadequate 'readiness'.	To support organizations ensure that on first day of operation (after completion and signoff of construction phase), airport service run smoothly, in effect. In effect, the study seeks to ensure that airport services and operations do not fail due to poor or inadequate 'readiness'. Therefore, the development of an operational readiness framework for airport services is proposed for the UAE consultants. By having such a readiness framework, the operations managers are able to analyze, evaluate and develop an awareness of their readiness in term of the implementation of airport services.	Identify and categorize factors from existing literature that constitute the major theory behind operations readiness. Identify and characterize key elements of operational readiness in the context of large infrastructure projects (Airports)	How do practitioners perceived operational readiness and contributing factors?	There are needs to identify and group operational readiness factors for future use in projects. Readiness Factors Barlem and Locke (1981) Gardner (1977) Readiness Model Armenakis & Harris (2002)
3		Develop a conceptual framework that can improve project success in large infrastructure projects (Airports).	What is the relationship between operational readiness and project success?	Investigating the impact of operational readiness factors on project success. To be able to create a framework that can be used in the future for large infrastructure projects.	

1.6 Overview of the Research

A research process has been designed to ensure thorough and validated information at the end of the process design as shown **Figure (4)**, which illustrates the steps that will be taken and the processes carried out to complete this research, chapter by chapter.

The first part of the research is the literature review and designing the research approach, which is covered by the first three chapters. Chapter 1 of this study presents the introduction, background, research problem, rationale, aims and objectives, research questions, justification of the research and term definitions. Chapter 2 presents a review of relevant literature, while Chapter 3 outlines the study's proposed conceptual framework. Methodological details such as site and participant selection, context, data collection tools, data-processing and analysis methods, reliability, validity and ethical consideration are outlined in Chapter 4.

The second part of the research is the analysis of the data and formulation of the discussion, which is covered in two chapters. Data collection and analysis are addressed in Chapter 5, while Chapter 6 presents a discussion of the findings.

Finally, the last part, which is the new knowledge generation, is presented in Chapter 7, which summarises and concludes the study by stating the research limitations, contributions and benefits to the field, and recommendations for further studies.

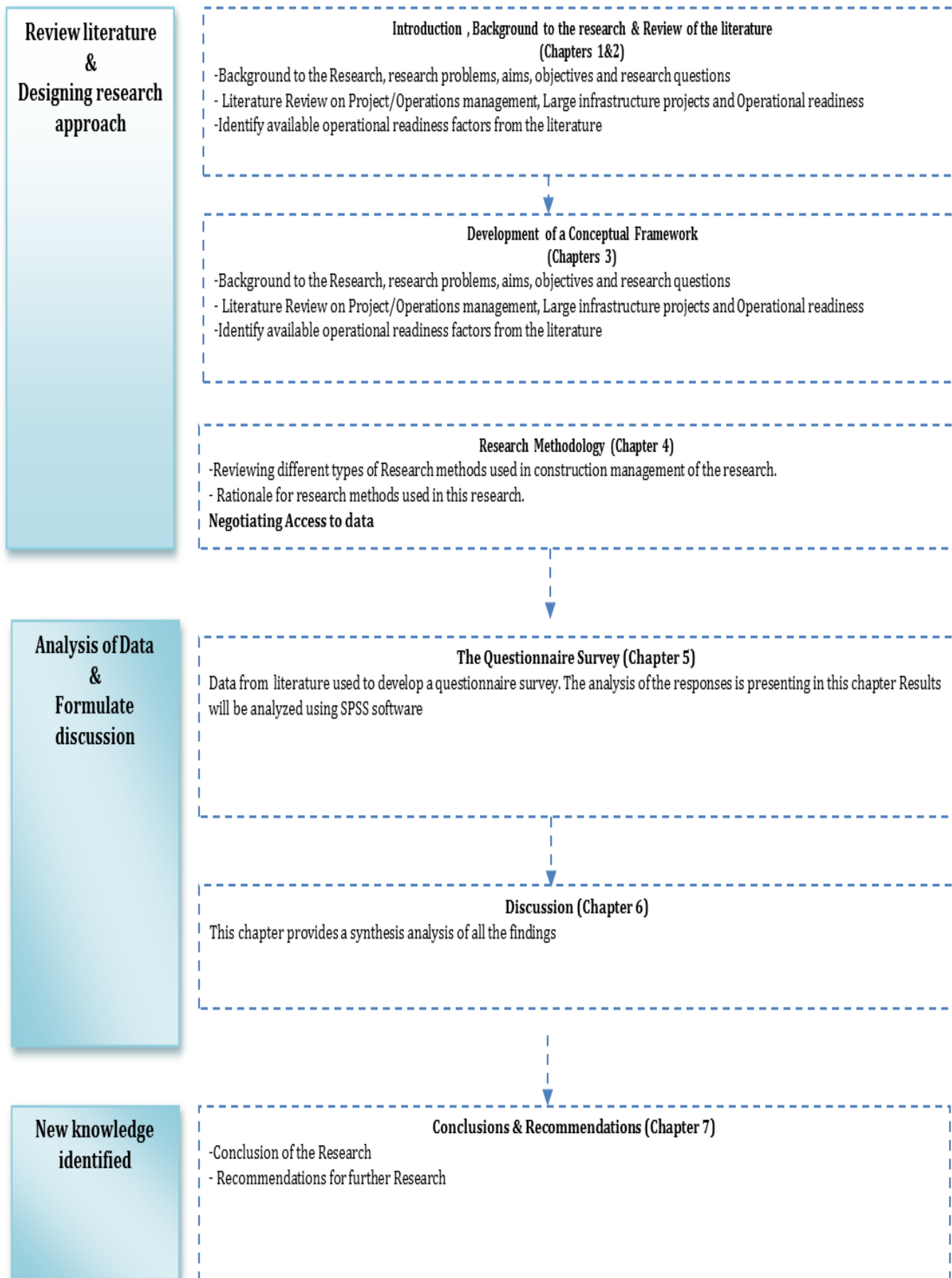


Figure (4) Research study flow diagram.

Chapter 2

Infrastructure Project's Characteristics and Challenges

2.1 Introduction

For any academic research, it is important to undertake a comprehensive review of the research areas in order to develop the knowledge base (Webster & Watson 2002; Tranfield et al. 2003). This chapter of the thesis presents a review of the literature. According to (Hart 1998; Webster & Watson 2002), the main objective for undertaking a literature review is to present a complete overview and evaluation of the concepts that underpin the research. More specifically, Webster and Watson suggest that a literature review, “...covers relevant literature on the topic and is not confined to one research methodology, one set of journals, or one geographic region” (Webster & Watson 2002, p. xv). It should also be noted that reviews of research literature are conducted for a variety of purposes (Okoli & Schabram 2010), inclusive of providing a theoretical background for subsequent studies; learning the breadth of research on a topic of interest, or answering practical questions by understanding what the existing research has to say on the matter. As this research addresses operational preparation and readiness in infrastructure projects (airports), it is useful to understand the essential components of the research: infrastructure projects including the challenges and characteristics of such kind of projects, project management and operations management, their relationship and investigate operational readiness stand within these two domains.

In this chapter, firstly, a review of the infrastructure projects and their characteristics, definitions, types that include airports projects will be presented. The review will also cover challenges faced by the project managers in constructions and during the commissioning of such large infrastructure projects. Secondly, a review of the project management and operations management will take place that will include the history of both and relationship to further enhance our understanding of the operational readiness.

2.2 Infrastructure and Airport projects Characteristics and Challenges

This section discusses the infrastructure projects' characteristics and challenges. Firstly, a thorough exploration of infrastructure projects will be reviewed, inclusive of definition, types and characteristics. Secondly, construction challenges, as well as the main difficulties projects encounter, such as shortages in resources, competencies and skills, and rapid changes in technology will also be discussed. Finally, the resolutions to address these challenges will be identified and reviewed.

The commissioning and transfer of operations challenges are explored in detailed with both the impact of poor commissioning process on the asset and the stakeholders being evaluated. A list of challenges was identified, such as inaccuracy of the project data, inefficient commissioning process, construction defects and early stakeholder involvement.

2.2.1 What are Infrastructure Projects?

Buhr defined the infrastructure of an area as, “*the sum of all relevant economic data, such as rules, stocks and measures with the function of mobilising the economic potentialities of economic agents*” (Buhr 2003, p. 16), and categorised them into institutional, personal and material infrastructure. Institutional infrastructure refers to the rules and procedures used by the government to guarantee and activate the economic potentialities of economic agents. Personal infrastructure represents the human capital of the working population that would influence the economic potentialities of the economic agents. Material infrastructure refers to the capital stocks, such as airports, seaports, factories, and roads that serve the function of mobilising the economic potentialities of economic agents (Buhr 2003).

The context of this study’s research focuses on the material infrastructure or infrastructure projects that are to be delivered by the governments for public use and to boost the economy. Infrastructure projects are the backbone of any country’s national economy, and they are highly complex because they involve of a multitude of stakeholders, risks of delays and cost overruns, as well as the significant amount of time it takes to be constructed (Flyvbjerg 2005; Doloi 2012; Winch & Leiringer 2015).

The infrastructure projects are defined in the Economical world as:

“One of the drivers of sustained growth and acts as an enabler for a country’s competitiveness. However, infrastructure development will not drive economic growth unless it is fully aligned with the country’s economic, industrial, social and environmental priorities, and is delivered efficiently and effectively” (World Economic Forum 2012, p. 1).

While the social and economic benefits and returns of infrastructure projects in modern societies are well understood (Winch & Leiringer 2015), their constructions and operations have typically been fraught with problems and challenges (Nguyen et al. 2009; Flyvbjerg 2007b). Management of the infrastructure projects has been one of the most sensitive parts of the acquisition of such projects, due to complexity, diversity and time. A standard project will take up to four years, whereas the average length of a major infrastructure project is about 10-15 years (Flyvbjerg et al. 2009).

Economists have projected that emerging countries, such as China, India, South Brazil and Russia would spend an estimated \$22 trillion on infrastructure projects—the largest share ever as it relates to the world’s Gross Domestic Product (GDP) (Flyvbjerg et al. 2009). However, the amount of money spent on infrastructure projects in the past has not been enough to meet today’s requirements (Woetzel et al. 2016), and if current rates are maintained, the gap between supplied and demanded infrastructure projects will continue to grow. An estimation shows that the world will need to invest \$3.3 trillion annually from 2016 through 2030 just to simply keep pace with the economic growth forecasts as illustrated in Figure (5).

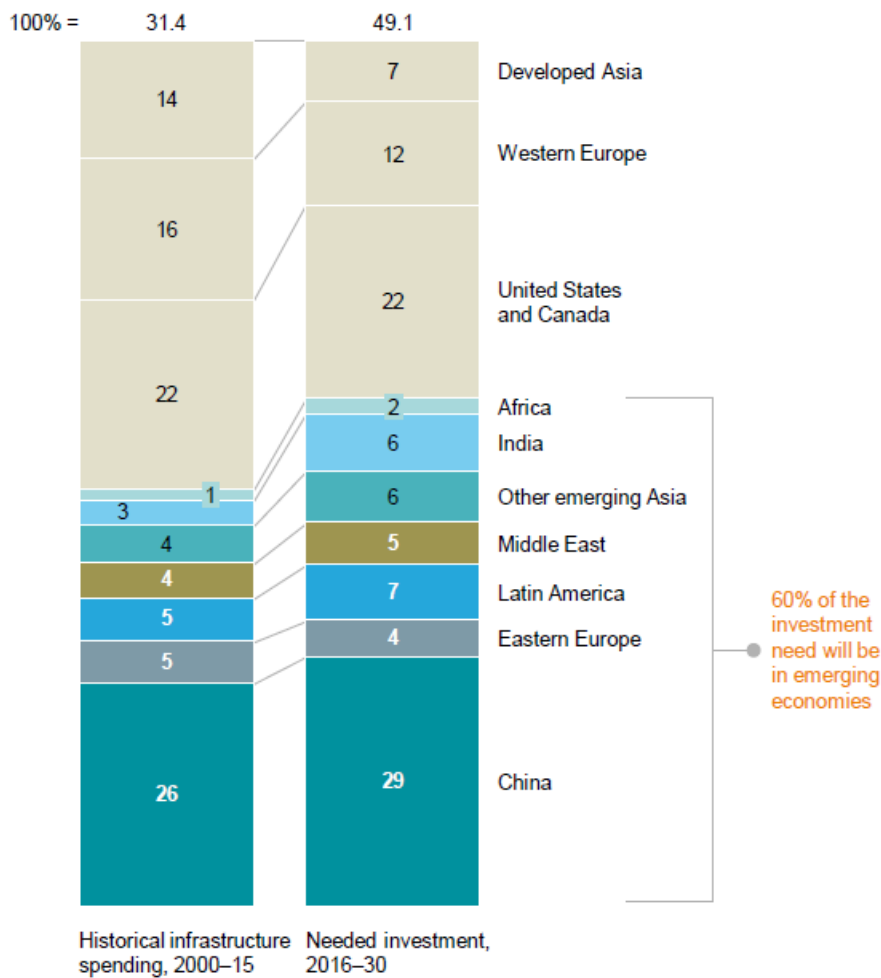


Figure (5) Annual infrastructure investment spending and needs (Woetzel et al. 2016).

While other developed and industrial regions, such as the United States and Europe have strong needs; it is the emerging countries that will require the majority of the investments for infrastructure projects. Additionally, it should be noted that in particular, spending in the Middle East and North Africa (MENA) region would be increasing in the coming years. According to Flyvbjerg (2009), a geographical shift in large infrastructure investments from developed to emerging economies has taken place, where a higher risk of cost overrun and delays in project delivery exist. Flyvbjerg stated that:

“In the past five years, China has spent more on infrastructure in real terms than in the whole of the 20th century. In the past four years, China has built as many kilometres of high-speed passenger rail lines as Europe has in two decades. Morgan Stanley predicts that emerging economies will spend \$22 trillion in today's prices on infrastructure over the next ten years.” (Flyvbjerg 2009, p. 18/31)

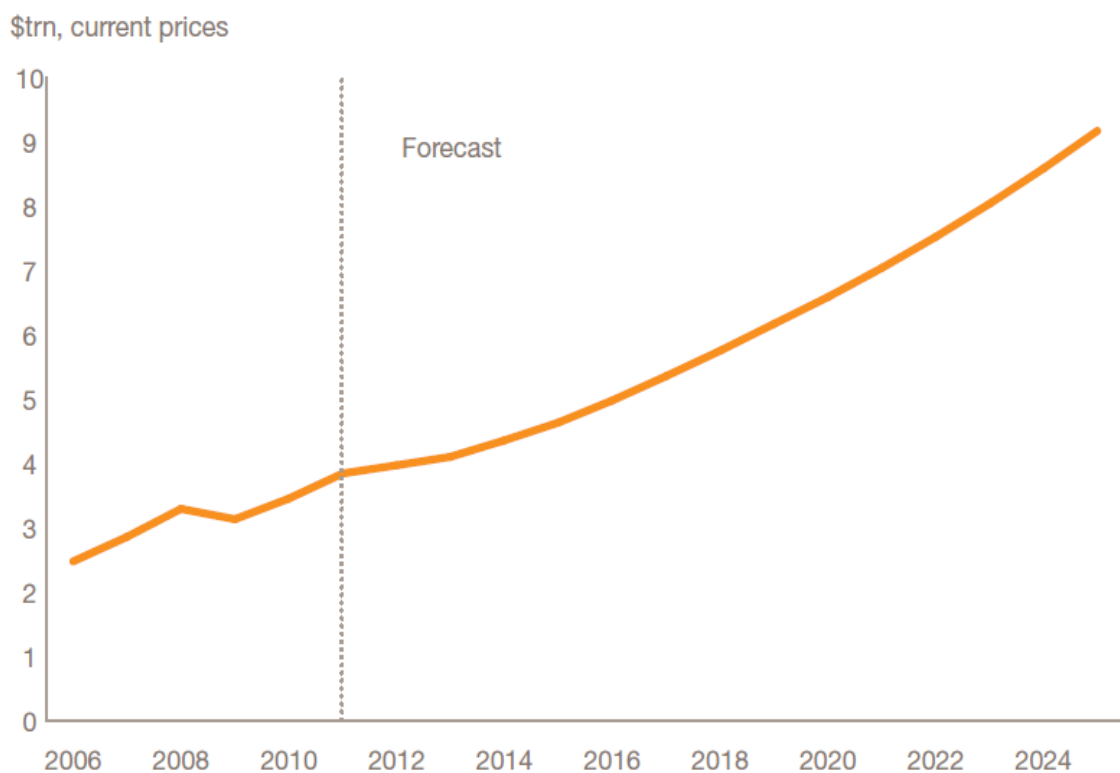


Figure (6) Global infrastructure spending to reach \$9 trillion by 2025 (PWC 2014).

Recently PWC (2014), reported that spending on the infrastructure worldwide would grow from \$4 trillion per year in 2012 to more than \$9 trillion per year by 2025. Overall, it is expected that close to \$78 trillion will be spent globally between 2014 and 2025 as shown in **Figure (6)**.

The concerns are not only in delays of project delivery but also in project performance and operations after delivery. This is an essential element not just for emerging economies that are now handling most of the large infrastructure projects but also for the developed countries, which have more experience in the production and delivery of large projects (DE Zoysa 2006; Zeng et al. 2015).

According to Cantarelli, “*investments in infrastructure are a considerable burden on a country’s gross domestic product (GDP)*” (Cantarelli 2009, p. 16) as almost all of the large infrastructure projects are financed and run by the governments of those countries. While the construction of large infrastructure projects plays a role in both the economy and project delivery worldwide, due to the high cost of construction activities, as well as the high cost incurred in resolving the conflict of projects, project managers are required to find new ways to avoid conflict and deliver projects on or before time (Ng et al. 2007). Therefore, knowing the burdens shouldered by governments to construct infrastructure projects, an appropriate method should be developed and implemented to ensure the timely operability of these projects, which is essential to providing a quick ROI, ensuring safety, as well as considering other measures to ease the financial burdens on governments.

Flyvbjerg et al., were particularly concerned about the cost and efficiency of large infrastructure projects; they stated that:

“The efficiency of infrastructure planning and execution is therefore particularly important at present. Unfortunately, the private sector, the public sector and private/public sector partnerships have a dismal record of delivering on large infrastructure cost and performance promises.” (Flyvbjerg et al. 2009, p. 2)

The efficiency of the planning and execution processes during the project construction phase is of vital importance, therefore, and with similar importance, planning and implementation of operations after the project is completed must also be considered.

One of the early empirical studies conducted by Hall (1980) focused on the inadequate planning of large infrastructure projects that resulted in cost overruns. Hall's research identified that the root causes of many of the planning disasters was insufficient forecasts and thus, suggested that planning uncertainty is incorporated as a critical element of such projects. However, Hall failed to identify the failures of planning at the last stages of the projects, which could lead to more disastrous outcomes for large infrastructure projects.

According to research conducted by Szyliowicz and Goetz (1995), the factors that prevent large infrastructure from realising its intended objectives included size, technological complexity, uncertainties, and the lack of appreciation of the local environment. However, their study remained unclear, as it is still difficult and costly to implement large infrastructure projects. They have suggested that the answer may be pursued in the decision-making processes, due to the fact that these projects are inherently political. Nevertheless, solving the political inherited problems did not solve the initial problems. It was emphasised by Flyvbjerg et al. (2003) that there is a need for formal procedures for risk management in mega infrastructure projects of high value, which can reduce the cost overruns of such large projects. Additionally, this can save the countries' economies by suggesting new policies for decision-making and reduce risk in mega-project developments. However, no attempt was made to discuss how the 'after success' of project management will be planned and ensured, specifically, reductions in cost, as well as the potential of operational expenditure to negatively impact on the countries' economies as it

relates to such mega-projects. As such, this gap in the literature guides the interest of this research study.

In a more recent study, Flyvbjerg et al. (2009) analyse a decision made by the United Kingdom's Department of Transport, which requires a complete risk matrix to manage risks during the implementation of large infrastructure projects. The register should include construction (e.g., time and cost perspective), and operational (e.g., maintenance, operations, revenue) risks; the register should also identify who is responsible for each risk. Flyvbjerg and his colleagues, however, did not specify any mitigations or plans to overcome operational risks and as such, their research was more concentrated on the lack of planning, delusions and deceptions of large infrastructure projects to avoid disastrous results during project execution. They also examined the oversight of operational planning to avoid and manage risks that may arise after handing over the assets, even if the project was on-time and to the approved budget; it will be considered a commercial waste if it is not operated on-time and with the right efficacy.

Definition of Infrastructure (Characteristics)

The definition of "large infrastructure projects" is described in the literature using various synonymous terms, such as mega projects, major projects, super projects, and large-scale projects (Haidar & Ellis 2010; Oliomogbe & Smith 2012). However, the most commonly used terminology found in the project management and construction literature is *mega-projects*, which indicates large scale, complexity, and huge cost (Gellert et al. 2003; van Marrewijk 2007; Boateng et al. 2012) as described in following section.

As discussed earlier, this study focuses on airports as a subset of transport and social infrastructure (Nijkamp & Yim 2001; Gil et al. 2012). Airport projects are considered to

be part of public transport projects (Quilty 2003; Starkie 2006) and thus, regarded as a large infrastructure project (Cantarelli et al. 2010; Guo et al. 2014).

2.2.2 Airport Projects

Aviation continues to grow as the preferred mode of travel and transportation, and as such, new airports continue to be planned and built around the world (Szyliowicz & Goetz 1995). Airport projects are considered to be one of the largest infrastructure transportation projects, which include other modes of transport, such as roads, rail lines, channels, harbours, bridges and tunnels. Adding to this, there has been a growing demand for airport projects around the world (Forsyth 2007) as airports are considered critical and dominant forces in boosting the community's economy as stated by Sarkis :

“Since 1970, airports have redrawn the economic map of the U.S. Locating airports in communities to further their economic development has been exacerbated by the deregulation of the airline industry, which has allowed airlines to expand services and pressured airports to provide additional services to the airlines' customers.” (Sarkis 2000, p. 336).

In the United Arab Emirates, from 1932 with the first airport opening in Sharjah, the third largest city in the UAE, aviation in the whole country has surged. This has coincided with the transformation of cities like Dubai and Abu-Dhabi in the UAE into trading hubs. Currently, the UAE has seven international airports and five airline carriers.

Middle Eastern countries are regarded as some of the world’s emerging economies (Jones & Viros 2014; Lyócsa & Baumöhl 2015), where the Gulf Cooperation Council (GCC) states are considered the engines of the Middle East, producing some of the world's highest GDP per capita results. Gulf Cooperation Council (GCC) countries are now experiencing high air transport market surges, with an increase in passenger and cargo traffic created by the successful expansion of the Emirates, Etihad and Qatar Airways fleets (Murel & O’Connell 2011; Squalli 2014). The demand generated by the airlines has forced major cities, such as Dubai, Abu Dhabi and Doha to launch massive airport expansion projects with a passenger capacity forecast reaching 340 million passengers per year in 2020 for the three cities combined (Murel & O’Connell 2011; Conventz & Thierstein 2014; Gupta et al. 2014).

This research study will focus on airport infrastructure projects in the UAE as the economy in UAE is shifting its dependency on oil revenues to a more sustainable source of income, such as tourism and air travel. Located midway between Europe and Asia, the UAE has a great potential for being a hub destination for many airlines. **Table (2)** shows the development plans for airport projects; the cost combined for the UAE alone exceeds \$11.3 billion. Abu Dhabi, Dubai and Sharjah are the main three cities in the UAE that are currently attracting more air traffic passengers due to the development of their airports’ capacity to cater for the demand.

Table (2) UAE’s Airports (O’Connell 2011; Kardes et al. 2013; Rizzo 2014; Asif 2015; Deloitte 2015).

Airport	City	Size	Scope	Cost (\$ Billion)
---------	------	------	-------	-------------------

Al-Maktoum International Airport	Dubai	Mega	New Terminals and Runways	32
Dubai International Airport	Dubai	Mega	New Concourses and Terminals	8.1
Abu Dhabi International Airport	Abu Dhabi	Mega	New Mid-Field Terminal and runway	3
Sharjah International Airport	Sharjah	Large	New Terminal and Runway	0.2

In particular, the city of Abu Dhabi decided to increase its airport capacity to reach 50 million passengers per year by 2020 by developing a new supersized terminal building, two mid-size terminals and a mid-field building between two runways. Dubai, on the other hand, has proposed the development of its current and new airports to reach more than 80 million passengers per year by 2020 by developing a mega terminal and the associated concourses for passengers, as well as a whole new airport, called the Al-Maktoum International Airport (Murel & O’Connell 2011; Gupta et al. 2014; Asif 2015).

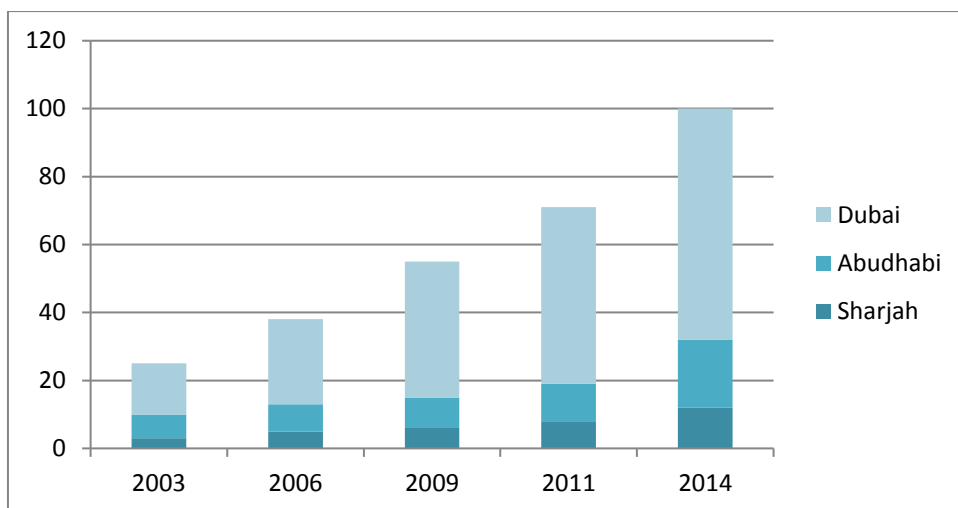


Figure (7) Regional distribution of UAE passengers (Millions) (CAPA 2015).

This research will focus on the UAE's three major airports Dubai, Abu-Dhabi and Sharjah that experience the most of the passenger traffic in the country, as shown in **Figure (7)**. All of the major airports are undergoing massive developments plans that require not only highly qualified project management skills but also customer services and care after the completion of the project. Currently, major airports in the region are competing for the best customer care and facility operations to be able to attract airlines and organisations to set up their operations, choosing them as the preferred hub for their passengers. One of the major factors influencing the aviation industry's strategy is customer service and safety (Gupta et al. 2014), and failure to address these two major components of operations and safety will lead to the worst case, overall project failure.

As airports are considered to be the transfer hub or final destinations of tourist and travellers to the country, this combined with the fierce competition among airports in the region indicates that airport service quality should be a top priority of the government (Sarkis 2000; Gupta et al. 2014). To ensure economic sustainability, airport infrastructure projects should impact the tourists' perceptions of the airport as a facility, as well as services should be provided to minimise travel time and to provide an enjoyable experience (Gil et al. 2012).

Sarkis (2000) has noted that most of the literature on airports projects focuses on the technical aspects of airport developments such as design, planning, and construction, which represents project management performance and thus, fails to investigate other aspects, such as operational efficiencies of the airports, where It has a direct impact on the passengers and other tenants if it is not performing well. These do not consider the impact of the operational readiness factors on the success of such complex multi-stakeholder airport projects.

Toor and Ogunlana (2010) investigated the perceptions of the key performance indicators (KPIs) in the context of a large construction project in Thailand, the Second Bangkok International Airport (SBIA) or Suvarnabhumi Airport. The authors selected this airport as their case of study for an infrastructure project based on the multi-stakeholders that are involved in this project including the government, which is keen to ensure future strategic business. The project was large in size and budget, and was also hit by excessive delays.

This is the gap identified in the literature that this research study intends to address the absence of operational readiness factors that could provide an assurance of the operational efficiency of airport projects in UAE from the first day of operation and eliminate financial and reputational disasters.

2.2.2.1 Customer Satisfactions and Services in UAE Airports

Customer's satisfactions and services in UAE airports have received attention from academics and practitioners (Taliah 2007; Arif et al. 2013; Gupta et al. 2014); different customer service models have been analysed to compare service quality from the customer's perspective in the three airports. While scholars (Taliah 2007; Arif et al. 2013; Gupta et al. 2014) measured the current service level, they did not investigate or measure airport management's preparations to provide such services. Also, it should be noted that in airport projects, many users need to be satisfied in order to be able to deliver top quality service to the final users. Some of the customers include government authorities at the airport such as police, customs and immigration, which requires the airport authorities to build areas specifically for their use, as well as provide them with adequate facilities to serve passengers with excellent services. The airlines are also considered to be airport customers, and they as well need to be satisfied first in order to be able to deliver the best

customer quality services. Finally, if all these different groups of customers are satisfied, then the airport can achieve excellent services for their ultimate customers, the passengers, from the first day of operations. However, studies found that many operational readiness elements from different airport operational organisations required attention from both airport project teams and airport operations management.

2.2.2.2 Recent Examples of Operational Readiness Failures in Airport Projects

In this section, recent large international airport projects will be analysed and discussed, with reference to cases of failures during initial operational start-up steps that have resulted in a financial and reputational loss to the governments and other stakeholders. Similar to and as adopted by other authorities who had studied the earlier snafus and start-up problems at other airports and were determined to avoid similar start-up problems, according to (Quilty 2003), the results of the examples of the real projects will be used as the seeds for the factors affecting smooth start-up and efficient operations. Furthermore, these findings will be later used to identify the contributing factors of operational readiness, which shall be the focus of this present study.

Over the last years, many cases of airport start-up operational failures have been recorded at major international airports as shown in **Table (3)**, where the development of the airport has cost the governments more than \$1 billion dollars (Kovaka & Fiori 2005), classifying these developments of airport projects as large infrastructure projects.

Table (3) Example of International Airports with start-up problems.

Airport	Cost (US Dollars)	Year of Operations	Operational Problems on Day 1
Indira Gandhi International, Delhi- India	\$2.6 Billion	2010	No
Heathrow-Terminal 5, London-UK	\$6.4 Billion	2008	Yes
Madrid Barajas International, Madrid -Spain	\$8 Billion	2006	No
Suvarnabhumi Airport, Bangkok-Thailand	\$3.9 Billion	2006	Yes
Toronto Pearson International, Toronto-Canada	\$2.7 Billion	2004	No
Chek Lap Kok Airport, Honk Kong	\$20 Billion	1998	Yes
Kansai International, Osaka-Japan	\$19.9 Billion	1994	No
Denver Airport, Denver-USA	\$5 Billion	1994	Yes

Learning the causes of primary operational challenges in large infrastructure projects (Al-bidaiwi et al. 2012; Heinemann & Killcross 2012; Winch & Leiringer 2015) and specifically airports (Croes 2007; Committee 2008), the start of operations failure should enhance the understanding of the difficulties and risk experienced by these airports. As such, plans can be drawn up to avoid this scenario in future airport projects by identifying critical operational readiness elements and factors and ensuring their readiness and availability before starting newly constructed airport facility's operations. Airports such as Denver, Chek Lap Kok, Suvarnabhumi and Heathrow-Terminal 5 will be discussed in the proceeding sub-section.

I. Denver Airport

In February 1995, Denver International Airport (DIA) opened for operations as the largest airport in the USA, costing more than US \$4 billion and represents the largest public works facility in the state of Colorado (Szyliowicz & Goetz 1995; Prather 1998). The original date of opening was set for October 1993, but this was postponed several times due to constant failures in testing the baggage handling system (Neufville 1994). The newly designed and constructed baggage handling system (BHS) was to be the largest and most sophisticated system in the world, moving 700 bags per minute, with a speed of 24 miles per hour (Szyliowicz & Goetz 1995). DIA represented a complex project that required a different scale of planning and implementation strategies (Szyliowicz & Goetz 1997; Prather 1998). Multiple organisations including airlines, Congress, county and city councils, among others, were involved in the decision-making process of the projects, which add another scale of complexity (Szyliowicz & Goetz 1995). Repeated delays in the completion and delivery of DIA in addition to the higher than expected cost overrun meant that it was perceived as a failed project (Zwikael & Globerson 2006). In summary, a number of lessons can be learnt regarding the construction of this airport's infrastructure:

1. The system of accountability was complicated.
2. The newly BHS system failed to operate initially.
3. Trial runs for the newly constructed facility, and systems should be conducted successfully before real operations.
4. Stakeholders' commitments and actual participation are essential not only to the timely delivery of the project but also to help and assist in its operations.

II. Chek Lap Kok Airport

Hong Kong's newly constructed airport began its operations on 6 July 1998. However, this event has turned into an international embarrassment rather than a pride for the country (Lee 2000), the airport was meant to be a major milestone for the new government, but chaos erupted in the both cargo and passenger operations of the airport from the first day; this was caused by major IT system failures (Flyvbjerg & Budzier 2011). At that time, Hong Kong's airport was considered the largest infrastructure project in the world, taking seven years to complete and with the government spending \$20 billion to construct the airport and its all-round services (Lee 2000).

The failure in the airport start-up operations completely halted the cargo operations for two months and caused the government a decline in the yearly GDP of about 0.22% (Lee 2000). Therefore, it can be noted that the financial impact of such failure in large infrastructure projects covers a broad range of stakeholders inclusive of government entities and private-sector investors. While new technologies were developed, and used in this airport, it was not tested properly. As a consequence, it malfunctioned and failed on the first day of operation and this caused major delays to flights, as well as loss of business for cargo due to the wastage of perishable goods and delays in deliveries and shipments (Human Rights Council 2015).

An operational readiness program was introduced late in the project to help assist with airport readiness, but views and reports of the operation readiness team were not taken seriously by the decision-makers of the airport (Lee 2000). The team raised serious concerns over system integrations testing and staff training of newly developed IT software.

The investigation reports also showed a series of delays in software development and installation, as well as repeated failures in trial runs. Findings from the investigating reports also indicated problems regarding the coordination and communication between the project's major stakeholders; these included the project managers, suppliers of the IT systems, and the operations team. In summary, the following lessons can be learnt from this case study:

1. The system of accountability was complicated.
2. The newly installed Information and Communications Technology (ICT) system failed to operate from day one in both passenger and cargo operations.
3. The airport did not seem fully prepared to operate.
4. Airport passengers and cargo operations cannot withstand any delays.
5. Operation, readiness plan and assessment should be introduced early in the projects.
6. New software to be used in operations should have enough time for testing and training of operations staff.
7. Trial runs for the newly constructed facility, and systems should be conducted successfully before real operations.
8. Rich and effective communication is essential among critical stakeholders not only for the successful delivery of the project but also for operating it.
9. Stakeholder's commitments and actual participation are important not only for the timely delivery of the project but also to help and assist in its operations.

III. Suvarnabhumi Airport

Bangkok's new airport (Suvarnabhumi) was opened for commercial operations on 28 September 2006, with an ultimate capacity of 45 million passengers per year (Croes 2007). Suvarnabhumi Airport cost more than US \$3.9 billion to support the growing economy of Bangkok and provide optimum passenger and cargo capacities to the city. The new airport's operational problems started to surface from the first day of opening with more than 100 cracks found on the airfield, as well as there were inadequate toilets and facilities. In the first days of operations, airlines started to complain about passenger visual guidance such as signage, the number and hygiene of toilets facilities, and lack of phone connections.

The baggage handling system created problems on the first day of operations when baggage was delayed for hours resulting in passengers having to wait hours before getting their baggage. Additionally, flaws in the new Information Technology (IT) system also caused many passenger and cargo flight delays, which led to confusion among the passengers (Lehmann 2016). Other contributing factors to the problems of the new airport included unclear documentations and processes, and the lack of experienced staff, both of which played a contributing role in the existing problems of the systems and resulted in unhappy customers and destroyed perishable cargo shipments (Croes 2007). In summary, the following lessons can be learnt from this case study:

1. Passenger's facilities and signage should be tested before operations.
2. A new and critical system such as BHS should undergo more operational testing and trials before airport opening.
3. Staff competency in the processes of the work should be tested before operations.

4. All documents and processes of the airport relating to different scenarios should be tested, and trials including the handling of situations of IT system failure should be carried out.

IV. Heathrow Terminal-5 Airport

Heathrow Airport Terminal-5 (T5) was opened in March 2008 for commercial operations and was considered one of the largest and complex construction projects in Europe (Potts 2008). T5 was designed to add 50% capacity to the current operating airport, which struggled for 46 months to secure approval to construct the new terminal (Potts 2008). T5 was large and cost more than 4.3 billion British Pounds; this includes the actual building along with all supporting internal and external transportation facilities (Alderman & Ivory 2011). Before the official opening, British Airports Authorities (BAA) and British Airways (BA) joined forces three years prior to the start of the operations to ensure that systems, people, and processes were ready to operate the newly completed facility (Committee 2008).

Regardless of the many previous studies conducted by BAA on past airport projects and problems related to opening, T5 was no different as on day one, the airport experienced multiple problems causing 20,000 bags to be misplaced and more than 500 flights to be cancelled, incurring costs of around US \$31 million (Davies et al. 2009). Based on the government investigation committee's report about the root cause of the problem, they found that the issues and problems faced in the opening could have been avoided by, "*better preparation and more effective joint working*" (Committee 2008, p. 6) between BAA and BA. Another major cause of the problems for T5 was inadequate training and familiarisation for the staff regarding the facility and the baggage handling system

(Committee 2008). The team had conducted simulated operational trials for a period of six months to ensure that all elements of the projects were ready to operate; unfortunately, although the trials identified improvements to the operational procedure and facility, they were still not able to ensure successful opening (Committee 2008; Hammond et al. 2008; Davies & Gann 2009; Gil & Baldwin 2014). In summary, the following lessons can be learnt from this case study:

1. The first day of operation is critical, and all should be ready for it.
2. Joint working between operational parties and project teams should be strongly encouraged.
3. Staff training and familiarisation with the facility and its critical operational systems are essential for successful and efficient operations from day one.
4. Simulated operational trials should be extensive enough to cover all aspects and scenarios of an actual operational day.

In summary, although large airport projects are completed successfully, their failure to operate successfully from day one was as a consequence of problems with the new ICT or new airport systems (Flyvbjerg 2009), as well as the lack of training in competency skills given to airport staff. Despite the rich body of literature on airport projects and planning, examples of failed projects are still evident, which motivates one of the potential outcomes of this study to construct a model that could help governments successfully run their airport operations from day one.

Furthermore, a list of initial operational factors have been extracted from the published research papers on Denver Airport (Szyliowicz & Goetz 1995; Cicmil & Hodgson 2006;

Committee 2008), Chek Lap Kok Airport (Lee 2000; Flyvbjerg et al. 2003; Flyvbjerg 2007b; 2009; 2014; Flyvbjerg & Budzier 2011), Suvarnabhumi Airport (Croes 2007) and Heathrow Terminal-5 Airport (Committee 2008; Potts 2008; Davies & Gann 2009; Brady & Davies 2010) and listed in **Table (4)**. The table illustrates the examples of factors and elements of operational readiness in real airport situations that involve operational failure after project completion, which could have been avoided by implementing the recommended elements and factors of operational readiness.

Table (4) Operational readiness’s items extracted from airports faced with start-up problems.

Operational Readiness elements	Denver Airport	Chek Lap Kok Airport	Suvarnabhumi Airport	Heathrow Terminal 5 Airport
Training and Familiarisation of the operational team		✓	✓	✓
Airport facility readiness		✓	✓	✓
Critical system readiness	✓	✓	✓	✓
Operational trials and simulation of the new facilities and systems	✓	✓	✓	✓
Stakeholder’s Commitment	✓	✓		✓
Stakeholder’s Participations	✓	✓		
Effective communication to stakeholders		✓		
Drafting new processes of operations and maintenance for the new facility and systems			✓	✓

Above examples of the operational readiness factors and elements extracted from other airports, which faced problems in the first days of operations, will be used as the initial list to gather all the operational readiness elements for airport projects; this will form the framework for the operational readiness factors for this study. In addition to the discussed airport's operational challenges, more challenges are also present in the constructions of large infrastructure project such as airport, which will be discussed in the next section.

Commissioning and Transfer to Operations Challenges

The literature on a project's commissioning is relatively sparse in comparison to all other areas of the project management field (Dvir 2005; Lawry & Pons 2013). This makes it difficult to find previous studies on effective project commissioning. Even though the commissioning process is the last phase of the project life cycle, it plays a vital role in the success of the project (De 2001; 2005; Khan & Kajko-Mattsson 2010; Al-bidaiwi et al. 2012). Furthermore, it is complicated and requires proper planning and budgeting, just like any other phase of the project (Dvir 2005; Gardiner 2005; Al-bidaiwi et al. 2012; Nossair et al. 2012). Early project termination could happen at any point in the project lifecycle due to a range of reasons, including insufficient funds, change in clients, political disturbances or natural disasters. However, this study focuses on a project commissioning process that follows the completion of the construction of the product/asset.

A project commissioning process can lead to time and cost overrun if it is not managed efficiently and if its risk is not reduced by the project manager; these are among the other issues (Khan & Kajko-Mattsson 2010; Al-bidaiwi et al. 2012; Whyte et al. 2012; Schultz et al. 2014) identified by De (2001) in his research on Indian projects. The study shows that conducting insufficient tests of a project's assets before operations can lead to real

defects and safety risks during the start-up of the asset. It is not only vital for the project's contractor or builder to commission quickly. It is also important for the asset owners and the client, as a faster project commissioning will increase profitability and return on investment (De 2001; Al-Bidaiwi et al. 2012). Unplanned project commissioning is also identified (Belassi & Tukel 1996; Khan & Kajko-Mattsson 2010; BRITO et al. 2015) as one of the main reasons for project failure, which has previously been confirmed by Dvir (2005) who observed a correlation between the preparation and planning of proper commissioning of the project, and project success.

According to Tribe and Johnson (2008), project management literature includes little on the commissioning of projects, and there have been few who have identified the need to plan, prepare and ensure the effective commissioning and start-up of large capital projects. These authors have suggested a plan for commissioning a capital project that should make sure a smooth start-up and successful delivery. However, no empirical evidence is yet available on the scheme or its effectiveness in reality. Regardless of the number of research studies available on project commissioning, no study has yet discussed and linked planned project commissioning processes that involve the end-users of the asset/product delivered with project success. Early involvement of a construction project's users can improve the commissioning process, which in turn will have an impact on the project's overall success (Krauss 2014; Emerson 2014).

The final part of any project construction phase and the crucial merging point with the operations phase is the commissioning and transfer of the asset (Lawry & Pons 2013; Zerjav et al. 2014; Brito et al. 2015). However, this process will be affected by decisions that have been taken a right from the very start of the planning phase, and many challenges need to be resolved to ensure the smooth transfer of an asset from the construction phase

to operations. Too often, assets have not performed to their designed potential due to changes in the construction process or complications in the commissioning phase, and improvements in information flow (Nossair et al. 2012). Collaborative working practices and defined commissioning (Kärnä et al. 2009), reduction in construction and design defects (Schultz et al. 2014), and early involvements of operational members of the assets (Zidane et al. 2015), are key factors in a successful commissioning process. These enabling factors, which have been extracted from the literature, will be briefly discussed.

2.2.2.3 Project Data Accuracy and Completeness

When transferring a completed asset from the project team to operations, the project team faces the challenges of firstly, ensuring data accuracy and completeness at the end of the project; and secondly, keeping data up-to-date for use in operations (Whyte et al. 2012). In the oil and gas industry, Nossair et al. (2012) highlighted the importance of maintenance strategies and plans, which will require complete and accurate data to support maintenance activities. The proper maintenance strategy will ensure maximum safety, reliability, and availability of the equipment and systems at a minimal overall cost. To overcome this challenge of providing the most updated and useful information, Ibrahim (2011) recommended the use of integrated management systems, such as Building Information Management (BIM) as it will play an important role in delivering large infrastructure projects.

2.2.2.4 Inefficient Commissioning

The commissioning process does not only refer to the transfer of documents and assets but also to a complete and approved process that will ensure the accuracy and satisfaction of the client (Whyte et al. 2012; Lawry & Pons 2013). One of the critical factors impacting

the customer satisfaction level is the inadequacy in the commissioning process in the closing stage (Kärnä et al. 2009). To address this, Kärnä et al. (2009) recommended that project-related commissioning processes be thoroughly planned and developed with a clear vision, as well as a knowledgeable team to handle the process. Nossair et al. (2012) linked a successful and steady state operation in critical projects of the oil and gas industry to a clear definition of the requirements, principles and responsibilities of the commissioning team during the closing stage of the project; notwithstanding the importance of the critical involvements of operations and maintenance teams during the commissioning processes. Availability of competent manpower to handle and receive completed assets during the handing-over process is essential according to Lesmana et al. (2014), who also correlated such competency of the operations team with the smooth transition from projects to operations.

2.2.2.5 Unresolved Constructions (Defects) and Contractual Issues

Defects in construction have attracted much attention from both the practice and academia. The number and quality of the defects identified before handing over the construction project to the client will severely impact its delivery and take over by the customer (Schultz et al. 2014). Al-bidaiwi et al. (2012) have recognised that the early identification and resolution of issues at the appropriate stages of each project will result in the smooth commissioning of the facilities. These construction defects management still poses challenges to the smooth handover of the completed projects to its operating team regardless of the several quality control mechanisms implemented such as flowcharts, inspection that is recognised by The Project Management Institute (2013). These tools once utilise, will help in preventing major defects, as well as in the smoothing out the commissioning process to clients.

2.2.2.6 Early Involvement of Operations Team (Asset Owner)

The lack of the operator's/user's presence in all project phases, except the commissioning and operating phase, results in missing critical knowledge and information about what should be delivered. Therefore, it is required to include them in the early project phases and continue to do so until the last phase, as this will smooth the final handing over steps (Zidane et al. 2015). Early involvement of operations and maintenance teams throughout the project's lifecycle is essential for providing the needed comfort and confidence for them to take over the facility. Al-bidaiwi et al. (2012) have acknowledged the participation in initial punch listing from operations during construction activities, which resulted in saving time in the implementation of corrective actions. As such, the operations teams were more comfortable in taking over the facility since they were involved right from the start of the project. Nossair et al. (2012) implemented an integrated readiness model, which maximise operational efficiency and ensures excellence through the integration of functional teams. In their study, a task force was formed among the company business units and divisions to work jointly with project teams throughout the project lifecycle, and this improved the commissioning of the asset to the operations.

Four major challenges have been identified from the academic and industry literature as shown in **Table (3)** where: the first challenge appears to project data accuracy and completeness; the second challenge was inefficient commissioning process; the third challenge was unresolved construction and contractual issues; and the last challenge was the early involvement of the operational asset team. At the end of this section, we note here the discussion of the large infrastructure projects with its characteristics and challenges along with the discussion of the airport projects and useful information gathered from

previously failed airports; the proceeding section will discuss operations and project management in details.

2.3 Project Success

Project success is the ultimate goal for any project manager or organisation, however; its definition is still considered ambiguous among project and construction professionals (Salleh 2009) and academics (Ika 2009). Project success in large infrastructure projects has a significant impact on the local community, as well as on the project's operations. These impacts on the society and lives of people involved in these large projects can either be negative or positive. In this regard, Dunović et al. (2014) suggested new and unique management approaches applicable to the specific characteristics of projects of a significant size and complexity. These suggested approaches are valid only during the project implementation phases and have not yet taken into consideration management's approaches to prepare the project and start it under more positive conditions.

It is important to recognise the difference between the success of a project and the success of project management skills. The latter will help to improve project success but cannot prevent project failure (De Wit 1988). Regardless of how good the project managers and their teams are, other factors play important roles in determining project success, such as stakeholder satisfaction and project financial returns. This study recognises the end-user participation and preparation processes that might have an impact on the success of infrastructure construction projects through their early participation and operational readiness to operate the final asset. A number of studies have been carried out in the last four decades to evaluate and identify critical success factors to improve project outcomes in building construction project management (Salleh 2009). Hence, refer to Figure (8) for the

building project success factors presented by Al-Tmeemy et al. (2011), which includes product success criteria and market success, along with the traditional project management success criteria.

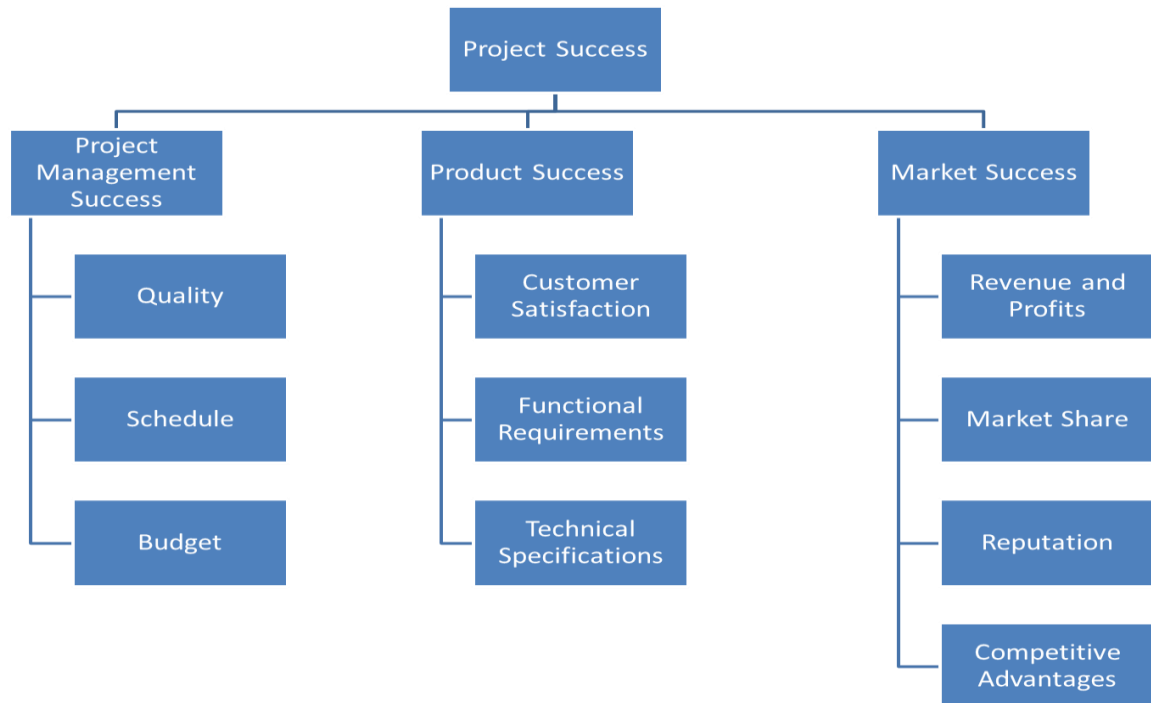


Figure (8) Building projects success factors (Al-Tmeemy et al. 2011).

Samset and Volden (2015) have considered two major performance factors for large public project success; these are *tactical* performance and *strategic* performance. Tactical performance relates to short-term project management performance targets such as cost, time and quality, while strategic performance includes a long-term and broader performance, such as relevance, sustainability and effectiveness. Strategic performance is considered essential elements of the projects are starting from the operational phase and continuing to the end of the project life cycle.

Furthermore, for the purposes of this research, the *airport project* will be considered as the case-study building construction project where the available measurement items for project success provided by (Bryde 2008) demonstrated in **Table (5)** will be adopted.

Table (5) Items to Measure Project Success (Bryde 2008, p. 804).

Item		Theoretical basis (link to literature)
1	Generally, our projects meet their time objectives	Iron Triangle, short-term perspective, project management success, task- orientated, objective measure
2	We are usually good at delivering projects within budget	Iron Triangle, short-term perspective, project management success, task- orientated, objective measure
3	Our projects usually result in tangible benefits for the organisation	Long-term perspective, project success, subjective measure
4	Generally, customers of our projects are satisfied with the outcome	Long-term perspective, project success, psycho-social orientated, subjective measure
5	Project specifications are usually met by the time of hand-over	Iron Triangle, short-term perspective, project management success, task- orientated, objective measure
6	Our key stakeholders are usually happy with the way our projects are managed.	Project management success, psycho-social orientated, subjective measure
7	Project team members are usually happy working on projects	Project management success, psycho-social orientated, subjective measure
8	There are often clearly identified intangible benefits from the projects we carry out	Long-term perspective, project success

9	End users are usually happy with the results from our projects	Long-term perspective, project success, psycho-social orientated, subjective measure
10	We usually employ an effective project management process	Project management success, subjective measure
11	Overall, we are very successful at projects	Project management and project success

As discussed earlier, three main success criteria for airports project success emerged from the literature smooth start-up, stakeholder's satisfactions and returned on investment. While we note that items in **Table (5)** cover the three criteria, it is worth discussing them in details in the coming sub-sections.

2.3.1 Smooth Start-Ups

A smoother start-up of the project's final products and assets means a smoother transition from the construction of the project to full operations capacity. In addition, as the extended project life cycle shows cascading stages of the commissioning and operations of the project, the success criteria of the commissioning stages can be considered to be the success factors of the operations stage (Carlos & Khang 2009). Morris (1989) stated that smooth start-ups are rare in construction projects due to difficulties in interfacing between the stakeholders of the project and operational teams. It may be postulated that a state of operational readiness between the two stages might reduce the interface difficulties and improve the project operational start-up phase. Nianti et al. (2009) correlated knowledge management and project transfer to the smooth transitions of the project phases. Considering the last stage of the project, if the knowledge of the project team members is not transferred properly, the start-up of the project will not be smooth and new problems that operation teams may not be aware of or experienced in, may arise. According to Al-

bidaiwi et al. (2012), a project's success is not only represented by time, cost and quality but also on adequate safety implementation, reliability and operational flexibility. A project will never be considered successfully handed over if any safety or operational constraints impact its start-up.

2.3.2 Stakeholder Satisfaction

Li et al. (2013) have defined stakeholder satisfaction as, “*the achievement of stakeholders' pre-project expectations in the actual performance of each project stage*” (Li et al. 2013, p. 124). This definition has been constructed based on the project life cycle and not the extended life cycle. However, if the same definition for project operational phase is used, then pre-operational expectations of different stakeholders in the project must also be examined. In the operational phase, projects conditions may satisfy one stakeholder but dissatisfy another, and this is dependent on the expectations and project outcomes. In relation to information technology projects, McKeen et al. (1994) have confirmed the improvement of user satisfaction through user participation and involvement in the project. The construction industry is known for the lack of performance and dissatisfaction to the industry's stakeholders; however, over time, other tools have been developed and introduced to measure other soft aspects of project success (Kärnä, Manninen, Junnonen, & Nenonen 2011). A specific case in the construction industry was discussed by Carù et al. (2004) with regards to achieving project success by having a rescue team to resolve all customer problems and thus, ensure customer satisfaction. Empirical evidence from Collins and Baccarini (2004) shows that the owner's satisfaction is the ultimate goal of the project managers surveyed and that all other success is just subordinate to that measure. This research also discusses an addition to the stakeholder the-

ory, namely, that the project's owner/sponsor is more significant than any other stakeholder in the project and that preparation and readiness for the project's operation will definitely have an impact on the overall success of the project.

2.3.3 Return on Investment (ROI)

This research focuses more on project success orientation and factors rather than on project management success. Return on investment is one of the critical long-term elements of project success (Munns & Bjeirmi 1996), and it has been recognised as a dependent variable in many studies, in addition to being a critical measurable criterion for project success (Müller 2012). In this study, ROI is also considered as part of the dependent variable items in the suggested conceptual framework. Tribe and Johnson (2008) have discussed the importance of having a fast rate of ROI on capital projects; from the time the project starts to fully operational production. The authors have suggested many recommendations to achieve successful delivery of the project in a short timeframe and reduce the time for the maximum rate of return on investment. Operational readiness should help to reduce the time between the start and full operating capability level in large infrastructure projects and speed up the rate of ROI in a way that will satisfy the owner, as well as other related stakeholders and thus, contribute to project success.

2.4 Summary

This chapter has addressed *infrastructure projects, construction challenges, and commissioning to operations challenges*, which are relevant areas of this research. First, a thorough and detailed articulation and description of infrastructure projects, definition, types and characteristics were provided. Airports projects that are considered large infrastructure projects are discussed in detail, drawing on previous examples of operating the new

constructions of large airports by describing and listing all operational problems and troubles that occurred during the opening and starting up of the airport. Second, discussions and detailed explorations of construction challenges were evaluated. Such challenges have been identified and listed, the impact of each one on the construction project has been described, and resolutions for each challenge based on the current literature have been suggested. Next, challenges involved in handing over of the operations were explored in detail showing the impacts of poor commissioning on the asset and the stakeholders. A list of challenges was identified, which included accuracy of project data, an inefficient commissioning process, construction defects, and early stakeholder involvement.

This chapter has also, addressed operations management and project management, which are relevant areas of this research. Firstly, definitions and a historical review of operations management were presented to explain how the developments in this field have emerged and where they are going. Secondly, project and project management definitions, project life cycle, and project success elements were explored in detailed on large infrastructure projects. Finally, discussions on the relationship between operations management and project management were also presented to understand the needs of the project management team not only to build the project but also to support the organisations to prepare for the operations during project construction time.

Chapter 3

Operational Readiness and the Development of a Conceptual Framework

3.1 Introduction

This chapter provides a detailed and systematic review of operational readiness as a concept where it will be articulated from project management different sources. Then definitions of the operational readiness from available sources in academia and industry will be presented. Furthermore, identifications of key components and items from available frameworks and models in the literature will provide the basis for the final operational readiness items of this study. Selected item will be further categorised into their respected factors and finally, operational readiness framework will be developed at the end of this chapter.

A review of the literature on the importance of stakeholder's participation in the early stages and before project completion is also presented in detail. The importance of this section lies in its exploration of the existing literature of operational readiness and the adaptation of the concept that is employed in this research study. It should also be noted that key components and elements of the operational readiness are the key factors that are measured and evaluated in this study.

3.2 Systematic Review of “Operational Readiness”

A systematic review of literature for operational readiness was undertaken by the author as it is a key research objective to harvest and manage the diversity of knowledge for this research specific academic inquiry (Tranfield et al. 2003). The use of the Tranfield et al.

(2003) approach for the systematic review of literature in the management discipline was adopted. Such approaches are distinguished from traditional reviews as it uses a replicable, scientific and transparent process. This approach of the systematic review of the literature utilises advanced technology to minimise biases; it covers the published, unpublished researches and documents the process taken by the researcher and conclusion.

This study drew from Geraldi et al. (2011), as to the use of a systematic review of project management research. This review differs from normal reviews by utilising a scientific process, which aims to minimise bias through comprehensive literature searches. The term ‘operational readiness’ is so broad and varied that such a review may result in missing valuable contributions from books, project management bodies of knowledge among others that are considered important for this study.

The systematic review was conducted initially using two databases Web of Science and SCOPUS with an initial keyword of “operational readiness”. The first journal article in these databases to meet this keyword criterion was published in 1958 (Heyne & Brotman 1958); hence, the time span of the search was from 1958 to 2016. There was no obvious intersection between the two databases of publications in Web of Science and SCOPUS. The results of the searches can be combined to provide a wider view of the subject area. This initial search resulted in 577 matches in SCOPUS and 649 in Web of Science. **Figure (9)** shows the distribution of the results over the period of 1961 to 2016, as well as illustrates a spike in the area of research from 2001 till 2016.

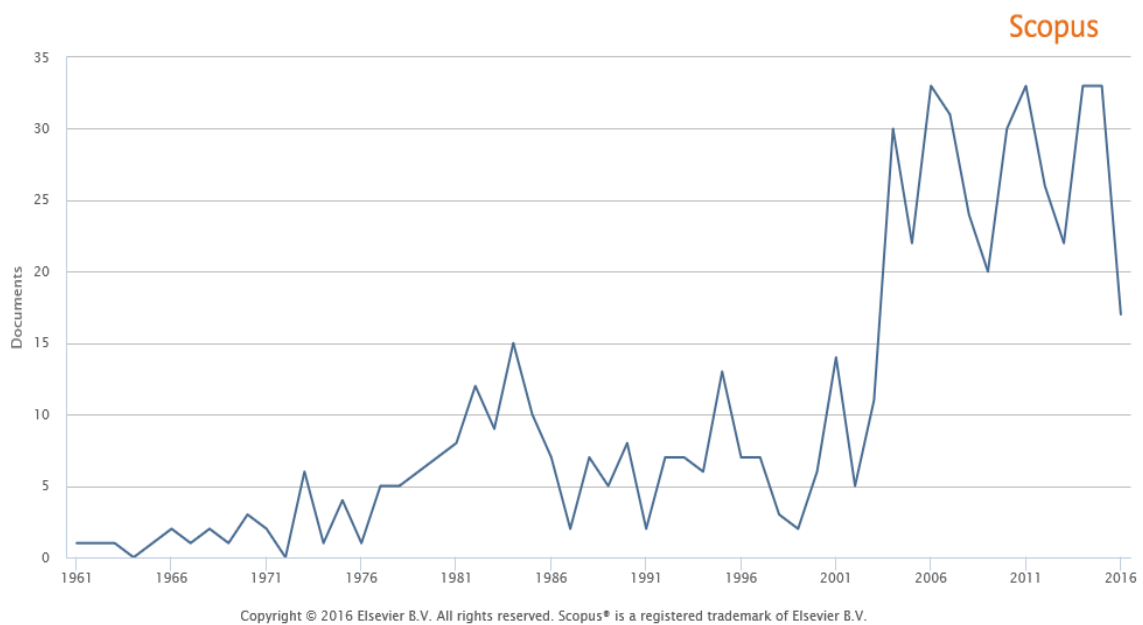


Figure (9) SCOPUS Search results of the term "operational readiness" per year.

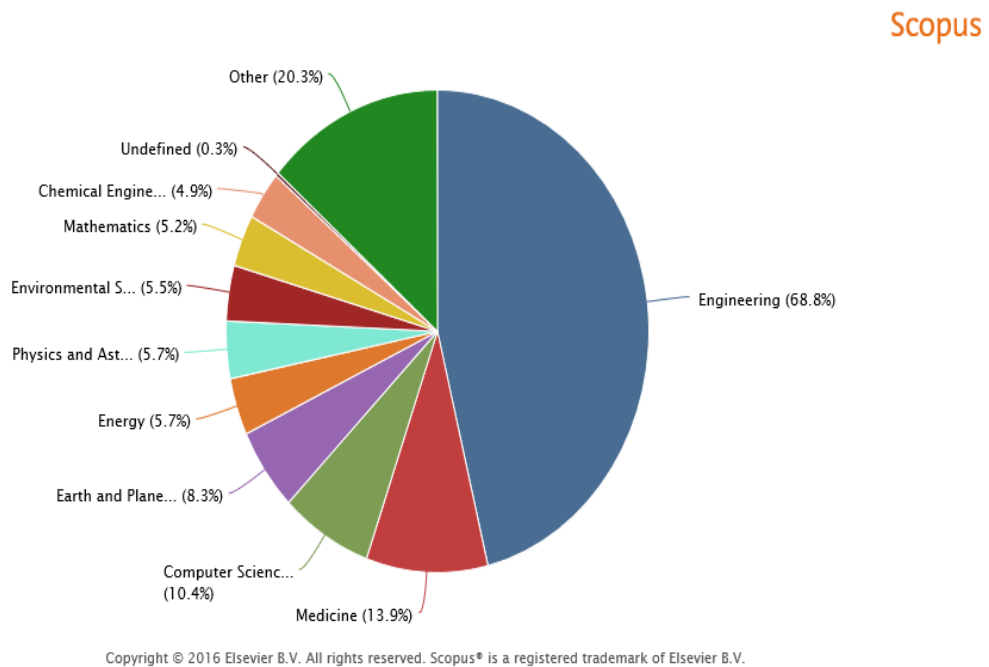


Figure (10) SCOPUS research results for the "operational readiness" per research area.

The results from SCOPUS has provided data regarding the areas of research for operational readiness, with 69% of it in the engineering field, 14% in the medicine field, 10.4%

in computer science and the remaining are distributed among other areas as shown in **Figure (10)**.

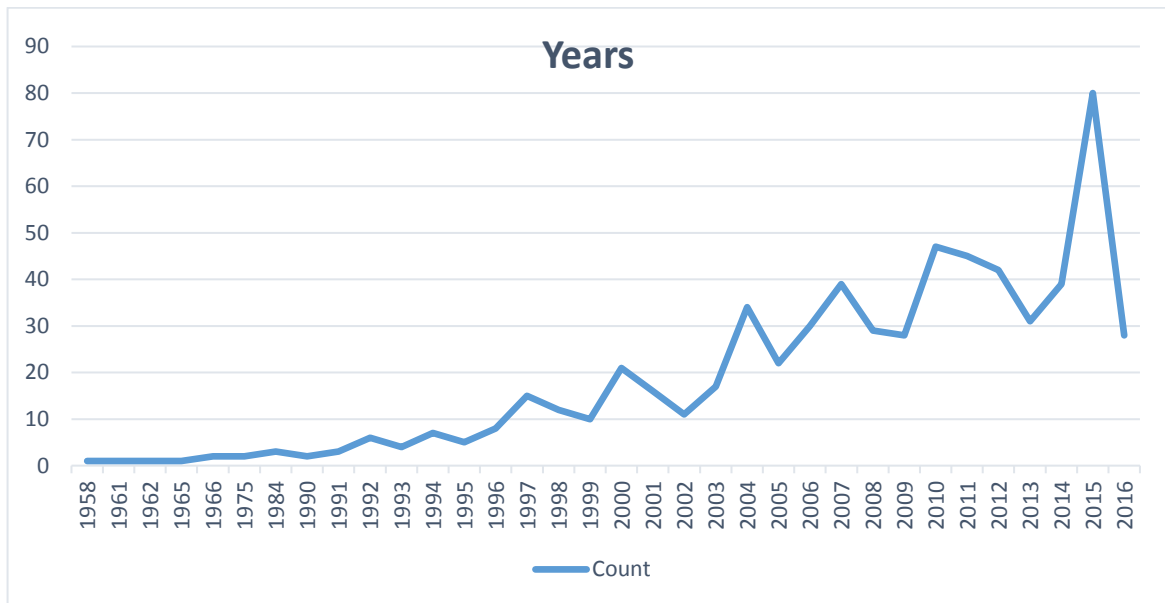


Figure (11) Web of Science search results of the term "operational readiness" per year.

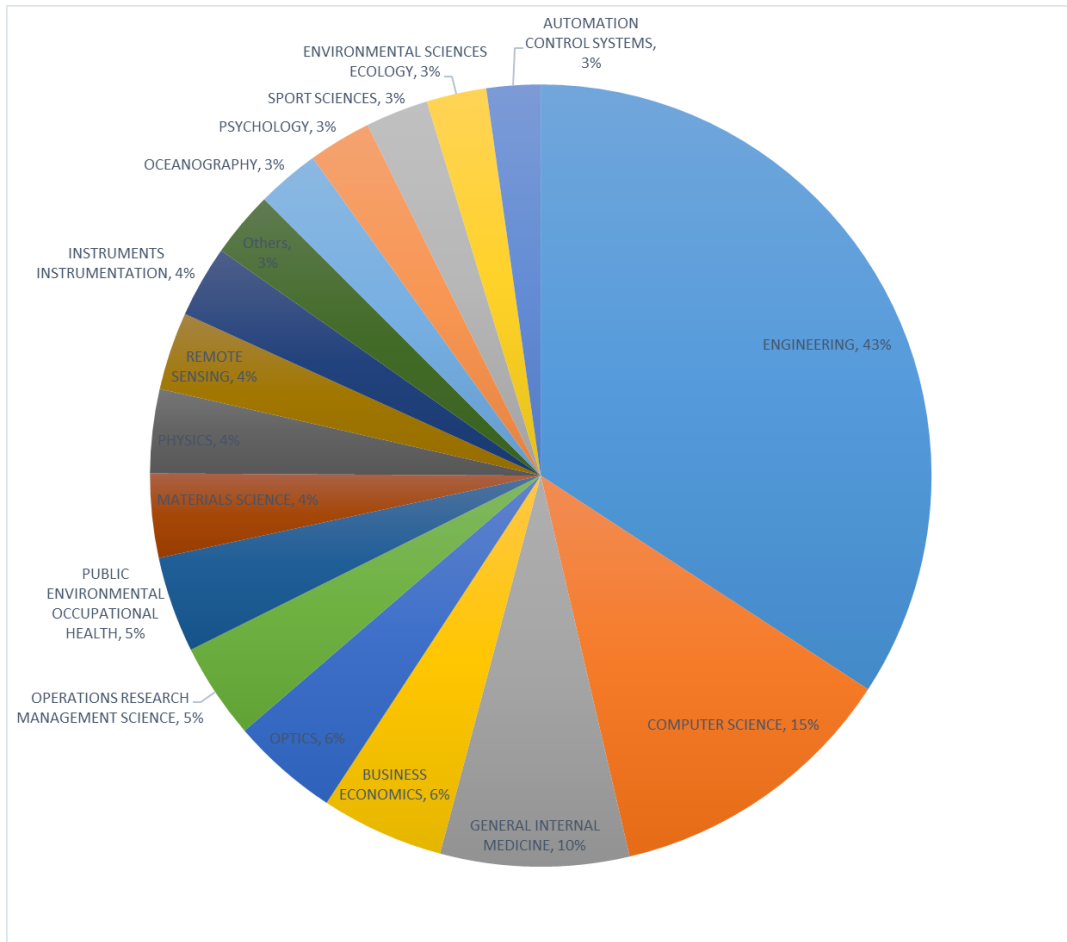


Figure (12) Web of Science research results for the "operational readiness" per research area.

The results from Web of Science was similar to SCUPOS, **Figure (11)** presented the results from 1958 to 2016 with a noticeable increase in publications from 2001 to 2016. The results from Web of Science on the type of publication has provided similar results to the one found in SCOPUS, where engineering field has 43%, computer science has 15%, medicine has 10%, and the remaining are distributed among other areas as shown in **Figure (12)**. It is to be noted here of the Web of Science results, 5% were found to be coming from operations research and management, while nothing was noted in SCOPUS.

Based on the results of **Figure (9)** and **Figure (11)**, academic interest in operational readiness is growing over time and increased rapidly from the year 2000. This growing interest can be explained by the increased infrastructures projects around the world that requires operational readiness to support it after construction.

The initial results from the two search engines were further refined using the six steps guidance adopted from Geraldi et al. (2011) as shown in **Table (6)**.

Six steps guidance adapted from (Geraldi et al. 2011, p. 970) used to refine the search selection:

- Step 1: *Identification of publications* - In this step, a general search using the keyword in both databases.
- Step 2: *Focus on academic papers* - In this step, we refined the search by focusing on academic papers and journals only in these two databases.
- Step 3: *Focus on operational readiness in projects* - In this step and based on the results obtained in step 2, the selection now is refined publications that are related to “operational readiness” and “projects”. Other publications were disregarded for not contributing to the discussion of operational readiness in projects, which has significantly, reduce the publications in this step to 17 articles.
- Step 4: *Checking completeness* - In this step, we ensure the completeness of sources by examining the references of the search results in step 3. This step will help in identifying any relevant studies or books that may have been missed by

the databases. This did not contribute to any further reduction or addition to the existing list.

- Step 5: *Focus on “operational readiness of building projects”* - The results were reduced to papers on operational readiness and preparing to transit the project from construction to operations. The output was reduced significantly in this step to four articles.
- Step 6: *Final filter*: in this step, we identified publication sources that provided a framework or explicit definition of operational readiness.

An overview of the results for the number of publications as refined by the six steps presented in **Table (6)**, where only 4 publications was found, therefore it is clear that “operational readiness” has a sparse presence in the publication in general and operations and project management in particular which we consider as a gap in the literature for this concept.

Table (6) Six steps search results of the terms.

Search Engines	Phrase	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
SCOPUS	“Operational Readiness” in the fields of Article, Title, Keywords, Abstract	577	263				
WEB OF SCIENCE	“Operational Readiness” in the fields of Article, Title, Keywords, Abstract	219	107				

The resulted four publications are briefly described:

1. **Airport Terminal Facility Activation Techniques Questionnaire** by (Lyons & Powell 2010). The publication is about capturing information about lessons learnt and successful practices from airport terminal facility openings from participants recently involved with activations of new airport terminal facilities, where many of the participants have led or participated in the activation of several other airport terminal facilities.
2. **NHS Ayrshire and Arran Patient Management System MSK Operational Readiness Questionnaire** by (NHS Ayrshire & Arran 2012). The publication was prepared by NHS Ayrshire and Arran, which is one of the fourteen regions of NHS in Scotland and provides health and social care to almost 400,000 people. The publication discusses a design to ensure that an organisation is operationally ready to use the newly developed patient management system; the design target seeks to ensure the relevant readiness of people and processes.
3. **The Software Support Qualitative Assessment Methodology Volume V Implementing the Operational Readiness Measure** by (Racine & Mitchell 1990). This publication was developed to measure operational readiness for an information system using questions. The objective of the questions was to help an organisation understand the operational readiness level and status of their IT system.
4. **Activation and Operational Planning: Ensuring a Successful Transition** by (Wilson et al. 2004). It provided a checklist for the operational readiness to ad-

dress the challenges faced by the hospital management in operating a newly developed facility into the existing hospital with no disturbance to the on-going business processes.

Also, it should be noted that the same process of the six steps identification has been applied to the three popular databases of project management articles: IJOP, PMJ, and IJOPM. The results did not provide any valuable data, which have led to the investigation of the operational readiness concept within the context of project management to be able to answer RQ1 of this research.

3.3 Operational Readiness Concept

To be able to define the concept of operational readiness in the context of this research, an articulation of the concept is investigated with current project management literature, followed by an investigation of the existing definitions of the concept in academic and industrial literature.

3.3.1 Articulation of Operational Readiness Concept in Operations and Project Management

Operational readiness has not been defined in any literature of project management nor operations management (Krauss 2014). This research focuses on the operational readiness concept and enabling factors in large infrastructure projects such as airports. To achieve this, an articulation of the operational readiness concept and scope has to be investigated in this section. A scope was outlined in **Figure (13)** for the concept exploration and articulation. In the outlined scope, a review is carried out on the papers published in highly

ranking operations and project management literature, rethinking project management agenda publications and project management bodies of knowledge.

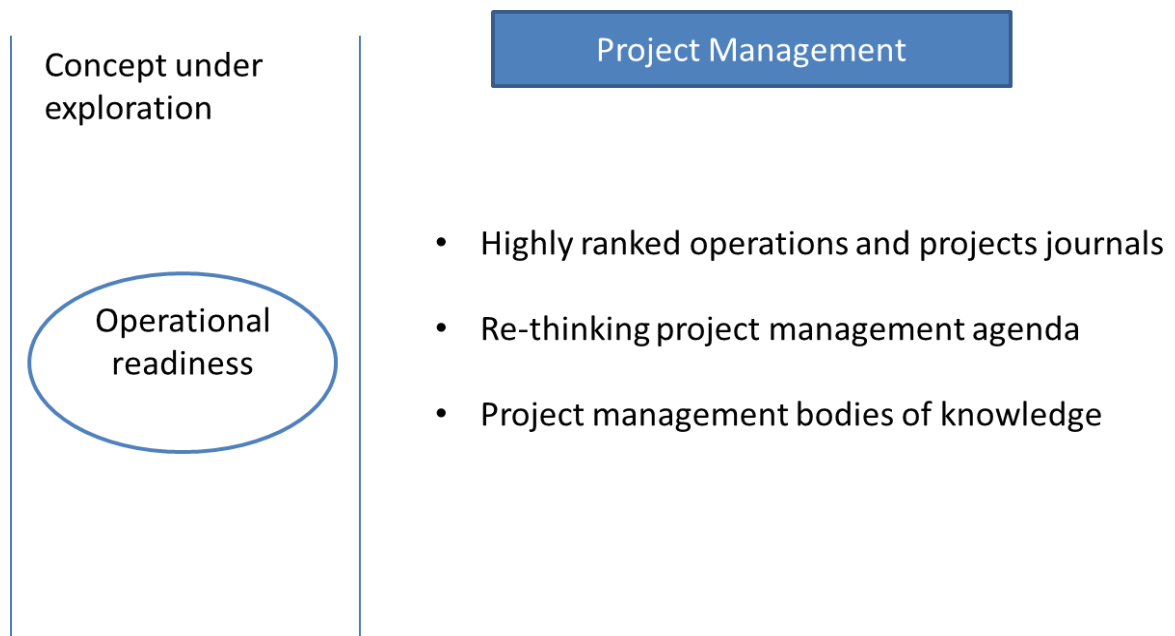


Figure (13) Outline the exploration of the operational readiness concept.

3.3.2 Review of the Top-Ranked Journals in the Field of Project and Operations Management

For this review, a selection of journals from top ranking journals in operations management and project management, recommended journals and relevant journals have been selected. Firstly, for the top ranking journals, we refer to Walker et al. (2015) who has identified the top three journals of POM, the IJOPM, and the JOM in the field of OM research topics, as well as Shah and Goldstein (2006) who ranked Management Science (MS), Operations Research (OR), Journal of Operations, Management (JOM), Decision Sciences (DS), and Journal of Production and Operations Management Society (POMS) as the top OM journals. Additionally, (Osei-Kyei & Chan 2015) have selected Journal of Construction Engineering and Management (JCEM), Construction Management and Economics (CME), International Journal of Project Management (IJPM), Journal of Management in Engineering (JME), Engineering, Construction and Architectural, Management (ECAM), which falls within the six top-ranked construction and project management journals. Secondly, for the recommended journals we refer to Thomé et al. (2015) who have selected the International Journal of Project Management (IJPM), Journal of the Operational Research Society (JORS) and IEEE Transactions on Engineering Management (IEEE-TEM) among other journals for their high publication in project management subjects. Thirdly, for the relevant journals for this study’s research topics, we selected Production Planning and Control Journal, and Manufacturing and Service Operations Management. A summary of the above journals is presented in **Table (7)**.

Table (7) Top-ranked, recommended and relevant journals reviewed for operational readiness.

Sr.	Top-ranked Journals
1	Management Science
2	Journal of Operations Management

3	Production Planning and Control
4	IEEE Transactions on Engineering Management
5	International Journal of Operations and Production Management
6	Production and Operations Management
7	Decision Sciences
8	Manufacturing & Service Operations Management
9	Journal of the Operational Research Society
10	International Journal of Project Management

A review of the extant literature (Rodrigues & Williams 1998; Weiss & Maher 2009; Brady & Davies 2010; Artto et al. 2015; Winch & Leiringer 2015) suggest that operational readiness within the context of operations and project management literature remains sparse. More specifically, Rodrigues and Williams (1998) did not directly define or use operational readiness but researched the influence of client behaviours. On the other hand, Weiss and Maher (2009) investigated operational hedging against severe uncertain events and future risks to normal operations. They provided a method on how operations policies can be utilised as a hedge against operational risks and how the organisation is affected by the supplier's behaviours.

Brady and Davies (2010) who have examined the case of Terminal 5 initial project failure in the start of the operations phase, did not specify any elements of operational readiness but analysed it via two theoretical lenses: *normal accident* theory and *high-reliability* theory. Others such as Artto et al. (2015) have conducted empirical research on adopting an operational network of organisations, that is, to connect all the operational organisations of that projects and integrate them socially, which is often considered a long process and takes place at the end of the project. They argued that having early or during the project

implementation will potentially improve the operations and yields substantial increases in the value created by its users.

Finally, this study notes the work of Winch and Leiringer (2015) who studied the concept and influence of a strong owner in infrastructure projects, and the effect of having strong owner capabilities that will deliver performance to project success. The researchers touched on the need for an asset integrator (who is the owner) to move the completed asset to beneficial use but did not discuss any approaches for that other than “asset integration”, which is mainly used in IT/IS, and Oil and Gas projects. In effect, we posit that operational readiness appears not to be a part of traditional project management literature. Traces of what appears to be a developing interest in operational readiness exists in some papers and in projects but does not explicitly frame and identify the concept of “operational readiness” as a core to project management; the search agenda was redirected to “Rethinking Project Management” (Winter et al. 2006).

3.3.3 Rethinking the Project Management Agenda

By reviewing the papers published for the agenda of “re-thinking project management”, we found that the agenda also calls for different approaches and perspectives on how to manage projects (Andersen 2015). Pinto and Winch (2015) stated that modern project managers should be equipped with more knowledge and greater competency not only to manage and control the execution phase of the project, but they also need to be engaged with and fully aware of the initial operational phases and its related processes.

Additionally, Cicmil et al. (2006) argued that there are sparse studies on the “actuality” of project-based working and management, as well as the practitioner’s lived experience

of projects. Furthermore, the same argument can be applied to this study, where the project manager should also fully participate in the final stage of the project, as well as the initial stage of the operational phase. Pinto and Winch added that “*project management is seen as not simply a delivery system, or technique-laden toolbox, but a partner with other managerial disciplines in developing the critical actions and interfaces, both internally and externally, that successful projects require*” (Pinto & Winch 2015, p. 4).

Winter et al. (2006, p. 650) presented the agenda for rethinking project management as stipulated by the UK Engineering and Physical Sciences Research Council (EPSRC) as:

1. *To create a new interdisciplinary network of academics, researchers and practitioners interested in developing the field of project management and improving real-world practice.*
2. *To define an interdisciplinary research agenda aimed at enriching and extending the field beyond its current foundations.*

By looking at the two points of the agenda, it can be observed that the main aim was to combine the findings of both academics from different institutions and industry practitioners of the project management field to improve the current processes, as well as understand the extending scope beyond the current PM foundations. Pinto and Winch (2015) also discussed the new elements of responsibility for the modern project manager extracted from a new framework introduced by the Morris Management of Projects (MoP), which states that the project manager should work on organisation’s human resources requirements to operate the constructed facility, such as recruitments and training. The “re-thinking project management” agenda, therefore, proposes a new shift in research to accommodate identified themes from practical experience (Cicmil et al. 2006) of project

and operations managers to provide new theories and knowledge that can be of interest to both practitioners and academics. A structural review of the “rethinking of project management” was conducted by Svejvig and Andersen (2015) who identified six overarching categories of the re-thinking of project management through the inductive analysis as shown in **Table (8)**.

Table (8) Six overarching categories identified by Svejvig and Andersen (2015, p. 283).

	Categorisation	Description
1	Contextualisation	Expanding the conception of the project to encompass elements. Such as the environment and organisational strategy
2	Social and political aspects	How social and political processes shape projects, e.g., power structures, emotionality and identities
3	Rethinking practice	Offering or suggesting alternative methods, perspectives and ways to rethink practice, e.g., through education or reflective practice
4	Complexity and uncertainty	Outlining the complexity of projects, their environment, and new methods to cope with complexity
5	The actuality of projects	Outlining the need to study how projects are carried out or empirical studies of the actuality of projects
6	Broader conceptualisation	Offering alternative perspectives on projects, project management and project success or outlining how the field is broadening beyond its current limits

This study adopts and utilises the “Broader Conceptualisation” category of “rethinking project management” agenda, where it is noted that recently published industry papers discuss a broader scope of the commissioning phase in large projects (Krauss 2014). Hickey (2008a) used the concept of operational readiness to not only commission projects but also to integrate them into the existing operational facilities. The intention was to broaden our understanding of what was going on in a real-time project from a practitioner’s point of view. The expanded conceptualisation should also cover the knowledge

considered useful in the day-to-day operations of the projects, and the kind of skills and competencies that are relevant to complex and large projects (Cicmil et al. 2006).

Another example from the industry is Storino (2012), who has demanded a comprehensive approach in addressing operational risks in commissioning and operating large capital projects, by utilising the approach of operational readiness that should impact business performance and determine operational risks. The assurance approach to operational readiness was also taken by Brereton and Papp (2013). This was a plan to prepare for any hazardous operations in operating a newly completed national igniting facility. The approach included: the assurance required by the equipment that was installed at the facility and ready for operations, all the operational and maintenance plans and procedures to be developed; and requiring training qualified personnel who will be performing the work in the new facility. This assurance for operation approach was used to safely operate the facility, not just commission it, as the scope had been extended to ensure human readiness to operate as well.

Another paper was published by Krauss (2014) on how traditional project delivery and commissioning of projects are not sufficient to guarantee successful start-up and operations of some projects due to their high complexity and large size. Krauss' paper was a high-level appraisal of issues that continue to plague projects and their owners in achieving effective delivery, system start-up and explained how operational readiness had become a more prominent phrase in project delivery, promising the earlier delivery of value from the complex new projects.

In the oil and gas industry, many operational assurance approaches that aim to look beyond the commissioning phase and expand their scope also to cover the operational phase

planning and assurance were observed. Some researchers (e.g., Al-bidaiwi et al. 2012; Nossair et al. 2012; Lesmana et al. 2014) have discussed and written about their new experience in the industrial projects of oil and gas as it relates to adding operational elements and approaches to ensure safe and trouble-free operations.

The concept of operational readiness and its activities gains momentum in all industries and the public sector (Krauss 2014). From the existing industrial literature, we argue that operational readiness was evidence of a new approach that was implemented in different industries to ensure operability of the final product by broadening the scope of the commissioning phase of the project as suggested by the agenda of “re-thinking project management” categorisation (Svejvig & Andersen 2015). By this conclusion, we move to the detailed search for the concept of operational readiness in the existing body of knowledge in project management.

3.3.4 Review of Bodies of Knowledge from PMI, APM and CIOB

Project management and construction bodies of knowledge provide the complete set of concepts, terms, processes and activities required to deliver projects successfully. These bodies of knowledge have been developed and updated over the years to cope with the changes in the domain of fast changes in project management. While the existence of many bodies of knowledge for project management, such as PRINCE2 can be acknowledged, in this referral is made to PMI, APM and CIOB. The first two have been widely recognised as the two largest specialised project management bodies of knowledge (Geraldi et al. 2011) and the third, specialises in construction as recommended by (Potts 2008). In this section, a review of the bodies of knowledge is conducted to explore the existence of the operational readiness concept.

I. Project Management Institute Body of Knowledge (PMBOK Guide)

While searching for the concept of operational readiness, we referred to the Project Management Body of Knowledge (PMBOK 5th edition), which is a widely accepted guidance document for project managers on handling single project (Project Management Institute 2013). It was found that PMBOK talks about many practices, norms, methods and processes while placing a strong emphasis on the standardised PM tools and processes up to the closing phase of the project. However, it ignores the other phases of the extended project life cycle.

In section 1.4, the PMBOK guide refers to the Organisational Project Management (OPM), it is the organisation's ability to deliver its strategic projects using organisational enabling practices, which combines the project management and operations management practices of the organisation to deliver the project successfully. OPM also refers to the maturity of the organisation in its project management practices but does not explain the methods and practices involved in integrating business-as-usual activities with project management, which is the target for the operational readiness activities at the last phase of the project.

Section 1.5 of the PMBOK guide presents an important discussion about the relationship between project management and operations management and operational stakeholders, with an emphasis on the intersection points between the two management disciplines. One of the important intersection points is between operations and project teams in the commissioning phase, where knowledge and resources are cross-utilised to ensure the delivery of the project. The section briefly discusses this intersection point without mentioning the activities and processes that should take place at this intersection or its outputs and

results. These processes have been discussed by the concept of operational readiness in industrial papers (e.g., Zerjav et al. 2014).

The closure phase in the PMBOK guide (sections 2.4.2 and 3.8) is considered the last phase. This is the phase at which the project is terminated. It refers to a process of commissioning or transfer of the final product to its owner and also a requirement for approval to close this phase. In the guide, there are no further discussions on who should approve or reject the final product and what type of inspection/tests should be conducted to accept the criteria. However, in the operational readiness concept relating to the case of Heathrow Terminal 5, more rigorous tests and operational trials and simulation were used to ensure the acceptance of the operations team of the final airport terminal (Doherty 2008).

Detailed diagrams and techniques of the project closure phase are outlined in section 4.6 of the PMBOK guide, where the tools mentioned for closing the project are limited to expert judgment, analytical techniques and meetings with stakeholders. What is evidently missing in these techniques is the heavy engagement of operational stakeholders who were recognised earlier by the PMBOK guide as critical members who need to be fully engaged. Moreover, this explains the need for operational assurance or operational readiness used by Nossair et al. (2012) among others, for the practitioners of the different industries for large and complex projects.

In the last chapter of the PMBOK guide, full stakeholder management plans, processes and techniques are illustrated based on the roles and needs of the project. Section 13.3 describes the stakeholder's engagement in general and provides flow diagrams and processes to illustrate it. However, the guide does not specify the ranges of stakeholders to

be engaged and the magnitude of engagement for each stakeholder at each phase of the project. The operational readiness concept recognises the need for operational stakeholders' engagement at the different stages, particularly at the last stage of the project, as experienced by Hickey (2008) for large railway projects in Australia.

In summary, it can be noted that the PMBOK guide provided by the Project Management Institute does not explicitly mention the concept of operational readiness in its content or processes for professional project management standards. Nevertheless, there were a few traces and pointers to some elements of operational readiness, which was also evident from the referenced industrial literature.

II. Association for Project Management Body of Knowledge

The Association for Project Management (APM) recognised the need for different approaches to managing complex and large projects stating that “*managing a major infrastructure development for delivery to a client will need a different approach*” (Association for Project Management 2012, p. 2). The APM recommended good governance to manage projects and stated that part of that governance is to ensure stakeholder engagement at all levels. Not only will this reflect their importance to the organisation, but it will also foster trust.

By reviewing the core components of project management as provided on page 12 of their Body of Knowledge 12th Edition, it may be argued that operational readiness is not explicitly stated nor considered as part of their core project management components. Nevertheless, there are traces of some components of operational readiness, such as stakeholder engagement at certain stages and as a consequence, the operational team is referred

to as the major stakeholders that must be heavily engaged during the commissioning and delivery of the asset to its operational phase.

By looking at the sponsorship aspect provided in the APM body of knowledge, it was found that the sponsor is acting as owner of the business case. Who is also responsible for overseeing the delivery of the benefits that will cover the whole project lifecycle. However, the body of knowledge does not specify the elements or the factors that will encompass the successful delivery of the benefits at the different stages (with special attention being paid to the delivery stage), and which will ensure early and safe operations of the final assets.

In the inter-personal skills section presented to the body of knowledge, the value is given to the dynamics, attitudes and relationships between people involved in the projects, which are considered the key enablers to the success of the project. By having improved interpersonal skills, high-performing teams will be created; individual effectiveness will be built, confidence will be developed, all of which in turn will drive success. More enablers, such as training and other competency skills are also required for the operations team and other stakeholders to be able to receive and operate the newly completed assets, which were not mentioned in the guide.

The Association for Project Management (2012) recognises and appraises the need for effective communication and has stressed that rich and effective communication skills are needed initially to gather stakeholders' requirements and prepare a business case for the initial phases of the project lifecycle. Once the project is under way, progress must be communicated to relevant stakeholders. In this regard, an oversight of the APM body of knowledge on the last phase of the delivery communication needs and importance can be

observed. These are essential elements as evident from operational readiness cases in the industries (Al-Bidaiwi et al. 2012; Nossair et al. 2012) that need to be considered.

Stakeholder's management and engagement are considered an important element of the project's delivery component, as stated by the APM body of knowledge. However, the guide discusses this in general and in all the phases of the project lifecycle. Existing operational readiness practices in the industry emphasise the need for, as well as the importance of end-users' and operator engagement at the last phase of the project. At this phase, the asset owner is required to be ready to take over the facility, integrate it, and operate it as part of its business-as-usual routines (Hickey 2008).

The APM guidelines discuss the framework of the benefits realisation and state that, *“where a project is only responsible for delivering outputs, it must interface with whoever is responsible for delivering the benefits. This may be a programme, portfolio or business-as-usual organisation”* (Association for Project Management 2012 p. 125). While the guide discusses the interface with the end-users and operator of the asset, there are no details for the framework of this interface. Neither are the enabling factors or processes for the successful interface explained in the guide regarding the successful delivery of the project, which is the core of the operational readiness concept to prepare the operator and interface with the project team before project completion.

Change management has been defined as, *“the structured approach to moving an organisation from the current state to the desired future state”* (Association for Project Management 2012, p. 136), where the change will be implemented by project execution and delivering an output. On this point, the guide recommends the project management team to support the assessment, preparation and planning steps of the change management

process, and coordinate with the change management team to facilitate the implementation. This support is considered an important element of the concept of operational readiness, particularly for the training and familiarisation of the operation team with a complex and large project that needs the knowledge of the project team before the project's closure.

In the review section of the APM's body of knowledge, it is noted that part of the review compares what was delivered against the original requirements, and this has to be done by test or simulation for the operations of the delivered product or asset. In the operational readiness concept found in the industrial literature, the presence of operational trials and simulation (Doherty 2008; Hickey 2008; Nossair et al. 2012) to check the operability of the facility delivered by the project with the operational team was noted. Then, a go/no-go decision based on the results of these trials is taken to proceed further to the actual operational and usual business of the organisation.

The APM's body of knowledge recognises the need for Human Resources Management (HRM) for the organisation as a whole, and for the project manager specifically. The project needs to coordinate and ensure recruitment, competency development and product-related training with the human resources team of the organisation not only to deliver the project but also to ensure its operability and the proper handing over of the completed assets. The need for competent staff recruitment and training of these operational staff are also considered part of the operational readiness core elements (Nossair et al. 2012). In summary, it can be concluded that although the APM's body of knowledge touches briefly on the core elements of operational readiness, it does not explicitly mention the concept and its contributing process and factors.

III. Charter Institute of Building (CIOB)

This is the code of practice for project managers working on construction and development projects; it was developed by CIOB (Chartered Institute of Building 2014), is considered to be a significant source of knowledge. The fifth edition was published in 2014. This CIOB initiative involved the formation of a multi-institute task force and is referred to as an example of cooperation between the professions (Potts 2008).

On page 5 of the CIOB's BoK, the testing and commissioning as a complete stage in the project lifecycle, as well as operations as the next stage has been emphasised. CIOB did not mention operational readiness as a standard process or a stage in its lifecycle but has given higher significance to commissioning and handing over before operations (Chartered Institute of Building (CIOB) 2014), which differentiates it from previously reviewed BoK. It is believed that the reason for this is the speciality of this BoK being specific to construction projects, while APM and PMI BoK are meant as a generic methodology for all types of projects. CIOB considers the commissioning stage very important for the new construction projects due to the complexity and sophistication of its engineering systems and thus, facilities required a separate stage for this after construction.

It has been further argued that commissioning activities run by the clients during the course of occupation to the facility would need careful planning and management to avoid any impact on the overall project success and may cause health, safety and environmental disasters. To quote CIOB on an important element of this research, the operational readiness activities, CIOB stated that, "*it is good practice for their interests and concerns to*

be considered during the earlier stages and preparation for their move into the new facility at the right time so that there are no surprises when the client's organisation takes occupation" (Chartered Institute of Building (CIOB 2014, p. 9). It is also noted that CIOB has another recommendation for the client (project owner), which is to ask the project manager to extend their services to support the transition of the completed facility from construction to an operational state. Thus, this can be matched to the needs of the project manager to manage the operational readiness activities to support the client.

The CIOB, on page 42, discusses the "client commissioning" process, which involves preparing new work practice manuals (processes and procedures) in close liaison with the client's/users of the systems and arranging staff training and recruitment. Therefore, it can be noted that the development of new processes for the client's standard operating procedure (SOP) and staff training and recruitment are considered to be essential parts of the operational readiness activities that need to be carried out by the dedicated team. The BoK also discusses the occupation preparation, which entails the overall plan of moving into the newly constructed facility and who is responsible for what, as well as the process. Again, it can be emphasised here, and as per this research, it may be argued that operational readiness should start early in the project phases, and the operations should be planned from all sides, including commissioning and occupancy.

In stage 6 of the CIOB BoK, as it relates to the commissioning and testing stage, it confirms that *"the building services systems have been installed in compliance with the design, have been fully tested and have been proven to be fully functional"* (Chartered Institute of Building (CIOB) 2014, p. 263). Therefore, the outputs of this stage are the important operational readiness elements and factors, such as O&M manuals, certifications and warranties, training of client staff, and updated health and safety plans and files.

Additionally, it was observed that commissioning stresses mainly on systems and not the facilities and the familiarisation of the client staff on the facility as a new structure. Therefore, for this research study, airports projects are considered where complicated systems are involved, as well as large facilities that required more than just commissioning steps, for example, more comprehensive operational readiness processes to ensure the successful operations and delivery of world class services from day one.

A very important aspect that was discovered in the CIOB that has not been detailed in other project management BoK is the detailed planning and steps for scheduling the hand-over to the client on page 287. The planning of handing over covers the submission of the required operational and maintenance documentations to the final owner and client, as well as monitors proposals for training relevant facility operations and maintenance staff and facilitate the final inspection and certification to the new facility.

The CIOB on Page 287, refers to client commissioning and occupation and states that, “...*the client has to finally prepare the facilities ready for occupation. This stage of the project lifecycle comprises three major groups of tasks: client accommodation works, operational commissioning and migration*”(Chartered Institute of Building (CIOB 2014, p. 287). This is another call for operational readiness, and it should be noted that the Bok is referring to the construction of any building, be it residential or commercial. Additionally, it is further evident that operational readiness is used for facilities with complex operational requirements such as airports, hospitals and other industrial facilities. The main argument surrounding this study is that the operational readiness has a wider scope to cover since multiple stakeholders, and complex operations are required for some projects; planning for occupation alone is not sufficient, and from the clients’ perspectives,

it is viewed as a single entity rather than a group of stakeholders who needs to operate in a smooth harmonic way.

In summary, it can be acknowledged that CIOB as BoK specialised for building construction does contain some elements of operational readiness contained with the commissioning and occupancy planning for the facility. However, it does lack other elements of operational readiness, such as the integrated operational simulations and trials that are needed to run a complex operational process, especially for airports and chemical plants before real the operations, along with others.

In conclusion for the review of existing body of knowledge in project management fields, it can be noted that review of Project Management Institute Body of Knowledge (PMBOK Guide), Association for Project Management Body of Knowledge and Charter Institute of Building (CIOB) did not explicitly mention the concept of operational readiness in its content or processes for professional project management standards.

3.3.5 Processes and Functions that Share Similarities with Operational Readiness

In addition to the detailed review for the operational readiness concept, it was important to review in detailed some of the available functions and processes that share similarities with operational readiness as found in section (3.3). These functions include commissioning, project delivery, stakeholder engagement and benefits realisation, which will be discussed and compared with operational readiness in the proceeding sub-sections.

Commissioning

In this sub-section, the major differences between operational readiness and commissioning are discussed, as operational readiness is a new concept in project management. The

existing definition of “commissioning” is, “*the disciplined activity involving careful testing, calibration, and proving of all systems, software, and networks within the project boundary*” (Lawry & Pons 2013, p. 1). Kats et al. (2008) also previously referred to it as the systematic process of ensuring that building systems are designed, installed and operating as planned. Thus, it was observed that the definitions of commissioning are connected to the systems, regardless of who is going to operate it, as well as other surrounding operational factors. The current literature recognises that the commissioning activity is critical to the success of any project (Lawry & Pons 2013) and others consider it as a major phase in the product lifecycle in the Oil and Gas and IT projects (Archibald et al. 2012).

Similar to other scholars, Tribe and Johnson (2008) recognise the importance of commissioning as a task, directed by the area commissioning leader with the help of the operations, the contractor, and the equipment manufacturers representative, to check if the equipment is operating as design. On the other hand, operational readiness takes a wider look at the readiness of the whole operational aspect including people readiness, systems readiness (commissioning), facility readiness, and processes and organisational readiness. Similar to the concept of operational readiness in project management, commissioning does not get enough attention, and it has been poorly defined and interpreted ambiguously (Lawry & Pons 2013) in the project management literature; this leads to inefficient utilisation within the industry.

In summary, recent scholars such as Brito et al. (2015), are searching for a mechanism that is better than the traditional commissioning process. They refer to such mechanism as the operability and commissioning to be used on new or refurbished facilities, which will represent opportunities for owners and operators to eliminate and mitigate exposures

to numerous risks, as well as increase the chance of success for the facility life cycle and the likelihood of satisfying the operational needs and requirements. This new mechanism is the guiding backbone of this study, and for this research, it will be referred to as operational readiness.

Project Delivery

According to the project management literature, project delivery involves networks of customers, contractors, sub-contractors, suppliers, and designers who are connected through strong inter-organizational relationships, to enhance project performance (Sariola & Martinsuo 2016). The term project delivery is used to explain the practices utilised by client organisations to deliver projects with successful outcomes (Pakkala 2002) more effectively. Project delivery is mainly associated with the construction phase of the project and has no impact on the interface with the operations phase of the final products. Examples of project delivery methods are Design-Build (DB), Design-Build-Operate-Maintain (DBOM), Design-Build-Finance-Operate (DBFO), and Full Delivery or Program Management (Davies & Mackenzie 2014). New and innovative approaches to project delivery suggested the integration of the different members of the involved stakeholders of the project who are having the right skills to create a virtual organization to enhance the delivery of the project (Baiden et al. 2006; Hammond et al. 2008) that include integrating the client as part of the virtual organization in delivering solutions.

The American Institute of Architects (AIA 2007) defines integrated project delivery as, *“a project delivery approach that integrates people, systems, business structures, and practices into a process that collaboratively harnesses the talents and insights of all project participants to optimize project results, increase value to the owner, reduce waste,*

and maximize efficiency through all phases of design, fabrication and construction” (AIA 2007, p. 2). Therefore, project delivery as a process is differentiated from operational readiness based on its scope that looks into the operations of the construction until its completed, while operational readiness focuses on ensuring the readiness of operations before and after the construction completion phase.

Stakeholder Engagement

The importance of stakeholders’ engagement in projects has been widely recognised in the literature (McKeen et al. 1994; Szyliowicz & Goetz 1995; Preble 2005; Ng et al. 2007; Herazo et al. 2012; Liu et al. 2016). It has been noted that stakeholders could have a positive or negative impact on the progress of projects and can even stop a project if it is not managed properly (International Finance Corporation 2007; Chandra et al. 2012). The influence of the stakeholders varies based on their role in the project and the phase of the project (Reed et al. 2009; Herazo et al. 2012), which has been observed in this research. Operational readiness is set to ensure stakeholders’ engagement from the design phases of the project through to the operations phases as illustrated earlier in **Figure (3)** (Doherty 2008; Al-bidaiwi et al. 2012; Nossair et al. 2012; Zidane et al. 2015). The project’s final users are regarded as part of the project stakeholders (Li et al. 2013) and their engagement is considered as one of the most important elements in transferring the final project to its operational users and achieving project success (McKeen et al. 1994; Dvir 2005; Lizarralde 2011; Li et al. 2013). Additionally, while research on user engagement in information systems (IS) projects has been underway since 1966 (Chan & Pan 2008; Jun et al. 2011), there is a lack of research in this area as it relates to construction projects. In fact, the impact of user’s engagement on project success has been widely acknowledged by all researchers in project management, but no clear methods or framework have been

defined for user's engagement (Chan & Pan 2008; Lizarralde 2011; Li et al. 2013). In a study conducted by McKeen et al. (1994), an analysis of 151 projects revealed that user engagement has a direct and positive impact on the relationship with user satisfaction, which in turn impacts project success. Also, a study by Dvir (2005) on 110 defence projects found that user's engagement in preparations for handing projects over has the highest impact on project success. Hence, Dvir's (2005) and other recent studies (Jun et al. 2011; Luyet et al. 2012; Li et al. 2013; Liu et al. 2016) have motivated the scope of this research to investigate the effect of stakeholders' engagement, (in general and among users in particular) on large infrastructure projects (airports) in the UAE.

Chang et al. (2013) collected interview data concerning the value created by stakeholders and project users who were actively engaged in three large defence projects in Australia. The aim of the study was to create new knowledge and processes for suppliers and customers by actively involving them throughout the project life phases. Based on the literature, the engagement of stakeholders in general and among users specifically in the last project stage, had a direct and positive impact on that project (Hickey 2008; Al-bidaiwi et al. 2012; Nossair et al. 2012). Previous empirical studies of Information System (IS) and defence projects have been conducted to investigate the relationship between user involvement in the project and project success. There is no evidence of any similar studies being conducted for construction projects in general or specifically for the UAE.

Chan and Pan (2008) highlighted the importance of stakeholders' and users' engagement in IS projects in their research studies for e-Government. They found that the sustainable engagement of stakeholders over the phases of a project will increase the chances of a system's acceptance and success. The assessment and successful engagement of stakeholders in projects requires skills and techniques on behalf of the project managers (Luyet

et al. 2012). The International Financial Corporation (IFC) has drafted a handbook that explains how to facilitate stakeholders' engagement in projects and what changes in processes and an internal core business that organisation needs in order to ensure such engagement (International Finance Corporation 2007). In construction projects, it was strongly suggested by Chandra et al. (2012) that the project manager should have the skills to identify and allow the engagement of project stakeholders. They note that this identification will also serve as the basis for modifying project planning. The end-user engagement in a large oil and gas project has been praised by Al-bidaiwi et al. (2012). They claimed that it has resulted in the successful implementation of projects and the smooth commissioning of the newly constructed facility.

To summarise, the project team is not only required to have the skills and tools to facilitate the engagement of the project stakeholders, but active stakeholder engagement in both the development of the design at an early stage and preparations for operation in the last stages of the project lifecycle is also needed. These two attributes combined will ensure project success.

Benefits Realisation

Benefits realisation is a well-established topic in the information and technology project literature, but limited attention has been noted in large infrastructure projects (Winch & Leiringer 2015) since it is considered the back end of the project. Chih and Zwikael (2014) linked the organisation's performance to the successful realisation of the benefits of the implemented project, where it has been defined as, "*the flows of value that arise from a project*" (Zwikael & Smyrk 2012, p. 11). Therefore, the benefits of the project will only be realised at the operational phase of the project by the operations members. Dupont and

Eskerod (2015) argued that the benefits from a great project could be harvested by assigning line managers, such as end-users and operators to maintain a role in the project from the start and to let them be part of the change. This is particularly important, as the business line manager will be part of the operational readiness to plan for the benefits realisation before the operational phase.

Winch and Leiringer (2015) pointed out that “*benefits realisation*” is a well-established topic in the literature of IS/IT projects, but the lack of attention paid to this topic has been found in large infrastructure projects regardless of their complexity. Subsequently, the challenges of operational benefits and realisation increase and as such, Winch and Leiringer (2015) suggest the use of the asset integration concept to address this gap in the last phases of the project.

In more complex and riskier projects, such as large infrastructure projects and airport projects, Zwikael et al. (2014) in their study of the 183 projects on planning context suggested that the line manager and end-users start the planning of the project benefits to ensure the successful delivery of outputs. The benefit planning has been discussed in the IS/IT sector and Ashurst et al. (2008) recommended introducing benefits planning competence to ensure timely planning before operations, in addition to setting all the parameters to harvest benefits from day one of the facility operations. This is the intention of the operational readiness concept, which forms the subject of research in this study with all its enabling factors.

In conclusion of this section of the operational readiness concept, it can be agreed that operational readiness may be “*commissioning*” on steroids or a ‘buffed-up’ version of

commissioning that is used herein to broaden the conceptualisation of the PM phase of commissioning as recommended by Cicmil et al. (2006).

3.4 Definition of the Operational Readiness

For the last four decades, operational readiness has been a commonly used term in the military (London 1967; Horning et al. 2012;) and for National Aeronautics and Space Administration (NASA) operations (Coleman & Abrams 1962). The term refers to the “*readiness assessment of a mission or system to be available for operation at any time*” (Coleman & Abrams 1962, p. 126). The definition of operational readiness has been adopted and used differently by other sectors, such as risk and accident prevention (Kingston et al. 2007) and the construction industry (Potts 2008). Within the literature, operational readiness has been discussed for a large infrastructure project by Doherty (2008), who integrated operational readiness with other project stages and discussed its value and preparations. Doherty (2008) explained operational readiness as a practice used by project managers and operations but did not refer to its theoretical base and background or discuss whether it has been theoretically proven as a good method to use.

Literature that looks at military settings suggests that operational readiness actions must be taken to ensure that military equipment and personnel are always ready for combat and operations (Coleman & Abrams 1962; London 1967; Cosenzo et al. 2007; Horning et al. 2012; Pickup et al. 2012). However, a review of the literature appears to indicate that the operational readiness concept has not been extensively applied to non-military settings. This is a gap this research study intends to address.

In the ICT projects and from a technology context, Main et al. (2015) define readiness as the capability of the organisation or countries to participate and obtain benefits arising

from the ICT projects, while organisation readiness is described as the ability of the organisation to adopt the new changes arising from the project and prepare the right attitude and behaviour of the organisation members to accept the changes. In specific, Ahmadi et al. (2015) have emphasised the importance of organisational readiness before starting ERP projects, and how this readiness smoothens project implementation and success. While the authors here refer to the readiness of the organisations before the start of the project, this research is interested in the operational readiness just before the project is completed and the overall preparedness of the organisation to operate.

Limited research into operational readiness in non-military settings appears to have spurred, except for the research of Hickey (2008), who defined operational readiness for transport infrastructure projects as the procedures and components used to provide operational readiness to these projects. Dvir (2005) on the other hand, described the benefits of plans to transfer projects to their final users for operation and the impact of such plans on project success. Operational readiness has also been researched in the context of medical/hospital operations, for instance, Edwards et al. (2007) explained the importance of implementing and maintaining operational readiness procedures for hospitals to be ready for natural disasters and war. Another study conducted by Brereton and Papp (2013) discussed operational readiness plans that were designed to ensure an igniting facility's readiness for operation and to avoid any safety and health risks. Based on the different use of operational readiness processes within multiple industries, no one definition of operational readiness has emerged as illustrated in **Table (9)**.

Table (9) Definitions of operational readiness.

DEFINITION	Area	Source
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1	<i>"...the probability that the system will be able to operate within the tolerances at a given instant of time"</i>	Operations Research	Hosford (1960, p.53)
2	<i>"The probability of performing without failure a specified function under given conditions for a specified period of time"</i>	Space Technology	Coleman and Abrams (1962, p.126)
3	<i>"The probability that a multi-device, multi-model system will meet specified operational requirements at any given time"</i>	Maintenance of Systems	Wohl (1966, p.1)
4	<i>"The condition or status of any military unit (or force) with regard to its capability or capacity to carry out the duly assigned operational mission (and/or objectives) and as such is broadly considered a function of that mission"</i>	Military	London (1967, p. 35)
5	<i>"The probability that the system starts operating when a mission needs to be performed"</i>	Network Systems	Lara-rosano (1981, p. 89)
6	<i>"... is just a method to organize your resources and job tasks to ensure a base, shop, or facility is ready to start work correctly"</i>	Engineering Management	Idaho National Engineering Laboratory (1987, p.12)
7	<i>"achieving a configuration which places the right people in the right places at the right times working with the right hardware according to the right procedures and management controls"</i>	Engineering Management	(Nertney 1987)

8	“... is a disciplined, systematic, documented, performance-based examination of facilities, equipment, personnel, procedures, and management control systems to ensure that an activity will be conducted safely within the approved safety envelope as defined by the activity safety basis”	Engineering Management	Idaho National Engineering Laboratory (1995, p.10)
9	“.... the state of preparedness of a unit to execute the normal mission reflected in the table of organization and equipment under which the unit is assigned”	Military	Kays et al. (1998, p. 3)
10	“... is a state that is moved toward incrementally by performing tasks and creating deliverables throughout the Project Life Cycle. An Operational Readiness Assessment ensures the operating environment is prepared to effectively support and accept the changes resulting from the project”	Project Management	Gardner (2001, p. 3)
11	“The probability that, at any point in time, the system is ready to be placed into operation on demand when used under stated conditions, including stated allowable warning time”	Engineering	Kececioglu (2003, p. 24)
12	“[Operational readiness] is about creating an organisation that places the right people in the right places at the	Incident Investigation	Kingston et al. (2007, p. 2)

	<i>right times, working with the right hardware according to the right procedures and management controls”</i>		
13	<i>“The completion of all activities necessary to enable hand over of all infrastructure that comprises a project, to the asset owners & operators, for commercial operation”</i>	Infrastructure Developments	Hickey (2008, p. 660)
14	<i>“... tests and trial “soft-openings” to prepare people, processes, systems, and facilities for the public opening”</i>	Construction Management	Davies et al. (2009, p.108)
15	<i>“... involves getting new or upgraded plant to the point where it can be handed over to operations”</i>	Asset Management	Hastings (2010, p.140)
16	<i>“The capability of military units is able to conduct the war plan when receiving battle orders”</i>	Military	Li et al. (2011, p. 754)
17	<i>“is a concerted program to address operational risks from the early stages of project execution, develop mitigation activities, and prepare new projects to be efficiently operated and deliver optimal performance”</i>	Infrastructure Developments	Storino (2012, p. 4)
18	<i>“The availability of aircraft to fly their assigned missions”</i>	Military	Horning et al. (2012b, p. 1)
19	<i>“.. is a set of operational activities and trials that need to be performed on mega projects such as airports before going</i>	Construction Management	Al-Mazrouie and Bajracharya (2013, p.32)

	<i>live. Usually these activities and trials are not in the main contractor's scope of work and it requires coordination between relevant stakeholders"</i>		
20	<i>"A concept that is user and intended use dependent. A model that one user may consider ready may not suffice for readiness with another user. Different users have different needs according to their missions"</i>	Health	Corley et al. (2014, p. 6)
21	<i>"Operational readiness involves getting new or upgraded plant to the point where it can be handed over to operations. A site operations representative should be nominated, to represent the interests of operations in the installation, commissioning, and operational readiness processes"</i>	Asset Management	Hastings (2015, p.140)

However, no clear definition of operational readiness in projects or project management was found in literature at this stage. Although operational readiness of large infrastructure projects and their factor influences important decisions on and in project management, operational readiness as such is often taken intuitively or from previous experiences.

Operational readiness can be distinguished from existing definition by the following attributes:

- Planned activity before operations.

- It includes human, technology and facilities aspects.
- Not in the project manager scope.
- Ensure operations of the final product efficiently.
- Ensure proper commissioning to the operations team.
- Right people, in the right place, working with the right procedures.

3.4.1 Adopted Definition in this Study

In this study, we combine and adopt the definitions of Hickey,

“The completion of all activities necessary to enable hand over of all infrastructure that comprises a project, to the asset owners & operators, for commercial operation” (Hickey 2008, p. 660),

and Krauss:

“The process of preparing the custodians of an asset under construction, and their supporting organisation, such that, at the point of delivery/ handover, they are fully ready to assume ownership of the asset and reassuring the various stakeholders in a project that their asset is in a state of operations readiness” (Krauss 2014, p.10).

3.4.2 Classifications by Sector

A review of the existing literature reveals some models and processes that seem to act as operational readiness and assurance factors that were created, adopted and tested by different organisations in different sectors. **Table (10)** presents the existing models and their

related industries, which are similar to the intended operational readiness model of this study.

Table (10) Existing models of readiness.

Model	Area/Industry	Source
Mathematical Model for Operational Readiness	System Engineering	Coleman and Abrams (1962)
Operational Readiness Index Model	Military	London (1967)
Readiness Assessment and Monitoring System (RAMS)	Military	Cosenzo et al. (2007)
Operational Readiness	Airport Projects	Doherty (2008)
Asset Integrity Management System (AIMS)	Oil and Gas	Ratnayake (2012)
Integrated Readiness Assurance Process (IRAP)	Oil & Gas	Nossair et al. (2012)
Operational Readiness Simulator (OR-SIM)	Military	Horning et al. (2012)
Operational Readiness	Physics	Brereton and Papp (2013)
Operability Assurance	Oil & Gas	Lesmana et al. (2014)
Operational Readiness	Chemical Production	Hendershot (2015)
Operational Readiness	Military Aviation	Verhoeff et al. (2015)
System for Human Factors Assessment and Readiness Evaluation (SHARE)	Operations Management	Del et al. (2015)

Models and concepts of readiness shown in **Table (10)** have been used mostly in the oil and gas, and military fields; except for the T5 airport project, where the British Airport Authority (BAA) and British Airways (BA) teams comprising of the operator and maintainer of the facility, conducted an operational readiness procedure to ensure that systems, people and processes are ready to operate the newly constructed facilities (Davies & Gann

2009). These models discussed in **Table (10)** differ based on the criticality and needs of the industry used for the stakeholder’s network involved, and also include different factors and critical elements based on the nature of the industry or sector. A collection of factors and critical elements is required to reveal the common factors and elements adopted for this study from the existing literature, which will be presented in the next section.

3.5 Key Factors/Elements of Operational Readiness

A review of the literature shows that operational readiness is composed of different elements and enabling factors that need to be available and prepared to achieve the desired level of operational readiness (Hickey 2008). This includes the factors extracted from real airport failures cases as previously shown in **Table (2)**. These factors will be used as the initial list of elements for operational readiness. **Table (11)** shows different areas in the literature associated with the operational readiness’ enabling factors.

Table (11) Existing operational readiness elements in the literature.

No.	Operational Readiness Elements	Area/Sector	Source
1.	Training and Familiarisation	<ul style="list-style-type: none"> • Airport Construction Projects • Reliability and Maintenance • Defence • Operations Management • Infrastructure Rail projects • Building Constructions • Oil & Gas 	Quilty (2003, p. 3) Dvir (2005, p. 263) Potts (2008, p. 10) Hickey (2008, p. 661) Defence (2010, p. 2) Storino (2012, p. 9) Herazo et al. (2012, p. 74) Nossair et al. (2012, p. 5) Parr and Cudworth (2013, p. 5) Brereton and Papp (2013, p. 600)

		<ul style="list-style-type: none"> • Chemical Operations 	<p>Lesmana et al. (2014, p. 2) Del et al. (2015, p. 5193)</p>
2.	Completion of Physical Building	<ul style="list-style-type: none"> • Airport Construction projects • Infrastructure Rail projects • Oil & Gas • Operations Management • Chemical Operations 	<p>Quilty (2003, p. 7) Potts (2008, p. 281) Hickey (2008, p. 661) Nossair et al. (2012, p. 4) Brereton and Papp (2013, p. 605)</p>
3	Systems are tested and ready	<ul style="list-style-type: none"> • Airport Construction projects • Infrastructure Rail projects • Oil & Gas • Operations Management • Chemical Operations 	<p>Quilty (2003, p. 7) Potts (2008, p. 281) Hickey (2008, p. 661) Nossair et al. (2012, p. 5) Brereton and Papp (2013, p. 600) Lesmana et al. (2014, p. 3) Del et al. (2015, p. 5196)</p>
4	Readiness of operational procedures documentation and certifications	<ul style="list-style-type: none"> • Airport Construction projects • Reliability and Maintenance • Defence • Infrastructure Rail projects • Oil & Gas • Operations Management • Chemical Operations 	<p>Quilty (2003, p. 9) Dvir (2005, p. 259) Potts (2008, p. 281) Hickey (2008, p. 661) Defence (2010, p. 2) Storino (2012, p. 6) Nossair et al. (2012, p. 4) Brereton and Papp (2013, p. 600) Lesmana et al. (2014, p. 6) Del et al. (2015, p. 5196)</p>
5	Procurement strategy and Critical equipment for operations	<ul style="list-style-type: none"> • Infrastructure Rail projects • Reliability and Maintenance • Operations Management • Infrastructure Rail projects 	<p>Hickey (2008, p. 662) Storino (2012, p. 7) Nossair et al. (2012, p. 5) Parr and Cudworth (2013, p. 9) Lesmana et al. (2014, p. 2)</p>

		<ul style="list-style-type: none"> • Oil & Gas • Chemical Operations 	
6	Staffing and Recruitments	<ul style="list-style-type: none"> • Reliability and Maintenance • Defence • Operations Management • Infrastructure Rail projects • Oil & Gas • Chemical Operations 	<p>Quilty (2003, p. 7) Hickey (2008, p. 661) Storino (2012, p. 9) Nossair et al. (2012, p. 5) Brereton and Papp (2013, p. 598) Parr & Cudworth (2013, p. 9) Lesmana et al. (2014, p. 3) Del et al. (2015, p. 5196)</p>
7	Effective Communication plan and process to all stakeholders	<ul style="list-style-type: none"> • Reliability and Maintenance • Operations Management • Chemical Operations 	<p>Quilty (2003, p. 9) Hickey (2008, p. 662) Storino (2012, p. 6) Brereton and Papp (2013, p. 602) Parr and Cudworth (2013, p. 7) Lesmana et al. (2014, p. 2) Del et al. (2015, p. 5196)</p>
8	Operability Review and Experimental Learning (Trials)	<ul style="list-style-type: none"> • Reliability and Maintenance • Operations Management • Defence • Chemical Operations 	<p>Dvir (2005, p. 263) Defence (2010, p. 6) Storino (2012, p. 7) Brereton and Papp (2013, p. 602) Parr and Cudworth (2013, p. 7) Lesmana et al. (2014, p. 4)</p>
9	Stakeholder's commitments	<ul style="list-style-type: none"> • Operations Management • Defence 	<p>Dvir (2005, p. 263) Parr and Cudworth (2013, p. 7)</p>

Based on **Table (11)**, it can be summarised that each industry has its specific enabling factors for the operational readiness of its assets. It is also noted that some common factors are repeated in many industrial sectors/areas, such as training and familiarisation,

operational team recruitments, and operational procedures. A detailed discussion of each factor and its sub-components is present in the following sections to elaborate on the importance of these factors, as well as their presence as an enabling factor for operational readiness planning and execution.

3.5.1 Training and Familiarisation

On-site training and familiarisation of the operational team are required to operate large infrastructure facilities and assets that have just been constructed and handed over by the project team. In the oil and gas industry, this has been recognised as being essential before any operation of the facilities (Heinemann & Killcross 2012; Nossair et al. 2012; Lesmana et al. 2014; Del et al. 2015). It is also considered as a critical wealth of knowledge that needs to be transferred from the project team to the sponsor and the operating team that will be responsible for operating the facility in an efficient manner (Havila & Salmi 2008). It has been argued earlier by Raelin (1997) that the best way to develop an organisation's employees is through training as it is believed to be helpful in increasing the knowledge and competency of such employees. The training of employees has also been considered an essential part of the high-performance systems by Johannessen and Olsen (2003), as the systems and assets rely on the employee's skills and initiative to resolve operational and maintenance problems.

Brereton and Papp (2013) emphasised the need to conduct training for all the staff involved in operating the new National Igniting Facility (NIF), where radiological issues and risks are involved. Training in operations and maintenance has been recognised as an essential part of the preparation to operate the new facility and avoid risks and hazards in the start-up operations. Similarly, a case study presented by Carù et al. (2004) shows a

competitive advantage gained by a construction firm in providing a model of management that alleviates some of the possible negative impacts on the customers in different project phases. The training was the critical element in the final phase, and the researchers have stated the importance of such training:

“The readiness of the operators to use this depends on the level of user involvement during the project and the quality of the user documentation and training that has been provided. Often these things are overlooked or given less rigorous attention, which results in problems with operator agreement” (Carù et al. 2004, p. 543).

Kealey et al. (2005) investigated the impact of training individual and cross-cultural teams on project success; however, the scope of the study was limited to the implementation phase of the project and did not cover the delivery and operational phases of the project, as the case in this study. Training in the project’s objective has also received importance in the literature, as discussed by Bryde (2008), who noted that training and familiarising the project sponsor’s staff with project objectives and goals would ensure their readiness to receive and operate the project after completion.

The orientation and familiarisation for the operational staff are considered a difficult task to implement as staff suddenly have to stop their day-to-day business routine and move to the project site for orientation and familiarisation (Armenakis et al. 1993; Nossair et al. 2012;). Although this is difficult to implement, it is equally important for the success of the project operations. Nossair et al. (2012) recommended the preparation of a training and development plan to prepare the operational team with adequate skills and competencies for the safe and efficient operations of the newly completed facility. This plan has

to be prepared during the construction of the project and implemented during either the last phase of the project or the project delivery phase. The importance of the training plans and its implementation before the operation has also been highlighted by Lesmana et al. (2014) who found that the assurance of a trained and competent operational human factor during the project implementation will ensure the smooth transition of a newly completed facility from its construction to an operational state.

As for the airport operations, Quilty argued that “*the ability to achieve world-class airport operations can occur only if airport personnel receive the proper education and training to manage safe operations and increase operating efficiency*” (Quilty 2003, p. 3). This is the case for new airport facilities that have just been completed. A qualified and well-trained operator needs to take care of its operation, the training and facility familiarisation should take place during the operational readiness of the facility, not once it is operational. Specifically, Winch and Leiringer (2015) recommended official training to those who will have to use the system once it is operational. Examples of these are baggage handlers, train drivers and production workers, as they form part of the organisation’s operational staff. Training for these groups is considered essential in moving the completed asset into beneficial use, once the construction phase of the airport is completed.

Hence, it can be argued that the building core of competencies through training and familiarisation is an important factor in the operational readiness concept. Training and familiarisation will add tacit knowledge to the operational team during the start of the facility operation and will raise their level of competency to be able to manage better and make proper decisions on time (Quilty 2003).

3.5.2 Completion of the Physical Building

The completion of the physical asset, such as an airport facility is important to ensure availability of not only front passenger areas but also the readiness of the back offices and facility for the airport staff. Without this, operations may not be achieved at the desired level. In his study on achieving recognition as a world class airport through education and training, which was specifically on an airport facility project, Quilty (2003) emphasised on training relating to the features of the completed facility and having the physical building ready for training to ensure best training and knowledge for the operations staff. Another example of an airport project was discussed by Potts (2008) who ascribed the importance of ensuring that the infrastructure is fully completed, which was one of the critical stages planned by BAA for the Terminal 5 facility at Heathrow Airport.

Completion of the physical infrastructure also drew the attention of Hickey (2008). He asserted that when considering the operational readiness of a project, for all infrastructure and facilities to be completed and commissioned, these must be validated against the operations and performance specifications as stipulated earlier in the design. In the context of the oil and gas industry, Nossair et al. (2012) considered the completion of the physical asset as an important element for the Integrated Readiness Assurance Process (IRAP), which is a readiness process to integrate and operate a newly built facility to the existing plant in the most efficient and safe operational way. In the case of chemical plants, Brereton and Papp (2013) identified three major factors that need to be ready based on the reviews of the plant's readiness to operate. One of these factors is that the facility should be completed state to operate in accordance with safety standards.

In summary, the importance of the physical completion of the asset has been emphasised by numerous authors across industries that span from the aviation to oil and gas. The

similar importance of the system completeness and readiness has also been emphasised by different authors.

3.5.3 Systems are Tested and Ready

Technology and systems are vital components of any airport's operations. For any infrastructure projects, the completion and readiness of the systems and technologies are critical for the operations after project completion. Quilty (2003) identified two major elements as to why in the past some airports experienced difficulties on the first day of their operations. These were: (i) critical operational systems of the airports were not adequately tested before operations, and (ii) the personnel were not properly trained to manage the operations or handle problems that did arise on the first day. The criticality of the system readiness was also highlighted by Hickey (2008) in preparation for the operation of a large rail system to be integrated into the existing network to avoid network system disturbances, as well as ensure the safety of the new and existing network systems. In the oil and gas industry, Nossair et al. (2012) did investigate not only the system completion and testing of the operational assurance process of the new project but also examined the maintenance plan and critical documentation of these systems to ensure reliability and availability before operations. Emphasis on the system's readiness was also demonstrated by Al-bidaiwi et al. (2012). The readiness of the critical safety systems is vastly important for the operations of the oil and gas facility before any operations can start.

3.5.4 Operation's Processes and Procedures

A detailed discussion of project operations, such as the front end (Morgan 1987; Samset 2009; Aaltonen et al. 2013), planning (Platje et al. 1994; Tasevska et al. 2014), and stakeholder management (Rowley 1997; Nguyen et al. 2009; van Offenbeek & Vos 2016) has

been available in the project management literature for several decades. However, evidence regarding the final asset operational procedures and plans are yet to be investigated in general. This may be attributed to the fundamental separation between project management and operations management. This has recently started to change as some project management organisations, such as APM-BOK have adopted an extended project life cycle, but without the details of the processes and procedures of operations after the commissioning of the asset.

In this study, the valuable opportunity for the project team to support and extend help in drafting operational plans and procedures to the operational teams (Chartered Institute of Building (CIOB) 2014) comes to the forefront. The importance of operational plans and procedures has been strongly recognised in a study by Brereton and Papp (2013). Who considered the readiness for the plan of operations of a radioactive facility before its operation as part of their readiness to operate the whole facility and reduce the health and safety risks for people working in the facility, as well as to operate the facility in an efficient manner. Tribe and Johnson (2008) employed key concepts and suggested improvements for construction projects, such as the support of the construction manager in assisting operational teams in commissioning and transferring large projects to their operational teams. This assistance will help in drafting the final operational plans.

In a new oil and gas project, Al-bidaiwi et al. (2012) recognised the importance of developing procedures and standards, which were specifically for the final facility's operations before completion of the project by the operational team to avoid time delays and cost overruns. Part of the new operating procedures creation was the development of maintenance plans and manuals (Al-bidaiwi et al. 2012; Nossair et al. 2012; Del et al. 2015). These plans and manuals will ensure the availability of the right personnel, tools and

necessary data to support the maintenance and operational activities during the operations of critical systems. Additionally, the operations team played a major role in developing and finalising the operations and maintenance philosophy for the new projects and coordinated with, the contractor in preparing the operating and maintenance manuals.

Adequate operations and maintenance plans will ensure the safety, reliability, and availability of critical equipment, facilities and systems at optimum cost. Part of the operating procedure to be developed is the safety plans and procedures that need to be documented (Nossair et al. 2012) to ensure that the safety regime and procedures are known and are ready to be carried out during any incident that may occur while starting the facility's operations.

3.5.5 Procurement of Critical Operational Assets

Procurement has been defined by Lester as, “*the term given to the process of acquiring goods or services*” (Lester 2006, p. 238). In this research, it is not only the materials and goods that spike an interest, but also the services that will be provided by the suppliers to maintain and operate the goods, equipment and after-sales support services. Procurement in construction projects is considered a complex and complicated process (Pesämaa et al. 2009) that requires close and continuous cooperation between different project participants (Kong & Gray 2006). The importance of coordinated procurement has been recognised by Tysseland (2008) as a critical factor to a project's life cycle cost, which provides a different methodology of procurement in the projects by examining just the initial cost of the procured materials rather than the full life cycle and cost.

A new cooperation model of procurement in constructions projects has been created and empirically tested by Pesämaa et al. (2009). There is strong evidence that mutual benefits

can be achieved for contractors/suppliers and clients by using this model. Procurement can either refer to purchasing materials that will be used to build the project or procuring maintenance and operational services from the same supplier of those materials. In the traditional process of procurement, suppliers of materials and equipment have to bid as per the client's requirements to win the contract. The bid usually entails less money initially, but once the equipment is installed and ready for operations and maintenance, the same contractor will monopolise the price. As a consequence, the costs will increase over time for the maintainer and operator of the assets and systems. The suggested model of cooperation in procurement should thus help to avoid such monopolies and to secure agreements on maintenance cost and spare services in advance. The need to shift away from traditional procurement has also been supported by Kumaraswamy et al. (2004) and Kong and Gray (2006) both of which are in search for a new model of procurement to support innovative construction systems and to avoid legacy problems in industrial and construction projects.

Baiden et al. (2006) argued and empirically tested that project team integration aimed at improving the procurement process has positive results. They also suggested that design and built (DB) projects deliver better results. In this study's case of operational readiness plans, a suggestion for more procurement cooperation about the equipment and its servicing with relevant stakeholders has also been made in the International Project Management Association's (IPMA) project excellence model (PEM). This model suggests that the process should be innovative and subject to continuous improvement to be able to deliver excellent customer satisfaction and projects results.

In their preparations for operation, (Hickey 2008; Nossair et al. 2012) highlighted the importance of procuring appropriate maintenance tools and equipment as part of the

maintenance planning activities before operations. Others prepared an inventory and procurement plan in the course of their supply chain readiness (Storino 2012; Brereton & Papp 2013) to support the operations and the maintenance of the new facilities with the needed spares and warehouse materials. The materials procurement readiness was not the only item to prepare as with a large facility to operate, support services contracts were also part of the essential procurement elements before operations to define and finalise the documentation and contractual structure of the external services needed.

3.5.6 Operational Staff Recruitment

Recognition of the hiring and training of operational staff, which goes way back (Morris 1989), has been highlighted as one of the most important aspects during project interfaces. Nevertheless, sparse discussions about how it may impact project success are available in the literature. At the last stage of any project, one difficult task is to either terminate the project team or shift them to another project. With regards to large projects where a huge numbers of employees are hired for project management, consultancy services and construction activities, most employees' contracts are terminated due to the unavailability of further large projects in the same organisation. It is always recommended that some of the project team members be transferred to the operational entity so that their knowledge and experience can be utilised in operating the project. In the oil and gas industry, Nossair et al. (2012) discussed the human resources and recruitment intake of the operational and maintenance personnel. This is needed to enhance the competency and skills needed to support operational requirements and needs to ensure maximum safety, reliability, and availability of the systems and the facility at a minimal overall cost.

3.5.7 Rich Communication

The UAE and other GCC countries are renowned for their multi-cultural project and operations teams, due to the scarcity of knowledgeable local resources to manage vast and complex projects. Such teams have been particularly prevalent in the last decade, following the government's plans to diversify its economic strength (Rees-Caldwell & Pinnington 2013). According to Cerimagic (2010), communication is one of the most important behavioural traits that project managers and other stakeholders need to master to deliver large projects on time in the UAE. Communication in multi-cultural projects is characterised by Diallo and Thuillier *“by how well information circulated among the actors, between the coordinator and the stakeholders, as well as among the members of the project team”* (Diallo & Thuillier 2005, p. 244). Furthermore, communication and cooperation among various stakeholders in a project have been strongly linked to project success (Diallo & Thuillier 2005; Milosevic & Patanakul 2005).

As noted in a study conducted by Condit (1994), Boeing changed its way of communicating in the design of the new B777 aircraft as customers were involved in real-time design meetings, which allowed the company to get immediate customer feedback and thus develop the project quickly. In addition to the customers, mechanics and other contributing end-users were also present. This meant that their feedback could be captured as well, which would help to ensure that the design avoided any misunderstandings or communication gaps. Having this communication enriches the relationships with final users, makes the delivery of such a project smooth and also ensures satisfaction among the project's stakeholders.

Lester (2007) has also recognised the importance of communication in projects and the informal opportunity that is given to the project manager and related stakeholders to en-

rich their relationship and build a true relationship that will result in valuable project outcomes and satisfactions. Others have developed close communication and trust relationships between the operation team and the project team, which has helped to successfully start the operation of a newly completed asset (Al-Bidaiwi et al. 2012).

In a study conducted by Yang et al. (2011) that investigated the impact of the project manager's competencies such as leadership, teamwork on project success, the findings suggest that stronger team communication is highly correlated with project success among other factors, such as collaboration and team cohesiveness. Similarly, Artto et al. (2015) discussed an initiative that was undertaken to enhance rich communication among different operational organisations, which resulted in many collaborative activities that led to successful operations of the newly developed facility.

3.5.8 Operational Trials/Simulation

According to the project management literature, a commissioning stage is needed for systems and large equipment to ensure their functionality. However, the commissioning plans are usually run by the manufacturer's staff and project team and sometimes witnessed by the final users and maintainer of the equipment and assets (Tribe & Johnson 2008) as per contractual agreements. Infrastructure projects such as airports require an operational trial or simulation that involves the final staff (as recruited), newly produced operational plans and procedures for this newly constructed facility, as well as the functionality of the systems and assets. Running operational trials will ensure adequate transfer of tacit knowledge and the proof of the effectiveness of training, as well as allow the facility to be tested with final users in real scenarios before it is introduced to its public customers. In the United States, a newly constructed children's hospital was operationally

simulated and trialled by Ventre et al. (2014), which resulted in the identification of many operational deficiencies that needed to be corrected before the official opening of the hospital to avoid medical mistakes and legal cases.

When conducting operational trials of newly completed projects and systems, all of the related components of the operations need to be ready and available (Lenfle & Loch 2010). This is an area that will allow this research to contribute to the field of operations theory and planning, as well as add to the phases of project management theory, as it is not included in the existing planning and management skills of these projects.

Artto et al. (2015) focused on scenario building and the simulation of possible operational needs and requirements of the different operational aspects of an organisation at an early stage of the project and simulated the scenarios before the operations phase. They elaborated on this by recommending the future project management scope to be expanded to include operational simulations and experiments:

“... This suggestion means that the scope of the project management function should be expanded in future projects: for example, future project management could include simulation exercises focused on the dynamics of the operations phase and related interactions between multiple businesses in order to reach decisions on ideal value-enhancing designs for each multi-organizational system and the capital element” (Artto et al. 2015, p. 10).

3.5.9 Stakeholder’s Commitment

Unless the project’s stakeholders commit their values and goals to the project, the chances of project completion and success will vanish. Andersen et al. (2006) indicated that early stakeholder engagement is needed to secure stakeholder commitment, which is important

to the success of the project. It is identified as one of the two factors that impact project success along with rich project communications. Stakeholder commitment has also received considerable attention from project management organisations, such as the Project Management Institution (PMI), which features it in their guide to navigating project management complexity (PMI 2014). They elaborated further on the difficulties in achieving project success without stakeholder commitment, which will vary depending on the stakeholders' roles and responsibilities.

In a large oil and gas project, Al-bidaiwi et al. (2012) indicated that the operations team management's commitment was an important step in the delivery and operation of the plant. And elaborated that, “...*a dedicated workforce from operations developed close working relations with projects and contractor staff, which promoted team work and helped in the successful start-up of Gas Recycling Plant*” (Al-bidaiwi et al. 2012, p. 8). Within the same industry, Nossair et al.'s (2012) asserted that the operational team has formed committees that are accountable to the operators, and have the relevant knowledge and experience to support the readiness for the operations of a new facility.

In conclusion of this section, the operational readiness factors identified from the literature was mapped to existing project management/operations management practices as shown in **Figure (14)**, to help us better understand how we can conceptualise operational readiness within the context of project/operations management for this research.

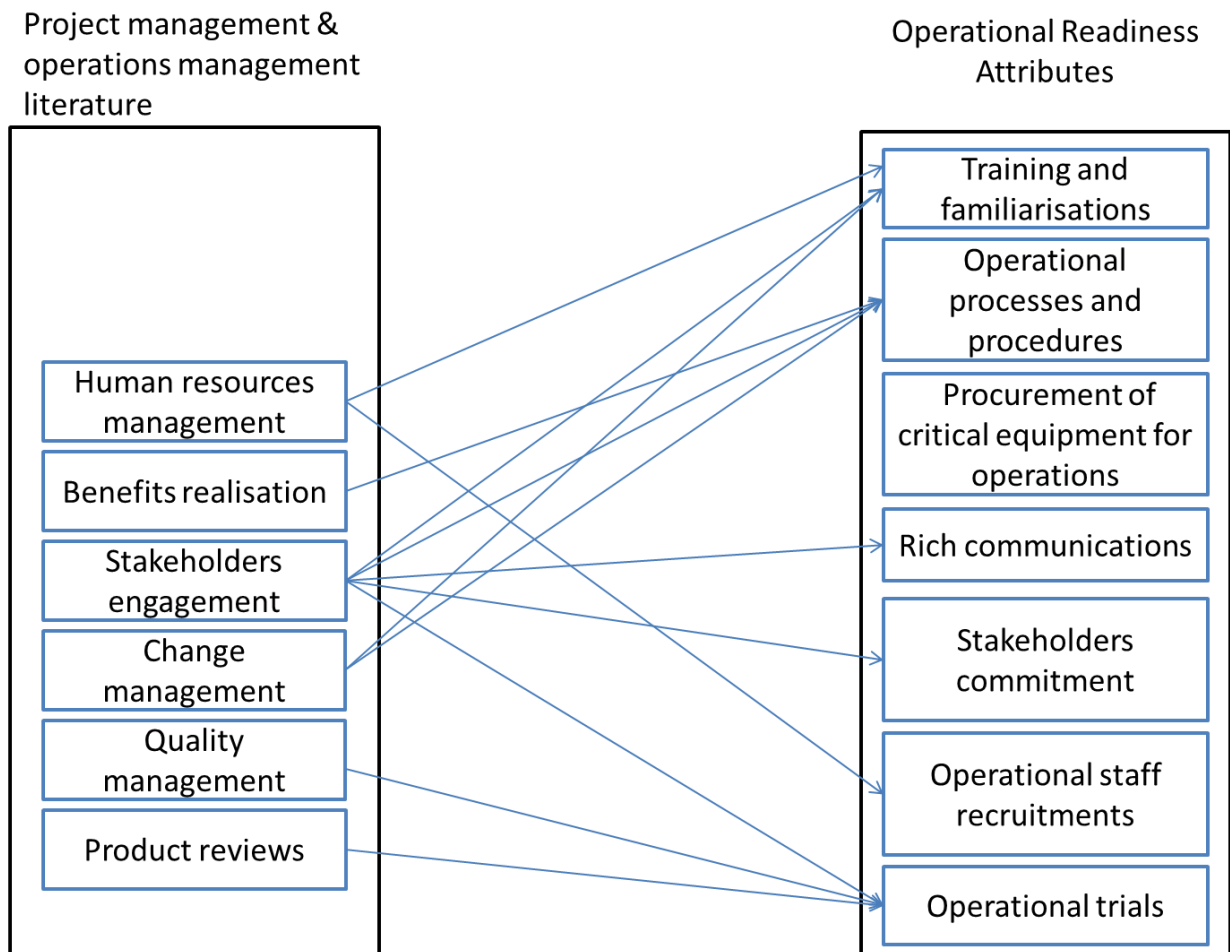


Figure (14) Mapping of operational readiness’s enablers to project management attributes.

3.6 Categorizations of the Operational Readiness Key Factors/Elements

All the factors and critical elements of operational readiness in section 3.5 have been extracted from the current academic and industrial literature. These factors have also been adopted from different readiness models and frameworks (Armenakis et al. 1993; Reymann 2003; Susanto 2008; Tribe & Johnson 2008; Rai et al. 2010; Al Khouri 2011; Potnis & Pardo 2011; Reinwald & Kraemmergaard 2012; Haron 2013; Ramasesh & Browning 2014). The readiness factors can be regrouped into four categories adopted

from the existing categorization in the literature, such as (Kingston et al. 2007; Nossair et al. 2012; Lou & Goulding 2010; Gardner 2001; Lyons & Powell 2010; NHS Ayrshire & Arran 2012; Racine & Mitchell 1990; Wilson et al. 2004) and mainly from (Krauss 2014) as guided by **Figure (15)**.

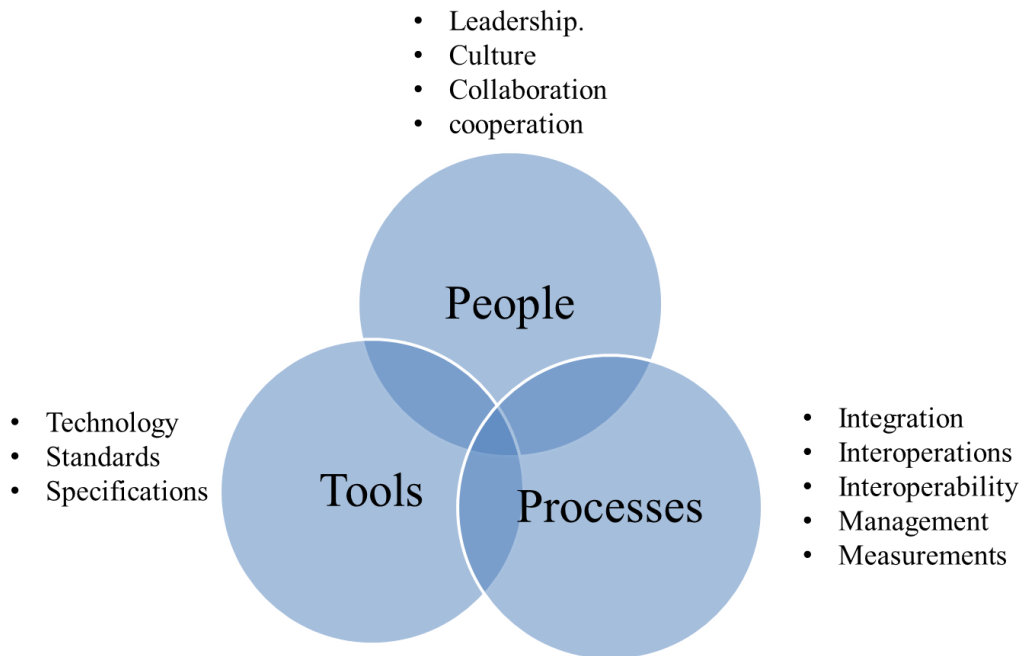


Figure (15) Delivery model building blocks (Krauss 2014).

The delivery model building blocks by (Krauss 2014) has been provided to investigate how operational readiness elements can assist organisations in asset management after project completion. For this study, airport projects operational readiness before opening for official operation is being investigated. Additionally, this study seeks to enhance this model by adding the physical facilities and asset as part of the main factors of readiness, which is also supported by the Idaho engineering lab analytical tree of the operational readiness of engineering and construction industrial facilities as shown in **Figure (16)**.

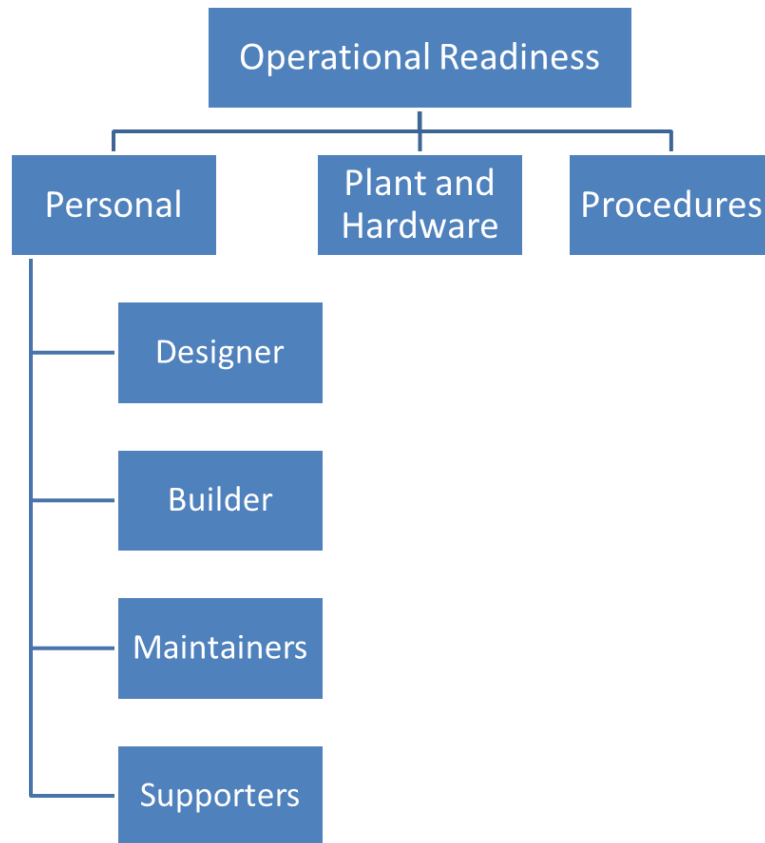


Figure (16) Operational readiness analytical tree (Idaho National Engineering Laboratory 1987).

This study also acknowledges the categorization of readiness from others, such as Gardner (2001) who adopted facilities, technology, people, and processes as the main categories for the operational readiness assessment for new projects. Because this research focuses on airport projects, this study will adopt the approaches of Quilty (2003) who used personal, equipment/technology, facilities, and procedures as the readiness categories for airports. The results indicate four main categories/factors that will be assessed in this study as shown in **Figure (17)**.

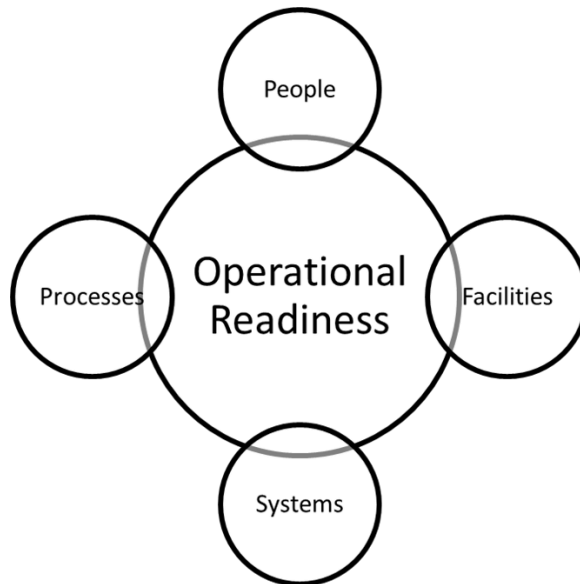


Figure (17) The main factors of operational readiness.

The categorization will result in further segregation of the elements of these categories of people, processes, facility, and systems and expand the list from the literature as shown in **Table (12)**.

Table (12) Operational readiness factors categories.

Items		Source
1	Training employee for new systems on the project	(Gardner 2001, p. 4) (Jones et al. 2005, p. 365) (Holt et al. 2007, p. 316) (Kingston et al. 2007, p. 4) (Lou & Goulding 2010, p. 182) (Torlutter et al. 2012, p. 7) (Nossair et al. 2012, p. 5) (Rafferty et al. 2012, p. 123) (Parr & Cudworth 2013, p. 9) (Kwong et al. 2013, p. 8) (Brereton & Papp 2013, p. 600)

		(Haron 2013, p. 50) (Ventre et al. 2014, p. 108) (Emerson 2014a, p. 5) (Main et al. 2015, p. 1884) (Del et al. 2015, p. 5193) (Ram & Corkindale 2015, p. 30)
2	Training employee on the organisation's new process and procedures	(Gardner 2001, p. 4) (Jones et al. 2005, p. 365) (Holt et al. 2007, p. 316) (Kingston et al. 2007, p. 4) (Susanto 2008, p. 55) (Lou & Goulding 2010, p. 191) (Torlutter et al. 2012, p. 7) (Nossair et al. 2012, p. 5) (Rafferty et al. 2012, p. 123) (Parr & Cudworth 2013, p. 9) (Kwong et al. 2013, p. 10) (Brereton & Papp 2013, p. 600) (Haron 2013, p. 50) (Ventre et al. 2014, p. 108) (Emerson 2014a, p. 5) (Main et al. 2015, p. 1884) (Del et al. 2015, p. 5193) (Ram & Corkindale 2015, p. 30)
3	Familiarisation on the new organisation's operational areas and facilities	(Lou & Goulding 2010, p. 191) (Nossair et al. 2012, p. 5) (Haron 2013, p. 86) (Brereton & Papp 2013, p. 602) (Ventre et al. 2014, p. 109) (Emerson 2014a, p. 4)
4	Recruitments of new operations staff for the project	(Gardner 2001, p. 2) (Lou & Goulding 2010, p. 191) (Nossair et al. 2012, p. 5) (Kwong et al. 2013, p. 3) (Brereton & Papp 2013, p. 603) (Emerson 2014a, p. 5) (Ventre et al. 2014, p. 107) (Del et al. 2015, p. 5196)

5	Recruitments of new maintenance staff for the project	(Gardner 2001, p. 2) (Nossair et al. 2012, p. 5) (Brereton & Papp 2013, p. 603) (Emerson 2014a, p. 5) (Ventre et al. 2014, p. 107) (Del et al. 2015, p. 5196)
6	Operability review and experimental learning trials (staff competency and readiness)	(Kingston et al. 2007, p. 2) (Brereton & Papp 2013, p. 603) (Parr & Cudworth 2013, p. 7) (Del et al. 2015, p. 5196)
7	Stakeholder's management commitments towards operational readiness plan and execution	(Gardner 2001, p. 3) (Helfrich et al. 2011, p. 3) (Nossair et al. 2012, p. 1) (Parr & Cudworth 2013, p. 7) (Haron 2013, p. 136) (Stevens 2013, p. 2) (Federal Network Resilience 2015, p. 3) (Ram & Corkindale 2015, p. 30)
8	Management willing to commit the necessary resources and make operational readiness implementation a high priority	(Gardner 2001, p. 2) (Holt et al. 2007, p. 21) (Susanto 2008, p. 54) (Lou & Goulding 2010, p. 191) (Helfrich et al. 2011, p. 3) (Rafferty et al. 2012, p. 113) (Nossair et al. 2012, p. 1) (Parr & Cudworth 2013, p. 7) (Brereton & Papp 2013, p. 600) (Kwong et al. 2013, p. 6) (Federal Network Resilience 2015, p. 3) (Ram & Corkindale 2015, p. 30)
9	Motivating employees to participate in operational readiness activities	(Gardner 2001, p. 3) (Jones et al. 2005, p. 367) (Susanto 2008, p. 54) (Lou & Goulding 2010, p. 191) (Helfrich et al. 2011, p. 3) (Rafferty et al. 2012, p. 116) (Kwong et al. 2013, p. 6)

		(Haron 2013, p. 136) (Main et al. 2015, p. 1885)
10	Adequate resources to facilitate and support operational readiness implementation	(Susanto 2008, p. 54) (Lou & Goulding 2010, p. 191) (Helfrich et al. 2011, p. 3) (Nossair et al. 2012, p. 3) (Brereton & Papp 2013, p. 602) (Haron 2013, p. 139) (Federal Network Resilience 2015, p.3) (Ram & Corkindale 2015, p. 30)
11	Continuous on-the-job training to improve skill and confident level	(Lou & Goulding 2010, p. 191) (Haron 2013, p. 139) (Kwong et al. 2013, p. 6)
12	Availability of dedicated operational readiness and project delivery team	(Helfrich et al. 2011, p. 3) (Nossair et al. 2012, p. 3) (Brereton & Papp 2013, p. 600)
13	Utilisation of experienced practitioner from all functional teams is vital	(Nossair et al. 2012, p. 3) (Brereton & Papp 2013, p. 597)
14	Update organisational structure to include the new asset operation	(Emerson 2014a, p. 2) (Ram & Corkindale 2015, p. 30)
15	Forming of positive attitudes towards the new change	(Ram & Corkindale 2015, p. 30)
1	Completion of organisation's operational procedures documentation and certifications	(Kingston et al. 2007, p. 1) (Nossair et al. 2012, p. 15) (Brereton & Papp 2013, p. 598) (Emerson 2014a, p. 4) (Ventre et al. 2014, p. 108) (Ahmadi et al. 2015, p. 91) (Ram & Corkindale 2015, p. 30)
2	Updating current processes and procedure to adopt new systems and facility	(Kingston et al. 2007, p. 4) (Lou & Goulding 2010, p. 191) (Nossair et al. 2012, p. 13) (Brereton & Papp 2013, p. 598) (Ventre et al. 2014, p. 108) (Federal Network Resilience 2015, p .5) (Ram & Corkindale 2015, p. 34)

3	Effective communication plan and process to all stakeholders	(Gardner 2001, p. 5) (Lou & Goulding 2010, p. 191) (Rafferty et al. 2012, p. 121) (Parr & Cudworth 2013, p. 15) (Haron 2013, p. 140) (Kwong et al. 2013, p. 9) (Ventre et al. 2014, p. 104) (Del et al. 2015, p. 5196) (Ram & Corkindale 2015, p. 30)
4	Operability review and experimental learning trials (processes readiness)	(Gardner 2001, p. 4) (Kingston et al. 2007, p. 2) (Nossair et al. 2012, p. 11) (Parr & Cudworth 2013, p. 9) (Brereton & Papp 2013, p. 602) (Emerson 2014a, p. 4) (Ventre et al. 2014, p. 104)
5	Customers' (users') participation in the development process	(Gardner 2001, p. 4) (Helfrich et al. 2011, p. 3) (Nossair et al. 2012, p. 11) (Rafferty et al. 2012, p. 121) (Parr & Cudworth 2013, p. 8) (Brereton & Papp 2013, p. 603) (Ventre et al. 2014, p. 104) (Emerson 2014a, p. 3)
6	Availability and updating business plans	(Gardner 2001, p. 7) (Lou & Goulding 2010, p. 191) (Nossair et al. 2012, p. 12) (Emerson 2014a, p. 5)
7	Developer's preparation plan to turn the project to its final users	(Gardner 2001, p. 4) (Helfrich et al. 2011, p. 2) (Nossair et al. 2012, p. 3) (Rafferty et al. 2012, p. 111) (Parr & Cudworth 2013, p. 5) (Brereton & Papp 2013, p. 598) (Emerson 2014a, p.7)
8	HSE plan readiness	(Nossair et al. 2012, p. 5) (Brereton & Papp 2013, p. 600) (Ventre et al. 2014, p. 105)

		(Emerson 2014a, p. 6)
9	Maintenance plan readiness	(Torlutter et al. 2012, p. 7) (Nossair et al. 2012, p. 5) (Brereton & Papp 2013, p. 600) (Emerson Reliability Consulting 2014, p. 8)
10	Availability of logistics plan for people to the new facility	(Nossair et al. 2012, p. 5) (Kwong et al. 2013, p. 9) (Brereton & Papp 2013, p. 601) (Ventre et al. 2014, p. 108) (Emerson 2014a, p. 7)
11	Availability of logistics plan for waste to the new facility	(Nossair et al. 2012, p. 5) (Brereton & Papp 2013, p. 601)
12	Availability of logistics plan for materials and operational supplies to the new facility	(Nossair et al. 2012, p. 5) (Torlutter et al. 2012, p. 7) (Brereton & Papp 2013, p. 601) (Ventre et al. 2014, p. 109) (Emerson 2014a, p. 7)
13	Availability of fire evacuation plan for the new facility and assets	(Nossair et al. 2012, p. 5) (Brereton & Papp 2013, p. 598) (Emerson Reliability Consulting 2014, p. 6)
14	Asset operations plan readiness	(Gardner 2001, p. 7) (Kingston et al. 2007, p. 4) (Lou & Goulding 2010, p. 191) (Nossair et al. 2012, p. 4) (Brereton & Papp 2013, p. 598) (Emerson Reliability Consulting 2014)
15	Maintenance and operations current contract amendment to new assets and systems	(Torlutter et al. 2012, p. 7) (Nossair et al. 2012, p. 5) (Haron 2013, p. 136) (Emerson Reliability Consulting 2014, p. 8)
16	Clearly defined roles and responsibilities for all the new asset and systems users	(Gardner 2001, p. 7) (Lou & Goulding 2010, p. 190) (Torlutter et al. 2012, p. 9) (Parr & Cudworth 2013, p. 8)

		(Haron 2013, p. 139) (Del et al. 2015, p. 5196)
1 7	Appropriate means to capture knowledge regarding the new facility and systems know-how and lesson learnt	(Lou & Goulding 2010, p. 190) (Parr & Cudworth 2013, p. 12) (Haron 2013, p. 139)
1 8	Well-defined framework to conduct operational readiness assessment and operational gap analysis	(Nossair et al. 2012, p. 3) (Torlutter et al. 2012, p. 6) (Parr & Cudworth 2013, p. 8)
1 9	Availability of legal and insurance coverage for the new assets and operations	(Nossair et al. 2012) (Ram & Corkindale 2015, p. 34)
2 0	Defines the documentation and contractual structure to support the use and execution of external services	(Lou & Goulding 2010, p. 191) (Nossair et al. 2012, p. 5) (Emerson Reliability Consulting 2014, p. 8)
2 1	Define, update, and implement the financial policies, procedures, and systems required to support the new project and ongoing operations	(Gardner 2001, p. 4) (Lou & Goulding 2010, p. 191) (Nossair et al. 2012, p. 5) (Torlutter et al. 2012, p. 7) (Ram & Corkindale 2015, p. 34)
2 2	Continuously measure the operational readiness process performance	(Gardner 2001, p. 4) (Nossair et al. 2012, p. 11) (Parr & Cudworth 2013, p. 15)
2 3	Availability of the quality assurance plans for operations	(Brereton & Papp 2013, p. 602) (Emerson Reliability Consulting 2014, p. 5)
2 4	Availability of risk management and mitigation plan or strategy	(Gardner 2001, p. 4) (Brereton & Papp 2013, p. 604) (Parr & Cudworth 2013, p. 5) (Ventre et al. 2014, p. 103)
2 4	Completion of all national and federal legal certification and authorization	(Torlutter et al. 2012, p. 7)
2 5	Establish suitable ramp up plans for the project	(Torlutter et al. 2012, p. 10)
2 6	Establishing operational readiness reporting and control	(Torlutter et al. 2012, p. 10)
1	Completion of physical building	(Gardner 2001, p. 4) (Torlutter et al. 2012, p. 7)

		(Brereton & Papp 2013, p. 598)
2	Operability review experimental learning trials (facility readiness)	(Kingston et al. 2007, p. 4) (Parr & Cudworth 2013, p. 7) (Emerson Reliability Consulting 2014, p. 6)
3	Completion of the testing and commissioning of the facility	(Kingston et al. 2007, p. 4) (Torlutter et al. 2012, p. 7) (Brereton & Papp 2013, p. 600) (Emerson Reliability Consulting 2014, p. 7)
4	Availability of fire & life safety certification of the building	(Nossair et al. 2012, p. 5) (Brereton & Papp 2013, p. 600)
5	Availability of safety certification of the building	(Emerson Reliability Consulting 2014, p. 6)
6	Facility final documentations readiness	(Nossair et al. 2012, p. 4) (Brereton & Papp 2013, p. 600) (Emerson Reliability Consulting 2014, p. 5)
7	Availability of operational spares for the facility	(Nossair et al. 2012, p. 5) (Emerson Reliability Consulting 2014) (Ventre et al. 2014, p. 108)
8	Completion of commission of all the facilities	(Nossair et al. 2012, p. 5) (Brereton & Papp 2013, p. 600) (Emerson Reliability Consulting 2014)
10	Availability of maintenance contract for the new facilities	(Nossair et al. 2012, p. 5) (Emerson Reliability Consulting 2014, p. 6)
11	Availability of operations contract for the new facilities	(Nossair et al. 2012, p. 4)
12	Development of facility operational risk management	(Emerson Reliability Consulting 2014, p. 4)
13	Facility Master data interface from engineering design to asset management	(Emerson Reliability Consulting 2014, p. 7)
14	Availability of the tools and equipment for the facility maintenance	(Gardner 2001, p. 5) (Emerson Reliability Consulting 2014, p. 8) (Ventre et al. 2014, p. 108)

15	Completion of all the supporting facility for the new asset that includes staff canteens, central utilities and transportation methods	(Torlutter et al. 2012, p. 7)
16	Integrating existing facilities to other existing facilities and resources	(Ram & Corkindale 2015)
1	Systems are tested and ready	(Gardner 2001, p. 5) (Kingston et al. 2007, p. 4) (Torlutter et al. 2012, p. 7) (Brereton & Papp 2013, p. 601) (Emerson Reliability Consulting 2014, p. 4) (Ram & Corkindale 2015)
2	Procurement strategy and critical equipment for operations	(Nossair et al. 2012, p. 5) (Torlutter et al. 2012, p. 7) (Ventre et al. 2014, p. 109) (Emerson Reliability Consulting 2014, p. 8) (Federal Network Resilience 2015, p. 6)
3	Availability of critical system third-party certification	(Nossair et al. 2012, p. 6) (Torlutter et al. 2012, p. 7) (Brereton & Papp 2013, p. 600) (Emerson Reliability Consulting 2014, p. 5)
4	Operability review and experimental learning trials (systems readiness)	(Kingston et al. 2007, p. 4) (Parr & Cudworth 2013, p. 7) (Ventre et al. 2014, p. 104) (Emerson Reliability Consulting 2014, p. 5)
5	Critical system's training conducted	(Nossair et al. 2012, p. 5) (Brereton & Papp 2013, p. 600) (Ventre et al. 2014, p. 108) (Ram & Corkindale 2015, p. 30)
6	Systems documentation readiness	(Nossair et al. 2012, p. 4) (Brereton & Papp 2013, p. 600) (Emerson Reliability Consulting 2014, p. 7)
7	Availability of systems maintenance contract	(Nossair et al. 2012, p. 5)

		(Torlutter et al. 2012, p. 7) (Emerson Reliability Consulting 2014, p. 8)
8	Availability of system critical spares and components	(Nossair et al. 2012, p. 5) (Torlutter et al. 2012, p. 7) (Ventre et al. 2014, p. 108) (Emerson Reliability Consulting 2014, p. 4) (Federal Network Resilience 2015, p. 6)
9	Appropriate means to evaluate the capability of the system vendor in providing services	(Haron 2013, p. 157)
10	Compatibility and interoperability of new software and systems with legacy and business partner's ICT system	(Haron 2013, p. 142) (Ventre et al. 2014, p. 110)
11	Regular review and upgrade of ICT and critical systems to meet changing business needs	(Lou & Goulding 2010, p. 191) (Haron 2013, p. 233) (Ventre et al. 2014, p. 110) (Emerson Reliability Consulting 2014, p. 6)
12	Completion of commissioning activities for all systems	(Nossair et al. 2012, p. 5) (Torlutter et al. 2012, p. 7) (Brereton & Papp 2013, p. 601) (Emerson Reliability Consulting 2014, p. 2) (Ventre et al. 2014, p. 109)
13	Completion of the handover of the systems	(Nossair et al. 2012, p. 5) (Emerson Reliability Consulting 2014, p. 2)
14	Development of systems operational risk management	(Emerson Reliability Consulting 2014, p. 5)
15	Development of an asset and equipment identification strategy	(Emerson Reliability Consulting 2014, p. 6) (Ventre et al. 2014, p. 109)
16	Systems master data interface from engineering design to asset management	(Emerson Reliability Consulting 2014, p. 7)
17	Availability of tools and equipment for the system's maintenance	(Emerson Reliability Consulting 2014, p. 8)

1 8	Completion of all systems integration and interfacing with existing systems	(Lou & Goulding 2010, p. 191) (Brereton & Papp 2013, p. 601) (Ram & Corkindale 2015, p. 30)
1 9	Completion and availability of all ICT and communication infrastructure such as GSM, WI-FI, and RADIO	(Lou & Goulding 2010, p. 191)

The review of the literature has addressed the first research question that this study seeks to investigate, **RQ1**, which was, “**Within the context of project management, what is operational readiness?** Firstly, a detailed and systematic review of operational readiness as a concept has been undertaken along with definitions, classifications and key components in the context of project management. Secondly, literature on the importance of stakeholder’s participation in the early stages and before project completion is provided in detailed. The findings indicate that existing literature regarding operational readiness in the context of project management is sparse, and the adaptation of the concept of operational readiness in project management field is almost rare.

3.7 Developing Operational Readiness Framework

This section outlines the conceptual framework that has been developed from the literature review of the available sources of knowledge in the academic and practitioner literature, as stipulated in previous sections of this study.

3.7.1 Conceptual Framework

According to Imenda (2014), despite the interchangeably utilization of the conceptual and theoretical frameworks in the literature, there are main variable differences such as genesis, purpose, conceptual meaning, process underlying review of literature, methodological approach, and scope of application. Examining these differences, the researchers believe that the conceptual framework most suitable to be utilized in this research should be

mainly qualitative, and deductive, and will gather the main data for the research using statistical surveys.

The need for a conceptual framework stems from its use as navigational devices or maps for practice disciplines in studies concerning complex human behaviours, which required different methods of investigation that reveal causal relationships between variables of the framework (Evans et al. 2011). It is considered maps that can help researchers revisit the study's objectives, which help in exploring extra paths within the framework (Sinclair 2007; Evans et al. 2011). Additionally, it can also be used as the best way to travel, by utilising previous experiences and the accounts of others who have been on similar trips (Sinclair 2007; Evans et al. 2011).

Maxwell refers to a theoretical framework as, “...*the actual ideas and beliefs that you hold about the phenomena studied, whether these are written down or not*” (Maxwell 2011, p. 39). For this reason, the need for a framework for this study is vital. It is primarily a conception or model of what will be the plan to study, and for determining the relationships between the study variables and factors, as well as indicative of where a tentative theory of the phenomena will be explored (Maxwell 2011).

3.7.2 Framework Development

The second aim of this study is to support organisations to ensure that on the first day of operation (after completion and sign off of construction phase), airport services run smoothly. In effect, the study seeks to ensure that airport services and operations do not fail due to poor or inadequate ‘readiness’. Therefore, the development of an operational readiness framework for airport services is required and can be utilised by operational

consultants working in UAE's large infrastructure project. Specifically for airports projects to help the operations team analyse, evaluate and develop an awareness of their readiness regarding the implementation of airport services (Evans et al. 2011). To develop a framework for operational readiness based on theory and practice, the guiding research questions to be answered in this study are:

RQ2: How do scholars and practitioners perceive operational readiness and contributing factors?

RQ3: What is the relationship between operational readiness and project success?

The framework in this research has been drawn from the literature and theories relating to the fields of project management theory, stakeholder management, operations management and organisations, organisational communication, organisational behaviour, and other industrial and practitioner literature (Maxwell 2011). These fields of study have been identified through an electronic database search of scholarly literature, as well as the available books and bodies of knowledge. The initial review of the literature began with an examination of publications that discussed the concept of operational readiness and how it existed. The review process was then narrowed down to publications that referred specifically to operational readiness in large infrastructure projects in general and in airports particularly. Some of the operational readiness concepts and models considered during the review included facilities readiness, people readiness, system/technology readiness, and organisations/processes readiness. The process of analysis and synthesis followed the initial broad review of relevant literature. Operational readiness-enabling factors related to this research, which emerged from the literature were then synthesised to form a conceptual framework.

The synthesising process focused on capturing the main ideas and repeated enabling factors related to operational readiness. The process revealed important ideas generated by several fields of study about readiness in general, as well as operational readiness in different organisations and industries. The framework presented in this research is an attempt to consolidate all the literature information about operational readiness factors into one whole model, to provide a comprehensive approach to understanding the operational readiness phenomenon in large infrastructure projects. The framework also proposes relationships between the different enabling factors for operational readiness identified from the literature and project success criteria, which was selected based on Lim and Mohamed's (1999) graphic representation of the criteria, factors and project success as shown in **Figure (18)**. Additionally, the framework adopted the criteria of project success for buildings, such as airports in as the context of this research based on Bryde's (2008) measurement for project success.

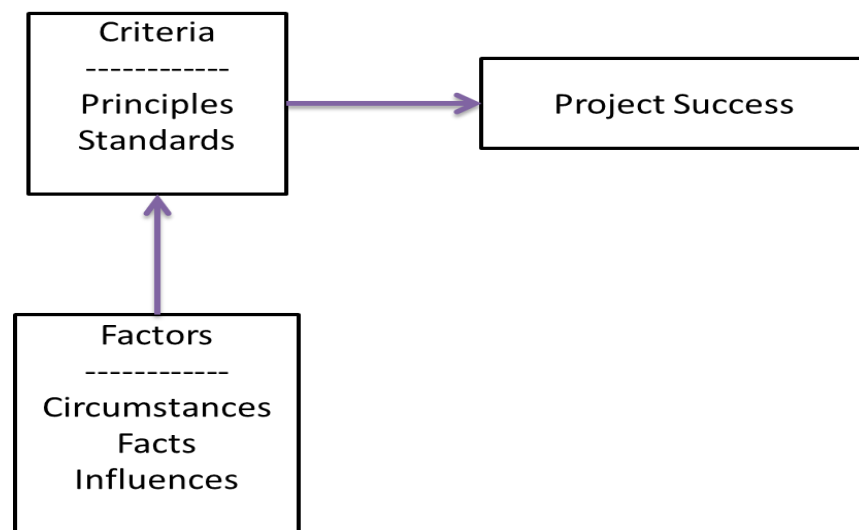


Figure (18) Graphic representation of the criteria and factors (Lim & Mohamed 1999).

The selection for Lim & Mohamed (1999) is based on their examination of the macro (external factors) and micro (internal factors) that determine the failure or success criteria.

As this study will heavily concentrate on the perceptions of failure or success accepted by all the project stakeholders inclusive of the project team, clients, end-users, and so on. The framework has incorporated critical enabling factors categories of operational readiness that have been identified earlier in the literature, such as:

- **Facility Readiness** ((Gardner 2001; Wilson et al. 2004; Hickey 2008; Lyons & Powell 2010; Nossair et al. 2012; Brereton & Papp 2013; Krauss 2014; Kidd & Howe 2014),
- **People Readiness** (Mumford 1976; Gardner 2001; Dvir 2005; Kingston et al. 2007; Deloitte 2011; Brereton & Papp 2013; Kidd & Howe 2014; Ventre et al. 2014; Verhoeff et al. 2015), which includes in it sub-elements, such as training and familiarisation (Cova et al. 2004; Bryde 2008; Havila & Salmi 2008; Heinemann & Killcross 2012), project/stakeholder commitments (Andersen et al. 2006; PMI 2014), and the hiring of operational staff (Morris 1989).
- **System/Technology Readiness** (Gardner 2001; Cosenzo et al. 2007; Kingston et al. 2007; Deloitte 2011; Brereton & Papp 2013; Emerson Reliability Consulting 2014; Del et al. 2015), which includes in it sub-elements, such as procurement cooperation (Kumaraswamy et al. 2004; Lester 2006; Kong & Gray 2006; Baiden et al. 2006; Tysseland 2008; Pesämaa et al. 2009; IPMA 2012).
- **Organization/Processes Readiness** (Dvir 2005; Weiner 2009; Laine 2012; Brereton & Papp 2013; Kidd & Howe 2014; Ahmadi et al. 2015), which includes in it sub-elements, such as operational processes and procedures (Association for Project Management 2006; Tribe & Johnson 2008; Brereton & Papp 2013), rich communication (Condit 1994; Diallo & Thuillier 2005; Milosevic & Patanakul

2005; Lester 2007; Cerimagic 2010; Rees-Caldwell & Pinnington 2013), and operational trials/simulations (Tribe & Johnson 2008).

- **Project success** (Bryde 2008). The project success criteria include a smoother start-up of the project (Morris 1989; Carlos & Khang 2009; Mohd Zin & Egbu 2009), stakeholder satisfaction (McKeen et al. 1994; Cova et al. 2004; Collins & Baccarini 2004; Li et al. 2013), and a quick return on investment (Munns & Bjeirmi 1996; Tribe & Johnson 2008; Müller 2012), which will be achieved by building trust, creating competency, ensuring operational continuity, and minimising the exposures to health, safety and environmental (HSE) risks.

The framework suggests that conducting these factors of operational readiness during the project life cycle in parallel with other project phases (such as design, construction and commissioning) will have an impact on project success (Dvir 2005).

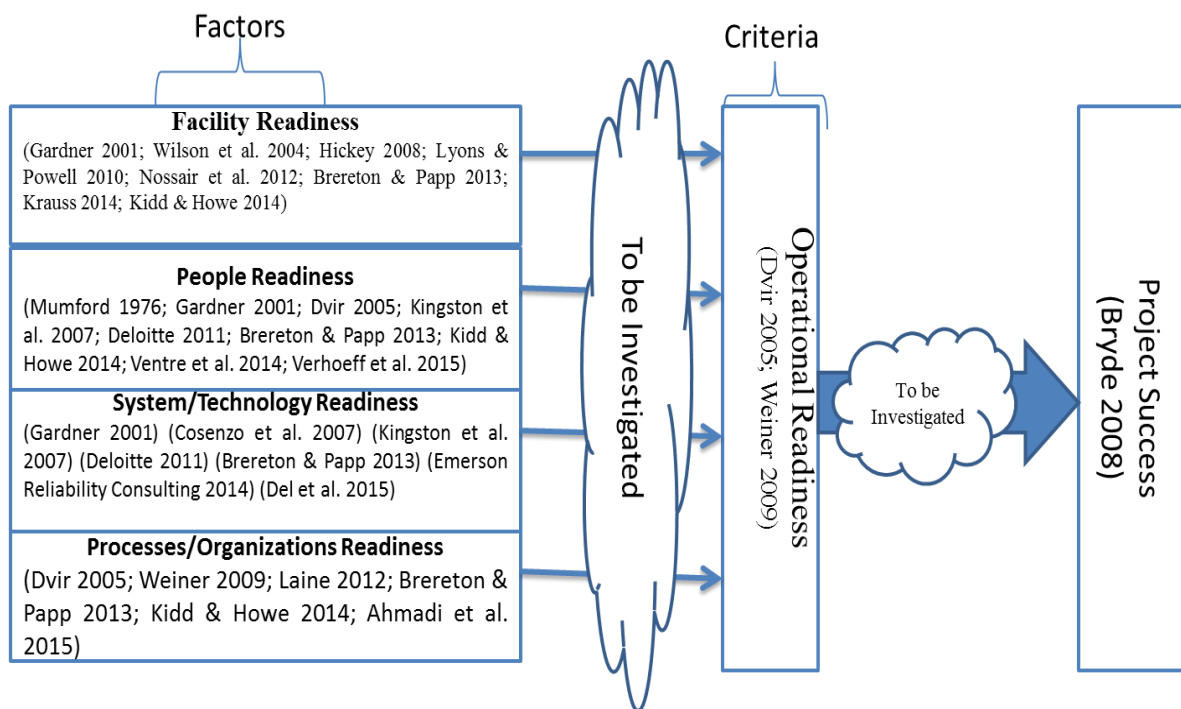


Figure (19) Operational readiness conceptual framework.

The operational readiness conceptual framework developed in **Figure (19)** suggests that facility readiness, people readiness, system/technology readiness and organisation/processes readiness are categories and enabling factors of operational readiness. The framework also suggests a relationship between operational readiness and project success. While some of these relationships are apparent in the literature, others are being proposed in this research to explore further the interaction between the primary factors that influence operational readiness in large infrastructure projects and project success. Based on the conceptual model for this study, research hypothesis is suggested for guide the investigation as shown in **Figure (20)**.

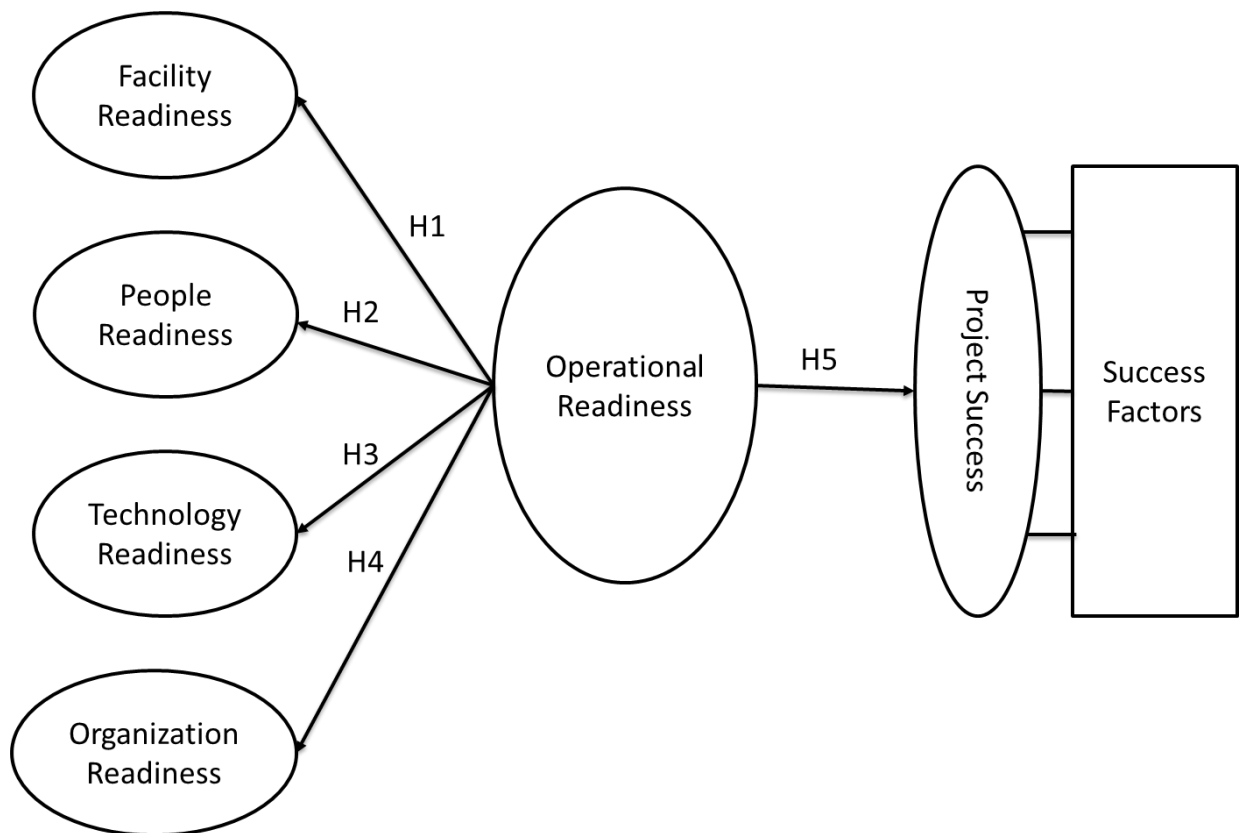


Figure (20) Hypothesised relations between the operational readiness variables and project success.

Hypothesis # 1: Facility readiness's factors positively correlated with operational readiness.

Hypothesis # 2: People readiness's factors positively correlated with operational readiness.

Hypothesis # 3: Technology readiness's factors positively correlated with operational readiness.

Hypothesis # 4: Organization readiness's factors positively correlated with operational readiness.

Hypothesis # 5: Operational readiness positively influences project success.

3.8 Summary

This chapter has addressed the concept of operational readiness, presented an articulation of the operational readiness terminology, definition and classification of the models in different industries, as well as the key elements and factors of operational readiness has been extracted from the academic and industrial literature, which are relevant areas of this research. Firstly, the definition and articulation of the concept were carried out to explain and position operational readiness within the context of project management. Subsequently, the classification of different operational and assurance readiness models were extracted from the available literature. Finally, operational readiness factors and elements that have been extracted from the existing models, as well as that were available in the literature from academics, and industrial practitioners were grouped based on their common characteristics for easy referencing and researching. In this chapter, a conceptual framework has been proposed, and it will be used in this study to guide the researcher in

selecting an appropriate research inquiry and methods to develop the research questionnaires. It sets out the area of exploration for this research scope to investigate the operational readiness factors presented in this study. The approach for the selection of the operational readiness factors and project success criteria have been discussed and demonstrated in this chapter, as well as how these have been integrated into the final conceptual framework.

Chapter 4

The Research Design and Methodology

4.1 Introduction

This chapter explores and discusses both the philosophical and methodological forms of the research design, as well as the processes associated with the current mixed-method study. This chapter also articulates what systematic approach was adopted in obtaining

and confirming new and reliable knowledge. This chapter presents a detailed discussion on the research's process design, philosophy and the justification for its selection, approach and the justification for its use, the strategy of inquiry, design, methods used to collect and analyse the data.

First, this chapter presents a review of the research's aims and objectives that have been developed in chapter 1. Second, a detailed discussion of the research process design is presented, which explains the procedures for collecting, analysing, interpreting and reporting the data. Third, a discussion of the research philosophy will then be presented, where necessary assumptions regarding the ways in which a researcher views the world and the selection of the research philosophy for this study will be drawn.

Next, the research approach chosen for this study will be discussed, which also guides the research strategy (Creswell & Clark 2007), as well as the methods used to collect the required data (Thomas 2004). Moreover, we will also address the fundamental concept of mixed-method research and its utilisation in helping to explain the phenomenon of operational readiness and the relationships between relevant variables.

The study will employ the use of a mixed-methods approach (triangulation) comprising of a focus group firstly to discuss and select the categorization and elements of assessment of operational readiness factors for airports, based on common elements drawn from literature, which was conducted (enabling the design of a survey instrument). The second step of the methodology will be to administer a survey questionnaire among all the airport project's stakeholders working across four international airports based in the United Arab Emirates (Dubai International Airport, Al-Maktoum International Airport-Dubai, Abu

Dhabi International Airport and Sharjah International Airport). The two stages of the research are fully discussed in the research methods sections, along with the reliability, validity and ethical considerations of the research. At the end of this chapter, detailed discussion about statistical tests and analysis of the data that includes validation and reliability and the ethical consideration of this research will also be presented.

Therefore, the purpose of this research is to have a better understanding of the ‘*operational readiness*’ factors related to projects and operational readiness impact on project success. The finding of the research will be compared with the theoretical perspective that requires knowledge of both theoretical grounds of the research, as well as a detailed view of the stakeholders in the large infrastructure projects such as airports. This will increase our understanding of the operational readiness actuality, which in turn will be able to bridge the gap between project management theory and practice by highlighting project management and operational readiness aspects that need to be assessed. The ground above is important in deciding the suitable research design and selection of methods for this study.

This research will focus on the following hypothesis and all the research design and methodology will be selected to help answer these hypothesis:

Hypothesis # 1: Facility readiness’s factors positively correlated with operational readiness.

Hypothesis # 2: People readiness’s factors positively correlated with operational readiness.

Hypothesis # 3: Technology readiness’s factors positively correlated with operational readiness.

Hypothesis # 4: Organization readiness's factors positively correlated with operational readiness.

Hypothesis # 5: Operational readiness positively influences project success.

4.2 Research Approach

As this study is part of the social science research, there are two main philosophical paradigms that are widely used in this field, namely *Interpretivism* and positivism (Mangan et al. 2004; Biedenbach & Müller 2011). The first explains the phenomenon using qualitative inductive methods, while the second uses a quantitative deductive method to test the research's hypothesis for generalisation (Smyth & Morris 2007; Scotland 2012).

Interpretivism paradigm: also referred to as phenomenological, qualitative, subjectivist, humanistic, interpretive/hermeneutic, and it is inductive in nature (Holden & Lynch 2004). This paradigm aims to induce ideas from gathering relevant data to increase the researchers understanding of the subject under study. (Wilson 2003).

Positivism paradigm: also, known as quantitative, social constructionism, objectivist, scientific, experimentalist, traditionalist, and it is deductive in nature. Project management researches are dominated by positivism (Biedenbach & Müller 2011), where it aims to identify universal rules using quantitative methods to achieve objectivity.

It is to be noted that Saunders et al. (2009) & Biedenbach & Müller (2011) suggested that in practical reality, the research infrequently falls into one philosophical paradigm. In particular, the research in management and project management often uses both interpretivism and positivist paradigms at the same time. This is beneficial as valuable outcomes

will be generated when using the two paradigms appropriately, and it is not considered weakness for such research (Cameron et al. 2015).

Examining the above explanations of the two paradigms, and based on the research's problem and objectives stated earlier in Chapter 1, interpretivism and positivism paradigms seem to fit this research. This study is trying to first understand and identify the operational readiness factors and items in airport's projects with respect to the project's actuality. However, due to the shortage of objectivity in conducting interpretivism research methods, the need to adopt a positivist approach is deemed necessary. In view of the above reasons for the research, the best fit for this research is therefore to employ the use of the two philosophies, as there will be an investigation of the relationship of operational readiness factors and project success that are tested using quantitative methods, in addition to ideas and more readiness factors that will be developed and explored using the inductive approach (Joslin & Müller 2015).

The approach and design of the quantitative and qualitative research differ regarding their epistemological, theoretical and methodological underpinnings (Yilmaz 2013), which will be discussed further.

Qualitative research: according to Collis and Hussey, it is “... *a subjective approach which includes examining and reflecting on perceptions in order to gain an understanding of social and human activities*” (Collis & Hussey 1997, p. 20). The qualitative research approach is used to understand a subject's lived experience to be able to further analysis the research phenomenon (Ghauri & Gronhaug 2002).

Quantitative research: emphasis on collecting numerical data and analysing them statistically, which is objective in nature, where scales and ranges of the items and factors

along with the frequency of the phenomena are the main concentration of this approach (Carr 1994).

The qualitative approach will be used to explore and identify operational readiness factor's items by the selected practitioners that may not have been captured in the literature review, whereas, the quantitative approach has been used to investigate the operational readiness factors relationships and further understand the relationship between operational readiness and project success using statistical methods and analysis. An advantage of utilising mixed-method approach in the research is the validating of the results from both approaches through triangulation (Joslin & Muller 2016).

Research methodology scholars identified two major types of multiple methods research (Venkatesh et al. 2013): (1) mixed methods research, which is the focus of the current study; and (2) multi-method research.

Tashakkori & Teddlie define mixed-method research as, “*a type of research design in which QUAL [qualitative] and QUAN [quantitative] approaches are used in types of questions, research methods, data collection and analysis procedures and/ or inferences*” (Tashakkori & Teddlie 2003, p.711). It was later defined by Johnson and Onwuegbuzie as “*the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study*” Johnson & Onwuegbuzie (2004, p.17). Though, it can be noted here the use of two approaches to the same study is different from multi-method as it uses two different data collection method from the same approach (Cameron et al. 2015).

There are many types of mixed methods available for use by the researchers. Lisle (2011) discussed three types of mixed methods research: qualitative dominant, pure mixed, and

quantitative dominant. Venkatesh et al. (2013) have further elaborated on the types of mixed method designs and provided discussions for four major types:

- 1) **Triangulation**, where qualitative and quantitative data merges to understand a research problem.
- 2) **Embedded**, where either qualitative or quantitative data is use to answer a research question within a largely quantitative or qualitative study.
- 3) **Explanatory**, where qualitative data is use to help explain quantitative results.
- 4) **Exploratory**, where the collected quantitative data is used to test and explain a relationship found in qualitative data.

While there are others, who have also provided additional mixed method typologies for the research design. A key characteristic of mixed methods is the sequential or concurrent combination of quantitative and qualitative methods (Terrell 2012) (e.g., data collection, analysis and presentation) within a single research inquiry as is the case for this study. This study adopted an exploratory sequential design based on Creswell & Clark's (2007) typologies for mixed methods that provided a prototypical version of six major mixed methods research designs as shown in **Figure (21)** below.

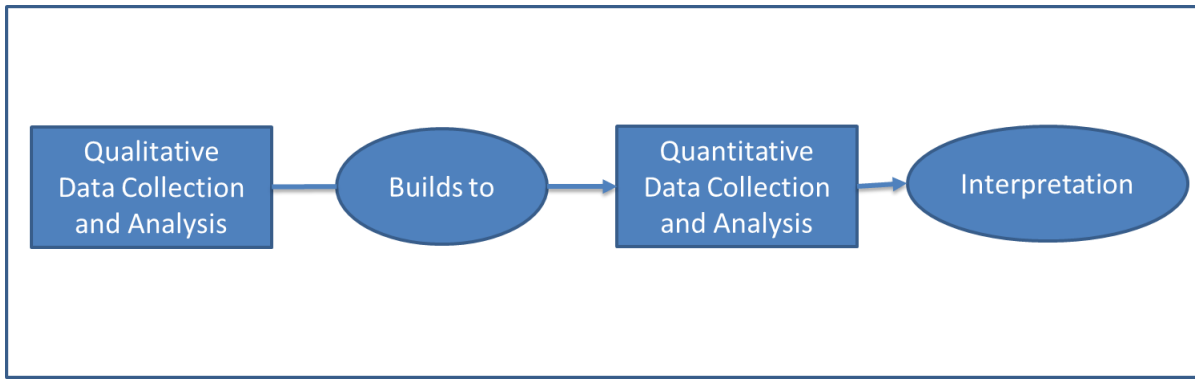


Figure (21) Exploratory sequential mixed design.

This research is exploratory in nature to assist in answering the research questions that address the “what” and “how”. According to (Creswell 1994; Crouch & McKenzie 2006; Archibald & Radil 2015), these categories of research questions can be classified as qualitative. The expected result of this process is a list of critical operational readiness elements, specifically for the airport's projects and operations, which is finalised and formulated into a questionnaire as the quantitative aspect of this study. The questionnaire will be sent out to the stakeholders of four airports in the UAE. These stakeholders will be the research participants, and they will provide their perceptions on each element in its category, and their perception of the project success of the same projects on their professional judgment. The questionnaire will employ the use of a Likert-type scale, where the respondents will be asked to agree with a list of statements, where 1 = strongly disagree, 2 = disagree, 3 = neither, 4 = agree, and 5 = strongly agree.

We note that the researcher can use different methods in the study to serve different purposes. In this current study, we utilise focus group as an inductive approach to investigate and confirm the list of the main operational readiness's items for airport projects developed from the literature. This is followed by the questionnaire as a deductive approach to investigate relationships between operational readiness and project success. The same has

been illustrated as shown in the research process design of this study in **Figure (23)**. The next section will provide a brief description and a discussion of the various research methods available and reasons for their selection to be used in this research study.

As this research is part of project management/operations management studies, we adopted a survey strategy (Westbrook 1995; Whybark 1997; Malhotra & Grover 1998; Forza 2002) from the available strategies for researchers, and the justification for the chosen survey strategy will be explained in the following sub-sections. The selection of the survey research strategy was based on the recommendation of Collins and Baccarini (2004) who used the survey strategy to provide empirical data on the subject of project success criteria, with a combination of qualitative and quantitative research methodologies. Additionally, Holt et al. (2007) also used the survey strategy to develop and evaluate an instrument to gauge organisation's readiness for change using a mixed method design. In this current study, the development of a readiness framework is one of the objectives of this study, which has motivated the use of such strategy.

To conclude, for this research as a project management study, there are many types of mixed methods typologies in the literature (Cameron et al. 2015). For instance, Tashakkori & Teddlie (2003) developed a four-dimensional typology for social sciences researchers, and these are Triangulation Design, the Embedded Design, the Explanatory Design, and the Exploratory Design. In this study, we drew upon earlier works of Bentahar & Cameron (2015) who used an exploratory sequential mixed methodological process design for a project management research as seen in **Figure (22)**.

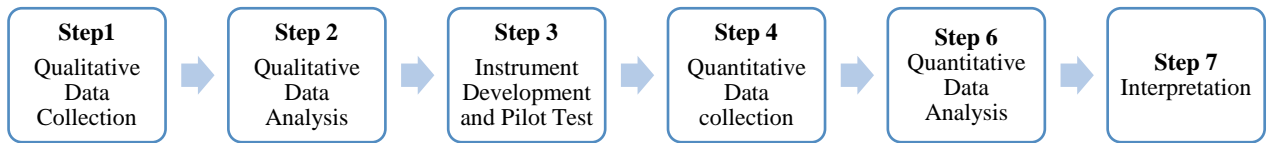


Figure (22) Exploratory sequential mixed method design

This study is divided into two major phases. The first phase is the qualitative phase, which is an exploratory phase where a focus group for the assessment and selection of operational readiness items drawn from the literature was undertaken, and the data was analysed to enable the design of a survey instrument for the second phase. The main outcome of this phase was to have a pragmatic perception of the project and to confirm the selected operational factor's items, which have been shortlisted from the review of the existing literature in Chapter 2. The second phase of the research process involved administering a survey questionnaire among airport projects major stakeholders and project managers working across four international airports based in the United Arab Emirates (Dubai International Airport, Al-Maktoum International Airport-Dubai, Abu Dhabi International Airport and Sharjah International Airport). A detailed structure of this study's research process is shown in **Figure (23)**.

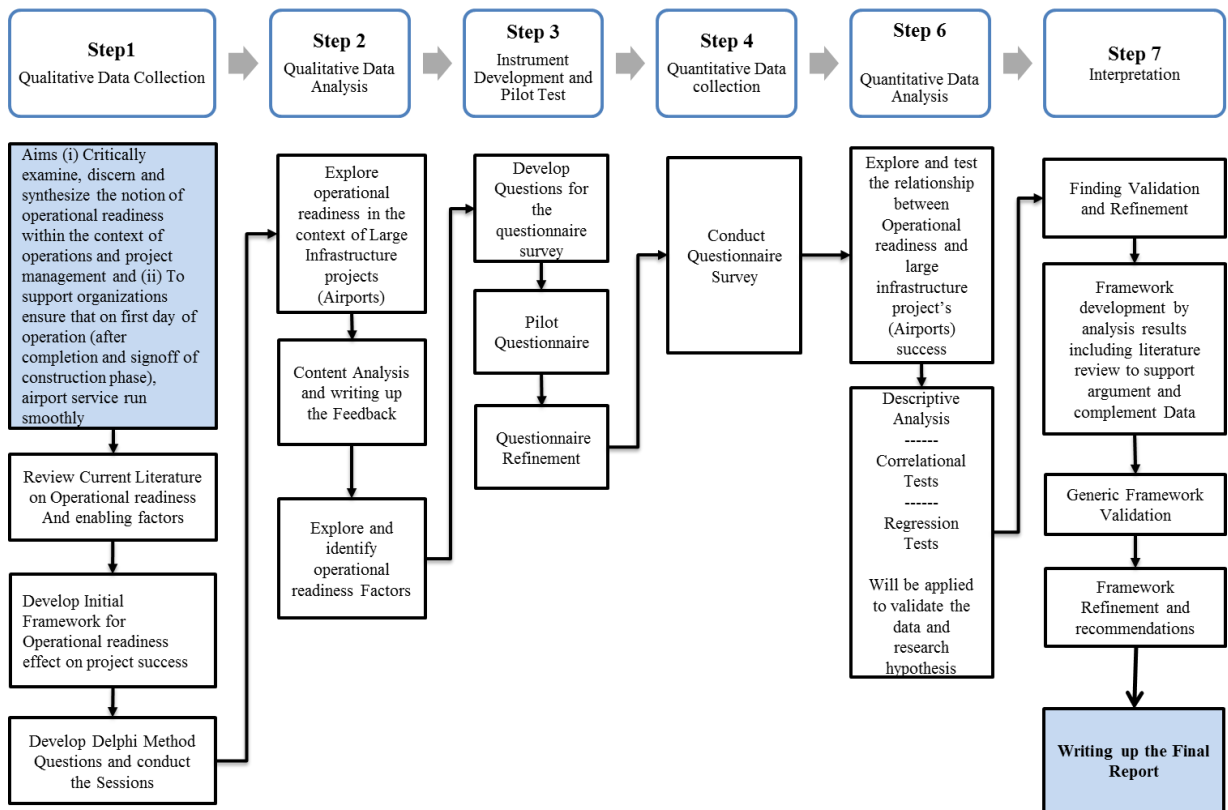


Figure (23) Structure of the research process.

Figure (23) provides the structure of this research process and implementation, where the processes and activities of the seven steps are described in detail. It starts with the aims and objectives of this study, conducting and analysing qualitative data, conducting the pilot survey, conducting and analysing quantitative data and finally, developing and validating the study's final framework.

4.3 Research implementation and Data Collection Techniques

When selecting the data collection for this research, we refer back to the philosophical lenses that have been adopted in section 4.4 of this Chapter. In this section, a discussion of the two main phases of the research will take place, which includes consideration of

the research process, justifications of the data collection tools, and advantages and disadvantages of the selected techniques.

Many data collection techniques are available for the researchers to select from based on their suitability to answer the research questions, as well as its objectives. **Table (13)** adapted from (Mitchell 1991; Collis & Hussey 1997; Handfield & Melnyk 1998; Hinkin 1998; Patel et al. 2001; Ouimet et al. 2004; Dilley 2004; Ryan et al. 2007; Kendall et al. 2007; Thomas 2008; Morse 2010), lists the main data collection methods/techniques available and provides a brief discussion of each.

Table (13) Data collection techniques.

Data Collection	Brief
Critical Incident Technique	A method used to gather data and relevant facts from subjects of the research in a defined situation.
Diaries	A method used by the researcher to record the subject's thinking and feeling by collecting data and capturing it in records.
Focus Groups	This method is used by the researcher to capture views and opinions of the research's subjects in the same context. It is typically associated with the phenomenological methodology.
Interviews	A method used by researchers in gathering data from the research's subjects by asking them relevant questions about their views, opinions, feeling or thinking on the research topic.
Observations	A method that takes place in the workplaces and real life situations of organisations and areas, where the researchers records the observed behaviours of the research subjects in a natural setting
Protocol Analysis	A method used to produce verbal data from research.
Questionnaires	A method to gather information from the research subjects using a set of questions that can have open or closed-ended; it is associated with both methodologies.

This study adopted the survey as a strategy for the research with mixed-method approaches. And for this strategy, we adopt focus group in the first phase of the study, while questionnaires are used in the second phase of the study as the tools for data collection. Further elaboration and detailed discussion on the selection and benefits of using them in this research are discussed in the next sub-sections.

4.3.1 Phase 1 – Identification of Operational Readiness’s Items (Qualitative Method)

To deliver a state of operational readiness for large infrastructure projects like airports, it is important to identify the enabling elements and criteria for it to be operationally ready. To achieve this, an extensive literature review was conducted and presented in Chapter 3 to determine the initial set of items and their categories. Focus groups followed this, as identified in Chapter 3, four main factors have been identified for the operational readiness items: facility readiness, people readiness, technology readiness and organisation readiness. The list of items are grouped with each factor and are being comprehensive enough to cover the major items that will be required by the airport operations team. A focus group technique is employed to investigate the appropriateness of the selected items and factors, which have been gathered and grouped from the review of relevant literature.

This phase will be used to confirm and investigate the readiness items that emerged from the literature and use these items to design a data collection instrument as detailed in the design research process in **Figure (23)**. The instrument design is adapted based on the recommendation of (Hinkin 1998), who employed an inductive research, where items

emerged through the qualitative analysis of subject matter experts' inputs. More so, because this discussion focuses on the instruments used to investigate the relationships between operational readiness and project success.

4.3.1.1 Focus Group as a Technique for Collecting Data Using Delphi Process

4.3.1.2 Justification for the Use of Focus Groups (Delphi)

Kitzinger defined focus group as, “... a form of group interview that capitalises on communication between research participants in order to generate data. Although group interviews are often used simply as a quick and convenient way to collect data from several people simultaneously, focus groups explicitly use group interaction as part of the method. This means that instead of the researcher asking each person to respond to a question, in turn, people are encouraged to talk to one another: asking questions, exchanging anecdotes and commenting on each other's' experiences and points of view” (Kitzinger 1995, p. 299). Focus groups as a research technique have received a notable growth (Folch-Lyon & Trost 1981), where it provides insights into the relationship of problems, attitudes and opinions of human activities. It has been particularly useful as a means to explore issues based on participants' experiences (Leung et al. 2014).

Social science researchers for the past two decades have frequently used focus groups as a research technique to collect data (Rodriguez et al. 2011). Focus groups are a powerful qualitative research method when designed perfectly, to facilitate the collection of rich and authentic data (Rodriguez et al. 2011). Focus groups as a qualitative technique are concerned with subjective perceptions of the research subjects and with concerns for the meanings or interpretations (Thomas 2008). It is also a qualitative method for gathering

data, where it brings together several research subject's experts to discuss a topic of research interest (Morgan & Spanish 1984).

Focus groups are perfect for 'filling in the gaps' and considered ideal for inductive approaches to generate concepts and hypotheses (Kitzinger 1994). The utilisation of a mixed method is common in social science studies, such as Thomas (2008) who recommended the utilisation of the focus group method in the Middle East and using it as part of a mixed method design. It should also be noted that Geist (2008) used the focus group method along with the Delphi process to investigate female community college science, technology, engineering and mathematics students' perceptions of using mixed methods. Additionally, a mixed method study conducted by Powell et al. (2013) used the focus group method to explore participants' perceptions of a range of implementation strategies, which resulted in data to develop a questionnaire survey similar to this study's approach. Yu and Leung (2015) have also used focus groups to explore the factors of preparing PE activities in the construction industry with different stakeholders. In a study of a mega development project, Leung et al. (2014) hosted focus groups with various types of stakeholders to explore and identify critical factors of the PE process to improve final project performance.

A Delphi method is considered to be a similar type of approach to focus groups and has been highly recommended as a qualitative method for project management and construction research (Fellows & Liu 2003). It has been used by Iromuanya (2012) in his research study, which focused on two groups of expert construction management practitioners. The Delphi process was also employed by Geist (2008) as a focus group to investigate the perceptions and the academic experiences of female students. Similarly, Bender et al. (2016) used focus groups and a Delphi process to develop a preliminary clinical nurse

leader practice model, and survey items were also developed. The Delphi method is recommended by Skulmoski & Hartman (2007) to collect the judgments of experts in a group decision-making setting about the research topic of interest. It also removes the dominant of a stakeholder group (Orndoff 2005), and the results are represented in a set of data outputs, which can be verified and generalised with a survey questionnaire (Skulmoski & Hartman 2007). In the social sciences studies, Delphi is frequently used and considered as one of the methods for the collection of rich data from the research subjects (Rodriguez et al. 2011) and are broadly located within the interpretive research paradigm (Thomas 2008).

The Delphi method is therefore considered as qualitative techniques (Skulmoski & Hartman 2007) from the point of the interpretivist, in the sense that the researcher is interested in how the social world is interpreted, understood and experienced. Similar to any other methodological techniques for research, the Delphi method has its unique advantages and weaknesses. An advantage of this approach is that it achieves effective communication to avoid the dominant influence of any one member of the stakeholders over the other (Heras Saizarbitoria et al. 2006). Another advantage of the Delphi method is group that knowledge collectively, will always supersede the best individual knowledge as this technique use the complemented knowledge of all the subjects. On the other hand, there are also weaknesses, for example, the selection of the panel experts from relevant organisations with knowledge about the session and the three round procedures of the technique, and because of the selection, there is no random sample (Orndoff 2005). The Delphi method was subject to various criticisms from academics, especially from qualitative methods researchers. This is due to lack of the scientific foundations of the method, as well as the significance of the collected data from the small group used in the Delphi

sessions (Heras Saizarbitoria et al. 2006). Many studies were found using the Delphi method in general and in social sciences, such as project management and operations management to have used the Delphi method successfully (Vidal et al. 2011), which justifies its use in this research study. Furthermore, Skulmoski & Hartman (2007) have modified the “typical” Delphi process that is followed in project management to best answer this study’s research questions.

In the examples of the Delphi research in project management, reference is made to Adnan & Morledge (2003) who conducted a study to identify the critical success factors, which need to be achieved in each construction joint venture in Malaysia. Also, Orndoff (2005) used the Delphi process in his study to create an interaction system for the project stakeholders to improve the decisions among them and enhance the project’s performance.

Additionally, Schmidt et al. (2001) used a “ranking-type” Delphi method to produce a rank-order list of risk factors from different stakeholders groups, where it has broadened the view of the types of risks, rather than relying on the opinion of a single culture; an aspect that has been ignored in past risk management research. Furthermore, Vidal et al. (2011) have used the Delphi method to identify the multiple aspects of project complexity and refund the project complexity framework. In operations management research, MacCarthy and Atthirawong (2003) applied the Delphi method using a panel of experts to investigate factors affecting international location decisions, which resulted in a comprehensive list of factors that may influence international location decisions. Finally, the Delphi method has been used in project management by Hatush and Skitmore (1997) to evaluate contractor prequalification selection criteria and project success factors.

4.3.1.3 Delphi Method Process

This study will use the Delphi method based on guided processes in the literature provided by (Hasson et al. 2000; Pawlowski, Suzanne, & Okoli 2004) proposed in **Figure (24)**.

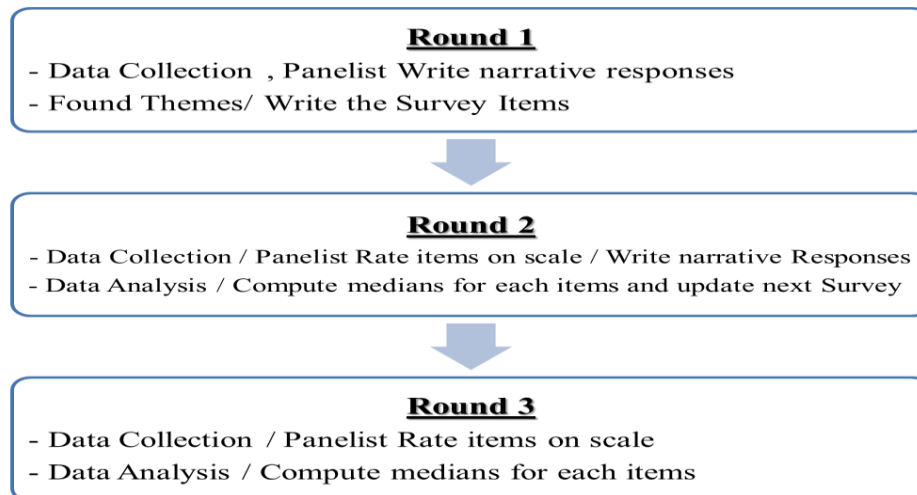


Figure (24) The Delphi method process.

4.3.1.4 Selection of Participants

Delphi's session success is mainly depending on the careful selection of the expert panel. Since the information under exploration involves detailed information and experience on the operation and construction works of airport projects, a purposive sampling method was used to select an expert for this session (Ojiako et al. 2008a; Denscombe 2010; Chih & Zwikael 2014). The purposive or judgmental sampling technique was selected to support the researchers in choosing participants sample with relevant airports projects construction and operations. To support this selection, reference is made to Chandra et al. (2012) who have conducted an empirical investigation among stakeholder in construction projects that included owners, project manager, consultants, contractors, suppliers, and construction experts.

The Delphi method use selected experts panel consisted of ten experts for the collection of data using series of questions progressively to answer the intended research objectives. (Adnan & Morledge 2003). As identified by (Welty 1972), an expert has more data and information in the area of expertise than the average man. When selecting the subject expert for the research, the researcher identifies them by having the experience in the field of airport projects constructions and operations. They are also identified by the years of experience and the position they are holding in their current organisations. For this Delphi study, ten experts will be selected based upon the recommendation from those involved in the construction and operations of airports in the UAE. E-mails were sent to the experts to get their approval to participate in the Delphi group. The choice of the ten experts was based on the recommendation of Warner (2015) to achieve reliability of the data. The ten expert panels will be selected from a senior operations manager, directors, senior project managers and managers based on their experiences and present airports projects both local and overseas, as well as three academics with expertise in the field of project management and operations management from UAE universities.

4.3.1.5 Interpretations and Analysis

For the Delphi sessions, data analysis will involve the careful management and analysis of qualitative and quantitative data (Hasson et al. 2000). To help identify the right choice of analysis for this method, reference is made to (Hasson et al. 2000; Pawlowski, Suzanne D, Okoli 2004; Skulmoski & Hartman 2007). In analysing the responses from the first round, identical responses and items will be removed, and it will be recorded on the combined list. The collected items will be grouped into their respective categories as per the identified categories in Chapter 3 (facilities, people, technology, organisation) to make it easier for the panellists to comprehend each item in the upcoming rounds. The qualitative

data that emerges from the first round will be analysed using content analysis. To help structure this; items identified based on the review of the literature in Chapter 3 on operational readiness will be employed. Analysing rounds two and three might require the use of descriptive and inferential statistics, where statistical summary will be provided for each item using ratings to ascertain the level of collective opinion. The participants will be provided with central tendencies (means, medians, and mode) of each item to help them know their stand compared to the group.

4.3.1.6 Reliability and Validity

In this section, consideration will be given to all the aspect of reliability and validity (Modell 2005). Reliability is the arrival of the same results using the same procedures under the same conditions (Hasson et al. 2000); whereas, Phelps et al. noted that validity “... is concerned with the data collected being accurate and meaningful” (Phelps et al. 2010, p. 58). The Delphi technique as a research method for achieving a consensus of opinions of participants is sometimes seen as a less reliable research method (Lumpur 2016) because of the changes in the participant's opinion during or between rounds.

From the **validity** point of view, validity will be constituted by the Delphi rounds (Pawlowski, Suzanne, & Okoli 2004). A clear definition of the research construct will support the construct validity, as the Delphi participants will validate their initial responses for the listed items. Skulmoski and Hartman (2007) recommended that the researcher triangulates with another research approach to increase the validation of the results of the Delphi method.

From the **reliability** point of view, Hallowell and Gambatese (2010) has ascertained the reliability of the data obtained from Delphi method through the use of strategically designed surveys. Others, such as (Warner 2015) have recommended engaging at least 13 expert panellists to achieve reliability. Also recommended by Skulmoski and Hartman (2007) is to have a continuous verification throughout the Delphi process, which is essential to increase the reliability of the results.

The researcher of this study truly believes that when pursued as a self-contained research technique, the Delphi method demands the same attention to detail as any other means of data collection. Morgan argues that *“as is always the case, the quality of the data depends on the quality of the preparation: careful planning cannot guarantee insightful results, but a cavalier approach to the design and execution of the research is almost certain to produce poor results”* (Morgan 2013, p. 5).

4.3.2 Phase 2 –Questionnaire Survey (Quantitative Method)

The second phase of the research is to conduct a statistical analysis on the selected item from phase 1, and also to investigate the relationships between operational readiness, its associated factors, and project success, using a questionnaire as the data collection tool. According to Collis and Hussey (1997), a questionnaire is used to collect data from subjects by answering clear and structured questions. Before conducting any data collection from the questionnaire, Hackley (2003) recommends a careful design of the questionnaire by the researchers with the thorough understanding of the research. Questionnaires are considered a popular quantitative method for data collection in research as it does not cost money or consumed the time of the researchers like other qualitative methods, but drawbacks do exist in this method, which could impact the outcome of this techniques if not

managed carefully (Saunders et al. 2009). There are two different styles to administer questionnaire for the research. First, the self-administered questionnaires, where the researcher distributes it by hand or post or conducted online using websites to be completed by the respondents (Burgess 2001); whereas, the interviewer records interview-administered questionnaires through face-to-face meetings or telephonic discussions. For this study, self-administered questionnaires have been selected using a website to gather the data. Further justification of the questionnaire is discussed in the next subsections including the subject selection, sampling, design of the questionnaire, pilot testing, statistical analysis, credibility and finally the ethical consideration using this method.

4.3.2.1 Justification for the Selection of Questionnaire Technique

According to Boynton and Greenhalgh (2004), questionnaires provide us with objective data that contains the research subject's views, knowledge and attitudes towards the subject being researched. As for this research study, it was recommended by (Armenakis et al. 1993) to use questionnaires along with other data collection tools to assess an organisation's readiness to change. He further noted, "*...if properly conducted; such assessments can reveal the need to intensify efforts, use additional strategies to create readiness, and offer insights into how readiness messages might be modified*" (Armenakis et al. 1993, p. 691). This study explores the readiness items of the organisations' needs to ensure proper operations from day one. This requires the need for obtaining the objective means of the knowledge of different stakeholders regarding readiness and will be gathered using a questionnaire. It was also noted by Yin (2003) that questionnaires are among the data sources along with other qualitative techniques that are used to understand and explain the social phenomenon. In this research, the researcher tries to investigate the phenomena of operational readiness and its impact on project success. Since this study is

a mixed method approach, reference is made to Boynton and Greenhalgh (2004) who recommend the use of a questionnaire within a mixed-method researches, such as extending and quantifying items found in an earlier exploratory phase, which is the case for this study. Berssaneti and Carvalho (2015) employed the use of a questionnaire survey to analyse the relations between project management maturity and the project success. It involved using the methodological research approach to survey 336 professionals in the field of project management and was conducted within Brazilian organisations, which is similar to the context of this study to analyse the relationship between operational readiness and project success. All of the above have encouraged this research to utilise a questionnaire as a suitable technique to collect phase 2 data and analyse it statistically with the accurate selection of respondents.

4.3.2.2 Research Participants Selection

For any research, researchers may select the subjects of his/her study randomly if they require a viewpoint across the area chosen. But this is not possible when trying to gather information about a particular phenomenon that is lived and experienced by selected subjects who became targeted expert for the study (Fowler 2002). For this study, reference is made to Chandra et al. (2012), who used a questionnaire to do an empirical investigation among stakeholders in construction projects including owners, project manager, consultants, contractors, suppliers, and construction experts. Participants of this research will be selected from completed large airport facilities in four main airports in UAE (Dubai International Airport, Al-Maktoum International Airport, Abu Dhabi International Airport and Sharjah International Airport) and will range from ground operators to decision-makers. The reason for having a large population for this phase is to ensure the statistical reliability of the data collected. The number of participants will exceed crude rules of

thumb for statistical validity as indicated by Vanvoorhis and Morgan (2007), who specified that 300 is a good number for statistical analysis; however, this study will exceed this recommendation. The size of 300 and more have been also recommended by Sharma and Gupta (2012) for the selection of participants due to the limitation in selection of participants as the case of this study. This sample size was also recommended by Iacobucci (2010) as suitable for statistical tests and analysis especially SEM, which will be used in this study along with CFA.

Participant selection and sampling for any study depend on the participants' experience with and exposure to the phenomenon of the study (Coughlan et al. 2007). For this phase, participant selection has been based on participants' cognitive experience in airport project's construction and operations. To enable the researcher to obtain consolidated information for this research, rigid selection of respondents is vital to providing validated data and outcome for this research. Further selection criteria for the research respondents have also been considered based on the research's aims and objectives:

- a) Respondent must be working in an airport's operational organisation. Therefore, the organisation must be working and having a critical and operational role in the newly developed airport.
- b) The respondents' organisation must have and be currently operating three large airport facilities.
- c) Each respondent must have an average of more than five to ten years of cognitive experience, which meets both PMI and the Association for Project Management (APM) requirements for professional project management designation (APM 2014).

4.3.2.3 Sampling Techniques

To be able to answer the research questions and objectives fully, the researchers are required to collect and analyse data from all the possible cases for that research subject. Unfortunately, it is not possible as the cost and time will not be sufficient to capture each and every case. Sampling techniques help in providing a range of methods to enable the reduction of the cases to sub-group for the data collection as illustrated in **Figure (25)**. According to Burgess (2001), the population is a term that refers to all the possible cases for that research, while the sample is the sub-group that will be chosen to provide data for the research.

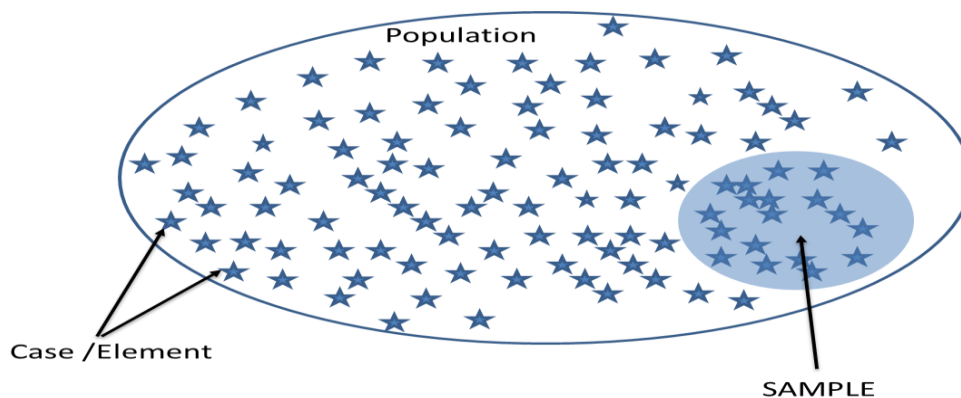


Figure (25) Population, sample and case (Saunders et al. 2009).

As stated by Boynton & Greenhalgh (2004), sampling techniques are important due to their effect on the researcher's preparation and administration of the questionnaire. The two techniques available for sampling are probability and non-probability.

Probability sampling: also called representative sampling where the probability of selecting each case is known, and it is also equal for all cases. It is popular with survey

researchers and divided into four sub-techniques, simple random sampling, systematic sampling, stratified random sampling and cluster sampling.

Non-probability sampling: also, called judgmental sampling where the probability of selecting each case from the total population is not known. It is commonly used by qualitative researchers as it provides the researchers with insights about the researched subject. It is also divided into six sub-techniques natural sampling, quota sampling, judgmental sampling, snowball sampling, self-selecting sampling and convenience sampling, which is considered the popular techniques used in the non-probability sampling by researchers.

The purposive or judgmental sampling technique was selected to support the researchers in choosing participants sample with relevant airports projects construction and operations. To support this selection, reference is made to Chandra et al. (2012) who have conducted an empirical investigation among stakeholder in construction projects that included owners, project manager, consultants, contractors, suppliers, and construction experts. For this purpose, the population of experts was divided into seven categories: airlines, ground handlers, government entities, contractors, consultants, project management agencies, and airport operators and maintainer. From these groups, 1000 subjects were targeted as the population in this survey, as shown in **Figure (26)**.

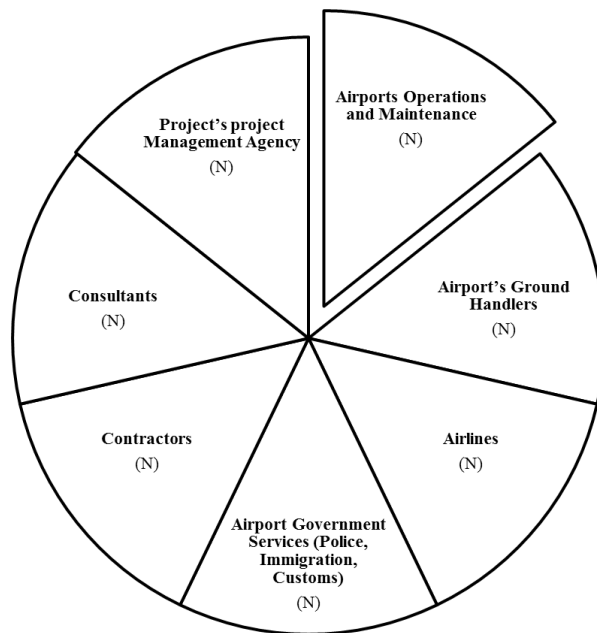


Figure (26) Research population.

The populations of the groups were selected from among government officials, airport operators and maintainers, and major airport airlines. The staffs of these groups are the major operations representatives since it is they who undertake major day-to-day operations-related activities within the newly constructed facilities in the airports and without them, all aircraft and passenger operations will be halted. Therefore, they are the most suitable selection of subjects relevant to the operational readiness of the airport projects.

Sample size: It has been recommended by Maccallum et al. (2001) to use a large sample in researchers to reduce the risk of errors, but a large sample cannot always guarantee the accuracy of the results. Large sample size will help in reducing biases from the selection processes. That is why the size of the sample for this research is important and discussed in this sub-section. The preferred sample size for this study should be equal to or more than of 150, with 95% level of certainty as recommended by (Burgess 2001; Saunders et

al. 2009), which exceeds the recommended number of the sample size for statistical research in management and business studies; this study is targeting 1,000 subjects from a total population of around 3,000 and this represent 35%. With the suitable sample collection and size, the researchers are now confident yielding consolidated outcomes for this questionnaire.

It is worth mentioning that such large size questionnaires take a longer time and cost the researchers more money to prepare, distribute, collect and analyse especially when we are referring to hard copies. Based on the reasons mentioned above and limitations, the researcher of this study decided to use online website named SurveyMonkey (www.surveymonkey.com), to compile and distribute the questionnaire electronically via the emails and social media connections.

4.3.2.4 Design of the Questionnaire

When designing this questionnaire, reference was made to (Burgess 2001; Boynton & Greenhalgh 2004; Lietz 2008; Parsian & Dunning 2009) who stress that producing useful and generalizable data from questionnaires requires careful planning and design. It is also an important part to make sure the questionnaire is suitable for the research and is devised in a way that addresses the needs and objectives of the research (Burgess 2001). The researcher designed the questionnaire to collect information about the facilities readiness, people readiness, system/technology readiness, and process and organisational readiness items as expressed by the different stakeholder's participants of the airport's project. In this research, a standardised questionnaire design will be implemented, where all the research participants will be asked to answer the same questions, and their responses will be recorded in a uniform manner (Boynton & Greenhalgh 2004). The standardising of the

questionnaire increases the reliability of the data to be collected. Reference is also made to Burgess' (2001) recommendation on three major sections that need to be addressed by the researcher when designing the questionnaire.

Section 1: Determine the questions to be asked?

Determination of the questions to be asked used in the questionnaire are important, and it has less attention in the literature (Burgess 2001). To design the questions for this questionnaire to be appropriate and produce relevant data for the research. Reference is made to Holt et al.'s (2007) framework for creating a readiness gauging instrument for the organisational changes. The authors collected relevant readiness items from literature, reduce the items using the qualitative method, and convert the items to questions to be employed in a questionnaire.

Before designing the questionnaire, a literature review was undertaken to set down the aims of the survey as recommended by Burgess (2001), followed by the identification of the critical elements and criteria relevant to operational readiness for newly completed large infrastructure projects (Refer to section 3.6). These items provide the basis for preparing the final questions to be used for this questionnaire. Four relevant operational readiness questionnaires from different industries have been selected and triangulated with the elements generated from the literature. The results were given as an input to the Delphi session in phase 1 of this research to choose the appropriate elements related to airports' projects and operations.

Reference is also made to an earlier study conducted by Santiago (2008), who have developed a questionnaire for organisational factors influencing leadership readiness for

change, by combining other existing instruments formulated by other researchers to analyse the relationship between the key variables of the study. Due to the scarcity of suitable operational readiness questionnaire for this study, previous relevant items and questions were used, which was selected from available sources in the industrial and academic literature. Unfortunately, none of these questionnaire matches the required questions to be asked in this study, which has encouraged us to use some relevant questions from these sources and triangulate and ensure the adequacy of its fitting to this particular study.

While researching the literature for relevant questionnaires for this study, four questionnaires were found relevant, and a discussion of their relevance is presented as follows:

1. **Airport Terminal Facility Activation Techniques Questionnaire** by (Lyons & Powell 2010). The questionnaire was prepared to capture information about, lessons learnt and successful practices from airport terminal facility openings from participants recently involved with activations of new airport terminal facilities, where many of the participants have led or participated in the activation of several other airport terminal facilities. Many relevant aspects of this questionnaire lead the researcher to use it and the use of its related questions in developing the current study questionnaire. However, the major differences were that the current study looks at the readiness elements from four different perspectives (facility, people, technology/system and processes/organisational), while the questionnaire by Lyons & Powell looks at the best practices used in the opening.
2. **NHS Ayrshire and Arran Patient Management System MSK Operational Readiness Questionnaire** by (NHS Ayrshire & Arran 2012). The Questionnaire was prepared by NHS Ayrshire and Arran, which is one of the fourteen regions of

NHS in Scotland and provides health and social care to almost 400,000 people. The questionnaire was designed to ensure that their organisation is operationally ready to use the newly developed patient management system, where it is targeting to ensure the relevant readiness of people and processes. Even though the questionnaire does not provide all of the readiness aspects that were found in the literature, it does, however, give us rich, relevant readiness elements for the operations of new systems.

3. **The Software Support Qualitative Assessment Methodology Volume V Implementing the Operational Readiness Measure by** (Racine & Mitchell 1990).

This questionnaire was developed to measure operational readiness for an information system. The objective of the questionnaire was to help an organisation understand the operational readiness level and status of their IT system. This questionnaire is relevant as it does look at the technical readiness of organisation from all angles, which is also the case of the current study in implementing operational readiness that looks into more than technical and system readiness.

4. **Activation and operational planning: ensuring a successful transition by**

(Wilson et al. 2004). It provided a checklist for the operational readiness to address the challenges faced by the hospital management in operating a newly developed facility into the existing hospital with no disturbance to the on-going business processes. Even though it was a checklist of items and not a questionnaire, the relevance of it for this study was high for the reasons that it included many of the major factors of readiness, such as facilities, people and processes with their elements as stipulated in this current study.

It is to be noted here that, the researcher of this study acknowledged the availability of an operational readiness questionnaire for airports, such the study conducted by Vines (1995) who developed a specialised questionnaire using a Likert scale format to attain the opinion of 20 airport directors or their representatives. This was analysed and found to be unsuitable for the utilisation of this study as it is short and does not cover major elements of operational readiness factors as stipulated in this study. Thus, the researcher for this study and to create appropriate questions to be used in the questionnaire, combined all of the four questionnaires selected and modified the questions to suit our study of airport projects. The results are provided in **Table (14)**.

Table (14) Combined questions from the four selected questionnaires.

No	Original Questions	Area	Modified Questions	Source
Airport Terminal Facility Activation Techniques				
			A formal Activation and operational readiness program is required	
			A formal Activation and operational readiness Team is required	
1.2	Was there a Charter or Mission Statement for the Team/Program? If so, what was it?	Processes	A formal Charter or Mission Statement for the Operational Readiness Program/Team is required	Airports (Lyons & Powell 2010)
			A clear protocol for communication during the operational readiness program is required	Airports (Lyons & Powell 2010)
			A clear protocol for, issue identification/resolution during the operational readiness program is required	
1.4	Was there a formal issue resolution structure? What was it?	Processes	A formal issue resolution structure during the operational readiness is required	Airports (Lyons & Powell 2010)
1.5	Was there a formal Activation/Terminal Opening Plan? Could you share this with us?	Processes	Operational readiness plan should be part of the project overall planning schedule	Airports (Lyons & Powell 2010)

1.6	How was progress managed and reported on?	Processes	Progress update on operational readiness plan shall be managed and shared with all airport stakeholders.	Airports (Lyons & Powell 2010)
1.7	Were checklists or other reporting mechanisms used? Could you share them with us?	Processes	A Checklist/Reporting mechanism is necessary to be used for the operational readiness program.	Airports (Lyons & Powell 2010)
			Operational readiness program should be led by Project team of the airport.	
			Operational readiness program should be led by the operations team of the airport.	
			Airport's Airlines shall be included in the operational readiness program.	
			Airport's government agencies such as police, immigration, and customs shall be involved in the operational readiness program.	
			Airport's public users shall be fully involved in the operational readiness program.	
			Local media shall be included in the operational readiness program.	
1.10	What were their priorities?	Processes		Airports (Lyons & Powell 2010)
1.11	When was Activation Team established?	People	Activation and operational readiness team shall be established early in the airport projects	Airports (Lyons & Powell 2010)
1.12	When was activation plan established?	Processes	Activation and operational readiness plan shall be established early in airport's projects.	Airports (Lyons & Powell 2010)
1.13	Was opening at a fixed date or soft?	Processes	Airport's project should have fixed date for an opening as part of operational readiness.	Airports (Lyons & Powell 2010)
1.14	If soft, how much time elapsed between first flight/passenger activity and fully operational terminal?	Processes		Airports (Lyons & Powell 2010)

1.1 5	What activities occurred between soft and final opening?	Processes		Airports (Lyons & Powell 2010)
1.1 6	Was opening phased— Yes	Processes	Airport's project should have phased (soft) opening as part of its operational readiness plan.	Airports (Lyons & Powell 2010)
1.1 7	How much time elapsed between first and final phase?	Processes		Airports (Lyons & Powell 2010)
1.1 8	When was terminal operation plan developed? P.	Facilities		Airports (Lyons & Powell 2010)
1.1 9	Were there any changes to design during construction?	Facilities		Airports (Lyons & Powell 2010)
1.2 0	Was activation program successful?	Processes		Airports (Lyons & Powell 2010)
1.2 1	What were the biggest challenges?	Processes		Airports (Lyons & Powell 2010)
1.2 2	What went particularly well?	Processes		Airports (Lyons & Powell 2010)
1.2 3	What would you do again?	Processes		Airports (Lyons & Powell 2010)
1.2 4	What would you do differently?	Processes		Airports (Lyons & Powell 2010)
1.2 5	With the benefit of hindsight are there any changes you would make or suggest making regarding?	Processes		Airports (Lyons & Powell 2010)
1.2 6	Are there any other lessons learned or caveats you can share with us?	Processes		Airports (Lyons & Powell 2010)
NHS Ayrshire and Arran Patient Management System MSK				
2.1	Can you confirm that the following areas of training have been received from your service?	People: Training	Airport's Operational services Training are essential for the operational readiness.	Health (NHS Ayrshire & Arran 2012)
2.2	Has your service been shown where to obtain	People: Training	New airport's system training material should be accessible	Health (NHS Ayrshire & Arran 2012)

	the PMS training materials		to the maintenance and operation team.	
2.3	Is there a sufficient understanding of the PMS functionality across your service	People: Training	New systems understanding and familiarisation shall be provided to the maintenance and operations team.	Health (NHS Ayrshire & Arran 2012)
2.4	Can you confirm that all clinic templates are signed off for your service	Processes	New facility's processes and forms shall be created and signed off by the airport operations.	Health (NHS Ayrshire & Arran 2012)
2.5	Can you confirm that all letters are signed off for your service	Processes		Health (NHS Ayrshire & Arran 2012)
2.6	Can you confirm that all eVetting and clinical outcomes are signed off for your service	Processes	New facility KPI and performance outcomes shall be documented and signed off by the operations team.	Health (NHS Ayrshire & Arran 2012)
2.7	Can you confirm that a process is in place for all internal referrals, i.e. clinician to clinician	Processes		Health (NHS Ayrshire & Arran 2012)
2.8	Can you confirm that this process is documented and communicated to your service	Processes	All the new facility's operational process should be documented and communicated to all operational stakeholders.	Health (NHS Ayrshire & Arran 2012)
2.9	Please provide supporting documentation SOP Complex Case attached	Processes	All the new Standard Operating Procedure (SOP) and Irregular Operating Procedure (IOP) shall be documented	Health (NHS Ayrshire & Arran 2012)
2.10	Have you ensured that eVetting is routinely undertaken on a daily basis within your service?	Processes		Health (NHS Ayrshire & Arran 2012)
2.11	Please provide supporting documentation E-Vet procedure attached	Processes		Health (NHS Ayrshire & Arran 2012)
2.12	Have you ensured that clinic outcome recording is routinely undertaken within your service	Processes		Health (NHS Ayrshire & Arran 2012)
2.13	Please provide supporting documentation Discharge report attached	Processes		Health (NHS Ayrshire & Arran 2012)
2.14	Can you confirm that all roles and responsibilities are fully documented and communicated to your service	Processes	Confirmation of all Roles and Responsibilities (Operator, Maintainer and user) are fully documented and communicated to all the airport stakeholders.	Health (NHS Ayrshire & Arran 2012)

2.1 5	Please provide supporting documentation, e.g. service sign-off of roles and responsibilities at the individual level. Hub SOP	Processes	Ensure all functions and responsibilities (Operator, Maintainer and User) documentations are signed off by relevant airport's stakeholders.	Health (NHS Ayrshire & Arran 2012)
2.1 6	Can you confirm you have an escalation process in place?	Processes	Confirmation of an Escalation process during operational readiness.	Health (NHS Ayrshire & Arran 2012)
2.1 7	Can you confirm that this process is documented and communicated to your service	Processes	Documentation of the Escalation process and communicating it to all relevant stakeholders of the new facility.	Health (NHS Ayrshire & Arran 2012)
2.1 8	Can you confirm that a process is in place for creating manual referrals	Processes		Health (NHS Ayrshire & Arran 2012)
2.1 9	Can you confirm that this process is documented and communicated to your service	Processes		Health (NHS Ayrshire & Arran 2012)
2.2 0	Do you have a process for tracking patients who have been referred to another Hospital out with NHS Ayrshire and Arran	Processes		Health (NHS Ayrshire & Arran 2012)
2.2 1	Can you confirm that this process is documented and communicated to your service	Processes		Health (NHS Ayrshire & Arran 2012)
2.2 2	Can you confirm that the following tasks are consistently completed in PMS to accommodate adequate waiting list management	Processes		Health (NHS Ayrshire & Arran 2012)
The Software Support Qualitative Assessment Methodology Volume V Implementing the Operational Readiness Measure				
3.1	What is the size of the system source code, in lines of code (LOC)?	System & Technology		Military (Racine & Mitchell 1990)
3.2	What language(s) is the software written in?	System & Technology		Military (Racine & Mitchell 1990)
3.3	How many modules (units that perform single functions or sets of functions) does the software product contain?	System & Technology		Military (Racine & Mitchell 1990)

3.4	What is the age (measured from the date of original installation) of the software product?	System & Technology		Military (Racine & Mitchell 1990)
3.5	How long has your organisation supported this software product?	System & Technology		Military (Racine & Mitchell 1990)
3.6	What are the TOTAL number of changes that have been made to this product (software and associated documentation) during the time you have supported it? Include both Software Change Packages and Emergency Change Packages.	System & Technology		Military (Racine & Mitchell 1990)
3.7	Does the software contain any code that aids in debugging the software?	System & Technology		Military (Racine & Mitchell 1990)
3.8	Is there any documentation explaining the overall function of the software?	System & Technology	All the system manuals and documentation to be made available during operational readiness.	Military (Racine & Mitchell 1990)
3.9	Is there documentation for each module explaining the module's function?	System & Technology		Military (Racine & Mitchell 1990)
3.10	Are there any user's manuals explaining the use of this software?	System & Technology		Military (Racine & Mitchell 1990)
3.11	For what amount of time (how many hours) during the month, if any, is the software system down and cannot be used?	System & Technology		Military (Racine & Mitchell 1990)
3.12	What is the average number of maintenance requests per month received for this system?	System & Technology	The arrangement of a Maintenance plan for the critical systems.	Military (Racine & Mitchell 1990)
3.13	Approximately how many of the above maintenance requests (per month) ultimately result in some change being made to the software?	System & Technology		Military (Racine & Mitchell 1990)
3.14	Approximately what percentage of the maintenance requests FOR	System & Technology		Military (Racine & Mitchell 1990)

	WHICH YOU PERFORM ACTIONS ON are			
3.1 5	Approximately what percentage of the maintenance requests FOR WHICH YOU PERFORM ACTIONS ON are	System & Technology		Military (Racine & Mitchell 1990)
3.1 6	What percentage of ALL maintenance requests you receive.	System & Technology		Military (Racine & Mitchell 1990)
3.1 7	What percentage are (0-100%) of EMERGENCY & URGENT requests for corrections to faulty software components?	System & Technology		Military (Racine & Mitchell 1990)
3.1 8	ON THE AVERAGE, what percentage (0-100%) of all requests requires more time to complete than is originally scheduled?	System & Technology		Military (Racine & Mitchell 1990)
3.1 9	What percentage of time spent maintaining the software is devoted to testing it?	System & Technology		Military (Racine & Mitchell 1990)
3.2 0	ON THE AVERAGE, how often do you communicate (either formally or informally) with a TYPICAL user organisation using this information system? Mark the one appropriate response below.	System & Technology		Military (Racine & Mitchell 1990)
3.2 1	How many people in your support organisation presently maintain this software either on a part-time or full-time basis?	System & Technology	Ensure adequate recruitment of operations and maintenance staff for all the new facility systems.	Military (Racine & Mitchell 1990)
3.2 2	AT PRESENT (NOT on the average), how many changes of all types (including corrections and enhancements) are there to be implemented?	System & Technology		Military (Racine & Mitchell 1990)
3.2 3	Of the above changes to be implemented, what percentage (0-100%) of these changes are EMERGENCY changes?	System & Technology		Military (Racine & Mitchell 1990)

	If there are no changes, answer 0%			
3.2 4	Of the changes (from #2) to be implemented, what percentage (0-100%) of these changes are for CORRECTIONS to faulty software components? If there are no changes, answer 0%.	System & Technology		Military (Racine & Mitchell 1990)
3.2 5	Based on the following scale, how you rate the estimated effort needed to complete changes to the software product over the next month:	System & Technology		Military (Racine & Mitchell 1990)
3.2 6	Overall, in your judgment, to what extent are (or have been) the following problems in maintaining this information system?	System & Technology		Military (Racine & Mitchell 1990)
3.2 7	Not enough people to support this system.	System & Technology		Military (Racine & Mitchell 1990)
3.2 8	People supporting this system are not trained adequately?	System & Technology	Ensure adequate training and familiarisation is provided for all the new facility systems.	Military (Racine & Mitchell 1990)
3.2 9	The system is overly large, making support difficult.	System & Technology		Military (Racine & Mitchell 1990)
3.3 0	The system is overly complex, making support difficult.	System & Technology		Military (Racine & Mitchell 1990)
3.3 1	System is not well-structured (written in "spaghetti code").	System & Technology		Military (Racine & Mitchell 1990)
3.3 2	Lack of system modularization makes changes difficult to implement. Page	System & Technology		Military (Racine & Mitchell 1990)
3.3 3	The system is old & needs to be replaced.	System & Technology		Military (Racine & Mitchell 1990)
3.3 4	System documentation is incomplete or confusing.	System & Technology		Military (Racine & Mitchell 1990)

3.3 5	System documentation is out-of- date.	System & Technology		Military (Racine & Mitchell 1990)
3.3 6	Not enough time is spent on testing after changes are made.	System & Technology	Ensure Full testing and commissioning and integration of the critical systems of the new facility in the airport project.	Military (Racine & Mitchell 1990)
3.3 7	Software repair schedules are hard to meet.	System & Technology		Military (Racine & Mitchell 1990)
3.3 8	Overall, there are more change requests submitted for this system than can be handled.	System & Technology		Military (Racine & Mitchell 1990)
3.3 9	There are too many change requests resulting from software bugs (vs. enhancement requests).	System & Technology		Military (Racine & Mitchell 1990)
3.4 0	There are too many emergency change requests.	System & Technology		Military (Racine & Mitchell 1990)
3.4 1	User requirements for this system change frequently.	System & Technology		Military (Racine & Mitchell 1990)
3.4 2	Overall, from your perspective, to what extent are (or have been) the problems as they impact on the ability to maintain this information system? (Check the appropriate category).	System & Technology		Military (Racine & Mitchell 1990)
3.4 3	Skills of maintenance programming personnel	System & Technology	Ensure adequate qualifications and competencies for all the maintenance and operations staff of the new facility.	Military (Racine & Mitchell 1990)
3.4 4	A number of maintenance programming personnel available.	System & Technology		Military (Racine & Mitchell 1990)
3.4 5	Inadequate hardware/software configurations in IS Organization.	System & Technology	Ensure and test all the systems integration of the new facility. Ensure new system integration of the new building to existing systems in the airport.	Military (Racine & Mitchell 1990)

3.4 6	Motivation of maintenance programming personnel.	System & Technology		Military (Racine & Mitchell 1990)
3.4 7	Maintenance programming productivity	System & Technology		Military (Racine & Mitchell 1990)
3.4 8	Competing demands for new systems development and maintenance.	System & Technology		Military (Racine & Mitchell 1990)
3.4 9	Budgetary pressures.	System & Technology	Ensure financial and budget coverage for all the new facility operations and maintenance.	Military (Racine & Mitchell 1990)
3.5 0	Meeting scheduled commitments	System & Technology		Military (Racine & Mitchell 1990)
Activation and operational planning: ensuring a successful transition				
4.1	Ensure that plans for the operation are developed in accordance with the vision and operating priorities.	Process	Ensure that plans for the operation are developed in accordance with the vision and operating priorities.	Health (Wilson et al. 2004)
4.2	Effectively manage the risks (economic and other) associated with the activation.	Process	Effectively manage the risks (economic and other) associated with the activation	Health (Wilson et al. 2004)
4.3	Minimise the time from construction completion to the start-up of operations.	Process	Reduce the time from construction completion to the start-up of operations.	Health (Wilson et al. 2004)
4.4	Ensure that regulatory and compliance requirements are met.	Process/ Facility/ Systems	Ensure that regulatory and compliance requirements are met.	Health (Wilson et al. 2004)
4.5	Manage the impact that activation will have on existing operations.	Process	Manage the impact that activation will have on existing operations.	Health (Wilson et al. 2004)
4.6	Ensure that patient care delivery and other service delivery processes are effectively planned and coordinated.	Process	Ensure that Passenger care delivery and other baggage service delivery processes are effectively planned and coordinated.	Health (Wilson et al. 2004)
4.7	Achieve service levels that meet or exceed the expectations of medical staff, the public, and other constituencies.	Process		Health (Wilson et al. 2004)
4.8	Facilitate accurate budgeting for start-up activities and ongoing operations.	Process	Facilitate accurate budgeting for start-up activities and ongoing operations.	Health (Wilson et al. 2004)

4.9	Leverage the facility activation to promote the new facility in the marketplace.	Process	Leverage the facility activation to promote the new facility in the market.	Health (Wilson et al. 2004)
4.10	Use multidisciplinary teams to drive the planning process and Ensure that cross-functional processes, as well as enabling elements (e.g., information technology, human resources), are clearly integrated within the process and activation plans.	Process	Use multidisciplinary teams to drive the planning process and Ensure that cross-functional processes, as well as enabling elements (e.g., information technology, human resources), are clearly integrated within the process and activation plans.	Health (Wilson et al. 2004)
4.11	Equip planning teams with the necessary knowledge and tools to effectively complete their work. This may include training in meeting facilitation as well as specific orientation to project objectives, macro schedules, and guiding principles.	Process	Equip planning teams with the necessary knowledge and tools to effectively complete their work. This may include training in meeting facilitation as well as specific orientation to project objectives, macro schedules, and guiding principles.	Health (Wilson et al. 2004)
4.12	Provide consistent, real-time communication of project schedules and plans to all relevant constituencies, including planning teams, medical staff, employees, and the community	Process	Provide consistent, real-time communication of project schedules and plans to all related constituencies, including planning teams, medical staff, employees, and the community	Health (Wilson et al. 2004)
4.13	Develop a database of activation issues, questions, and answers that are accessible to interested parties. Many organisations have adopted intranet capabilities to serve this need.	Process	Develop a database of activation issues, questions, and answers that are accessible to interested parties.	Health (Wilson et al. 2004)
4.14	Assign a project champion to coordinate, facilitate, and drive all aspects of activation planning and implementation, and ensure that this individual has adequate time allocated to fulfil this role.	Process	Assign Stakeholders Project Single point of Contact (SPOC) to coordinate, facilitate, and drive all aspects of activation planning and implementation, and ensure that this individual has adequate time allocated to fulfil this role.	Health (Wilson et al. 2004)
4.15	Make decisions in a timely manner, and communicate the decisions	Process	Operational Readiness team should make decisions promptly, and communicate the decisions across the	Health (Wilson et al. 2004)

	across the planning organisation.		planning organization	
4.1 6	Do not underestimate the time and dollar investments that activation planning and implementation will require	Process		Health (Wilson et al. 2004)
4.1 7	Contractor building turn-over schedules.	Facility	Ensure the Availability of the Contractor building turnover schedules.	Health (Wilson et al. 2004)
4.1 8	Coordination with building commissioning activities.	Facility	Coordinate and support building commissioning activities and integrate it with Operational Trials	Health (Wilson et al. 2004)
4.1 9	Building cleaning and security.	Facility	Ensure Adequate Building cleaning and the safety during operational readiness activities and Trials.	Health (Wilson et al. 2004)
4.2 0	Inspection and licensure preparedness and schedules.	Facility	Ensure the preparedness and schedules of all the Inspection and regulatory licensing for the facility and associated systems.	Health (Wilson et al. 2004)
4.2 1	Equipment and furniture installation and acceptance.	Facility	Ensure that all the new Equipment and furniture installation and acceptance are completed.	Health (Wilson et al. 2004)
4.2 2	Preoccupancy stocking of supplies, medications, and linens.	Facility/Systems	Ensure Pre-occupancy stocking of all Maintenance and operational supplies for all stakeholders.	Health (Wilson et al. 2004)
4.2 3	Implementing the IT/telecom program.	Systems/IT	Ensure the completion of the Implementation of the IT/telecom program.	Health (Wilson et al. 2004)
4.2 4	Ordering and installing IT/telecom equipment.	Systems/IT	Ensure Ordering and installing IT/telecom equipment for all the operational stakeholders of the airport.	Health (Wilson et al. 2004)
4.2 5	Validating new phone numbers, new computer addresses.	Systems/IT	Ensure the Validation and communication of the new phone numbers; new computer addresses to all relevant stakeholders and airport users.	Health (Wilson et al. 2004)
4.2 6	Sub networking to support departmental operations.	Systems/IT	Ensure that all the airport users Sub-networking are completed to support all stakeholder's operations.	Health (Wilson et al. 2004)
4.2 7	Relocating equipment as planned, with minimal operating disruptions.	Systems/IT	Support and ensure the relocation of stakeholders existing equipment as scheduled, with minimal operating disruptions.	Health (Wilson et al. 2004)

4.2 8	Establishing patient-move sequence and routing.	Move Planning/ Process	Establishing common control room with all the stakeholders for the move sequence and new operations.	Health (Wilson et al. 2004)
4.2 9	Organising patient-move support equipment and personnel.	Move Planning/ Process	Organise and help stakeholders move of operational equipment and staff.	Health (Wilson et al. 2004)
4.3 0	Maintaining patient safety and dignity during the move.	Move Planning/ Process	Ensure and maintain passenger safety and security during the initial move and operations.	Health (Wilson et al. 2004)
4.3 1	Defining support department responsibilities during the move.	Move Planning/ Process	Identify and communicate the supporting department responsibilities during the initial phase of operations that includes the contractor and consultant as part of the stakeholders.	Health (Wilson et al. 2004)
4.3 2	Maintaining lines of communication with families and medical staff.	Move Planning/ Process	Ensure and maintain lines of communication with all the stakeholders during initial start-up and operations.	Health (Wilson et al. 2004)
4.3 3	Department is operating dependencies and move sequences.	Move Planning/ Process	Prepare and ensure the availability of stakeholders operating dependencies and move sequences.	Health (Wilson et al. 2004)
4.3 4	Specialty equipment disconnect/ reconnect requirements.	Move Planning/ Process	Provide a plan for specialty equipment disconnect/ reconnect requirements.	Health (Wilson et al. 2004)
4.3 5	Moving-contractor support.	Move Planning/ Process		Health (Wilson et al. 2004)
4.3 6	Interim operating plans and continuity of service	Move Planning/ Process		Health (Wilson et al. 2004)
4.3 7	Grand opening activities.	Marketing-PR/Process	Prepare and communicate the grand opening activities.	Health (Wilson et al. 2004)
4.3 8	Public and speciality tours and events.	Marketing-PR/Process	Ensure adequate arrangement for the public and speciality tours and events to the new airport facilities.	Health (Wilson et al. 2004)
4.3 9	Public communications, including service-scheduling impact.	Marketing-PR/Process	Prepare and agree on the public communications, including service-scheduling impact.	Health (Wilson et al. 2004)
4.4 0	Facility staff communications and updates.	Marketing-PR/Process		Health (Wilson et al. 2004)

4.4 1	Change of address issues.	Marketing- PR/Process		Health (Wilson et al. 2004)
4.4 2	The orientation of staff to new facilities, including new operational plans and practices.	Training/ People	Arrange orientation of staff to new facilities, including new operational plans and practices.	Health (Wilson et al. 2004)
4.4 3	Staff training on new building systems.	Training/ People	Arrange and ensure Staff training on new building systems.	Health (Wilson et al. 2004)
4.4 4	Staff training on new equipment, including IT/telecom systems.	Training/ People	Arrange and ensure Staff training on new equipment, including IT/telecom systems.	Health (Wilson et al. 2004)
4.4 5	New business operational procedures.	Operational processes	Prepare all stakeholders New business operational procedures.	Health (Wilson et al. 2004)
4.4 6	New clinical and support operational procedures.	Operational processes		Health (Wilson et al. 2004)
4.4 7	Training and simulation activities.	Operational processes	Prepare and conduct operational trials training and simulation activities.	Health (Wilson et al. 2004)
4.4 8	New policy and procedure documentation.	Operational processes	Prepare and communicate all the new policies and procedure to all stakeholders for the new Facility.	Health (Wilson et al. 2004)

Table (14) provides the results of a combination of the questions from the four selected questionnaires available from the literature. From the first questionnaire, the Airport Terminal Facility Activation Techniques Questionnaire by (Lyons & Powell 2010), 26 questions were gathered, of which 19 questions were modified and selected as relevant to this study. From the second questionnaire, the NHS Ayrshire and Arran Patient Management System MSK Operational Readiness Questionnaire by (NHS Ayrshire & Arran 2012), 22 questions were gathered, of which 11 questions were modified and selected as relevant to this study. From the third questionnaire, the Software Support Qualitative Assessment Methodology Volume V Implementing the Operational Readiness Measure by Racine & Mitchell (1990), 50 questions were gathered, from which nine questions were modified

and selected as relevant to this study. From the fourth questionnaire, the Activation and Operational Planning: Ensuring A Successful Transition by (Wilson et al. 2004), 48 questions were gathered, of which 42 questions were modified and selected as relevant to this study.

To create a validated operational readiness questionnaire for the survey, and due to the lack of available operational readiness survey for the airport project, this study adopted a Delphi method, which is considered to be one of the best approaches for conducting a multi-criteria analysis (He et al. 2013). The Delphi method is a structured communication technique that encourages individuals (or groups of individuals) to provide their views to a facilitator, who collects the information anonymously. The facilitator then summarises the results to the group, who are asked to provide their opinion again, which is considered a key feature of the Delphi approach (Anderson 1997). It is believed that this approach creates a more balanced analysis by giving stakeholders an opportunity to reflect on what they have heard. As such, this study combined the questions that resulted from **Table (14)**. With a quantity of 81 questions with extra elements added based on their relevance and sub-divided some of the main questions to a more specific items, which was then categorised into operational readiness items for four major factors (facility, people, technology and organisation) to be used for the Delphi session with stakeholder's expert from the airports and academic expert from operations management backgrounds.

The results of categorising the selected modified questions from **Table (14)**, is shown in Table (15), which will serve as the input for the first round for Delphi session in phase 1, to select the suitable elements from this table based on the expert opinion in phase 1. The final list of questions that is used in this study questionnaire can be found in Appendix B of this study.

Table (15) Operations readiness elements for the Delphi session.

No.	Operational Readiness Element	Category	Required /Agree	Not required /Disagree
1. Facility Readiness				
1.1	Ensure that regulatory and compliance requirements for all the new facilities are met.	Facility		
1.2	Coordinate and support building commissioning activities and integrate it with operational trials	Facility		
1.3	Ensure the preparedness and schedules of all the Inspection and regulatory licensing for the facility and associated systems.	Facility		
1.4	Ensure that all the new small outfitting's and furniture installation and acceptance are completed.	Facility		
1.5	Ensure pre-occupancy stocking of all Maintenance and operational supplies for all stakeholders.	Facility		
1.6	Ensure adequate building cleaning and security during operational readiness activities and Trials.	Facility		
1.7	Ensure the availability of the contractor building turnover schedules	Facility		
1.8	Availability of the facility operational and maintenance procedures and processes.	Facility		
1.9	Availability of all the new airport facilities operating dependencies and move sequences.	Facility		
1.10	Availability of supporting department from contractors and consultant for the new facilities during the initial phase of operations.	Facility		
1.11	Operational trials and simulation for the new facility with important stakeholders.	Facility		

1.12	Facilitate accurate budgeting for start-up activities and ongoing operations of the new airport facilities.	Facility		
1.13	Manage the impact caused by the new facilities might have on existing facilities operations.	Facility		
1.14	New facility's processes and forms shall be created and sign off by the airport operational stakeholders.	Facility		
2. People Readiness				
2.1	Airport's operational services Training is essential for the operational readiness.	People		
2.2	Activation and operational readiness team shall be established early in the airport projects	People		
2.3	Local media shall be involved in the operational readiness program.	People		
2.4	Airport's airlines shall be involved in the operational readiness program.	People		
2.5	Airport's public users shall be fully involved in the operational readiness program.	People		
2.6	Arrange orientation of staff to new facilities, including new operational plans and practices	People		
2.7	Airport's government agencies such as police, immigration, and customs must be involved in the operational readiness program.	People		
2.8	Arrange and ensure staff training on new building systems.	People		
2.9	New airport's system training material should be accessible to the maintenance and operation team.	People		
2.10	New systems understanding and familiarisation shall be provided to the maintenance and operations team.	People		

2.11	Availability of the entire new airport's staff operating dependencies and move sequences.	People		
2.12	Ensure and maintain staff's safety and security during the initial move and operations.	People		
2.13	Organise and support stakeholders move of existing operational staff and suppliers.	People		
2.14	Equip operational teams with the necessary knowledge and tools to effectively complete their work. This may include training in meeting facilitation as well as specific orientation to project objectives, macro schedules, and guiding principles.	People		
2.15	Facilitate accurate budgeting for start-up activities and ongoing operations of the new staff hired and temporary human capital support.	People		
2.16	Ensure that regulatory and compliance requirements from airport security for all the new hired staff are met.	People		
3. Systems / Technology Readiness				
3.1	All the system manuals and documentation to be made available during operational readiness and before actual operations.	System		
3.2	The arrangement of maintenance and operational plans for the critical systems.	System		
3.3	Adequate recruitment of operations and maintenance staff for all the new systems.	System		
3.4	Ensure adequate training and familiarisation is provided for all the new systems maintenance and operational staff.	System		
3.5	Ensure full testing and commissioning and integration of the critical	System		

	systems of the new facility in the airport project.			
3.6	Ensure the completion of the Implementation of the IT/Telecom program.	Systems		
3.7	Ensure adequate skills and competencies for all the system's maintenance and operations staff of the new facility.	System		
3.8	Ensure and test all the systems integration of the new facility to the existing systems.	System		
3.9	Support and ensure the relocation of stakeholders existing equipment as planned, with minimal operating disruptions.	System		
3.10	Ensure pre-occupancy stocking of all maintenance and operational supplies (Spares) for the critical systems of all stakeholders.	System		
3.11	Ensure system integration of the new facility to existing systems in the airport.	System		
3.12	Ensure the validation and communication of the new phone numbers; new computer addresses to all relevant stakeholders and airport users.	System		
3.13	Ensure that all the airport users sub-networking is completed to support all stakeholder's operations	System		
3.14	Ensure ordering and installing IT/Telecom equipment for all the operational stakeholders of the airport.	System		
3.15	Ensure that regulatory and compliance requirements for all the new and critical systems are met.	System		
3.16	Ensure financial and budget coverage for all the new facility operations and maintenance.	System		

3.17	Availability of all the systems operational and maintenance procedures and processes.	System		
3.18	Availability of all the new airport's systems operating dependencies and move sequences.	System		
3.19	A plan for speciality equipment and systems disconnect/reconnect requirements	System		
3.20	Availability of supporting department from suppliers and vendors for the systems during the initial phase of operations.	System		
3.21	Organise and support stakeholders move of existing operational equipment and systems.	System		
3.22	Operational trials and simulation for the new systems with critical stakeholders.	System		
3.23	Facilitate accurate budgeting for start-up activities and ongoing operations of the systems.	System		
3.24	Manage the impact caused by the new systems might have on existing systems operations.	System		
3.25	Manage the safety and operational risks associated with the activation of the new systems.	System		
4. Organisation Culture / Processes Readiness				
4.1	Ensure that plans for the operation are developed by the vision and operating stakeholder's priorities.	Process		
4.2	Documentation of the escalation process and communicating it to all relevant stakeholders of the new facility.	Processes		
4.3	Confirmation of an escalation process to higher management during operational readiness.	Processes		

4.4	Ensure all roles and responsibilities (operator, maintainer and user) documentations are signed off by relevant airport's stakeholders.	Processes		
4.5	Confirmation of all roles and responsibilities (operator, maintainer and user) are fully documented and communicated to all the airport stakeholders.	Processes		
4.6	All the new standard operating procedure (SOP) and irregular operating procedure (IOP) shall be documented and communicated to all operational stakeholders.	Processes		
4.7	All the new airport operational process should be documented and communicated to all operational stakeholders.	Processes		
4.8	New facility objectives and performance outcomes shall be documented and signed off by the operations team.	Process		
4.9	Airport's project should have phased (soft) opening as part of its operational readiness plan.	Process		
4.10	Airport's project should have fixed date for an opening as part of operational readiness plan.	Process		
4.11	Activation and operational readiness plan shall be established early in airport's projects.	Process		
4.12	Operational readiness program should be led by the Operations team of the airport.	Process		
4.13	Operational readiness program should be led by Project team of the airport.	Process		
4.14	A Checklist/Reporting mechanism is necessary to be used for the operational readiness program.	Process		
4.15	Progress update on operational readiness plan shall be managed and	Process		

	communicated to all airport stakeholders.			
4.16	Operational readiness plan should be part of the project overall planning schedule.	Process		
4.17	A clear protocol for, issue identification/resolution during the operational readiness program is required.	Process		
4.18	A clear protocol for communication during the operational readiness program is required.	Process		
4.19	A formal charter or mission statement for the operational readiness program/Team is required	Process		
4.20	A formally dedicated activation and operational readiness team are required.	Process		
4.21	Effectively manage the administrative and economic risks associated with the activation.	Process		
4.22	Minimising of the time from construction completion to the start-up of operations.	Process		
4.23	Ensure that regulatory and compliance requirements for all the processes and procedures are met	Process		
4.24	Manage the impact caused by the new activation might have on existing operations.	Process		
4.25	Use multidisciplinary teams to drive the activation planning process and Ensure that cross-functional processes, as well as enabling elements (e.g., information technology, human resources), are clearly integrated within the process and activation plans.	Process		
4.26	Equip airport activation teams with the necessary knowledge and tools to effectively complete their work. This may include training in meeting facilitation as well as specific	Process		

	orientation to project objectives, macro schedules, and guiding principles.			
4.27	Provide consistent, real-time communication of project schedules and plans to all relevant Airport stakeholders including constituencies, including planning teams, medical staff, employees, and the community.	Process		
4.28	Develop a database of airport activation issues, questions, and answers that are accessible to all relevant stakeholders.	Process		
4.29	Assign stakeholders to project single point of contact (SPOC) to coordinate, facilitate, and drive all aspects of activation planning and implementation, and ensure that this individual has adequate time allocated to fulfil this role.	Process		
4.30	Timely manner decisions making shall be taken by the activation team and communicate the decisions across the planning organisation.	Process		
4.31	Establishing Joint control room with all the stakeholders for the move sequence and new operations.	Process		
4.32	Ensure and maintain passenger safety and security during the initial move and operations.	Process		
4.33	Define and communicate the supporting department responsibilities during the initial phase of operations that includes the contractor and consultant as part of the stakeholders.	Process		
4.34	Maintain lines of communication with all the stakeholders during initial start-up and operations.	Process		
4.35	Prepare and communicate the grand opening activities.	Process		

4.36	Adequate arrangement for the public and speciality tours and events to the new airport facilities.	Process		
4.37	Arrangement and agreement on the public communications, including service-scheduling impact.	Process		
4.38	Availability of new business and administration operational procedures and processes for all stakeholders.	Process		
4.39	Prepare and communicate all the new policies and procedure to stakeholders of the new facility.	Process		
4.40	A formal activation and operational readiness program.	Process		

Section 2: Select the question type for each question and specify the wording

Open-ended questions and closed questions are the two types of questions that can be used in the questionnaire (Harris & Brown 2010). Researchers select between these two types of questions based on what answers he/she is looking for from the respondents. Open-ended questions provide the respondents with freedom to write anything they have in mind with the space given from the researchers while the answers to closed questions are contained within predetermined choices that responded has to select from (Boynton 2004; Saunders et al. 2009). When using closed questions in questionnaires, researchers insert multiple-choice answers with rating scales. The rating scales such as Likert-type scales help in estimating the respondent's opinions in numerical values that can be further analysed statistically (Collis & Hussey 1997; Burgess 2001), which is the case in this research.

In this research study, respondents' perceptions will be measured using a five-point Likert scale (Boynton & Greenhalgh 2004). Where, '1' represents 'Strongly disagree', '2' Disagree, '3' Neither, '4' agree, and '5' 'strongly agree'. To increase the reliability and validity of the responses, a middle option was included as recommended by Lietz (2008) in the options to be answered by the respondents. In the earlier research studies of project management and project success, which were mostly quantitative (McLean et al. 2012), authors used Likert scales to evaluate the questions so that it can be using statistical techniques. This has encouraged the usage of the Likert scale for this study similar to others, such as those who have used it in previous project management studies (D.K. Ahadzie et al. 2008; Jiang et al. 2009; Stare 2011; Din et al. 2011; Chan et al. 2011; McLean et al. 2012). The questions for this study will be set in a way that values of the respondents 3 or above is considered an agreement while less than 3 are disagreement for the items provided in the questions.

For the wording of each question, reference is made to (Boynton & Greenhalgh 2004), who advised that when designing questionnaires, to make questions short and to the point (around 12 words or less). Thus, all the questions that have been generated are less than 12 words as illustrated in **Table (15)**. Lietz (2008) also recommends that all questions in the questionnaire be constructed in a simple and clear writing that is relevant to the research topics and to avoid vague quantifiers.

Section 3: The Sequence of the questions and overall layout

It is recommended by (Burgess 2001), not to clutter the questionnaire pages with unnecessary information that will not help the respondents on answering the questions. The only parts are needed for any questionnaires are the title of the research, a revision to

track recent copies and the date. In the current study, a brief introductory statement has been added, as it is also useful for the subjects to be briefly informed about the research objectives. For the questions, labelling for each of the questions shall be adequately representing the items to enable accurate data entry and analysis in the later stages. For this research, we have labelled the numbered based on the categories they fit in as shown in **Table (15)**.

The questionnaire layout designed for this study consisted of seven sections (available in Appendix B):

Part 1: Research information. As recommended by (Gendall 1998; Boynton 2004), this part consists of the introduction of the research objectives and questions, and the assurance of the participant and information confidentiality.

Part 2: Demographic information. The second part of the questionnaire consists of demographic questions about respondents, such as gender, organisation, work experience and places as recommended by (Jobe & Mingay 1989; Lietz 2008). The following work-related questions were asked to ensure the quality of the data required by experienced experts in airport projects:

- Q1. Kindly select which airport you are working in?
- Q2. What is your job role?
- Q3. How many years of experience do you have?
- Q4. What is the type of organisation you are working in?
- Q5. How many Airport projects you have worked in?

Part 3: Facilities readiness factor's items. The third part of the questionnaire called, "*Facilities readiness factor's elements*" focused on the readiness assessment of all the items related to the facilities that are associated with the new project and challenges.

Part 4: People readiness factor's items. The fourth part of the questionnaire is called, "*People readiness factor's elements*" and questions the human factor readiness assessment elements of the organisation.

Part 5: System/technology readiness factor's items. The fifth part of the questionnaire is called, "*System/technology readiness factor's elements*" and focuses on systems readiness assessment and management and its broader preparation for the operation.

Part 6: Organisations/processes readiness factor's items. The sixth part was labelled, "*Organisations/processes readiness factor's elements*" and contains items for processes, as well as organisations procedures for operational readiness assessment.

Part 7: Project success. The last part was labelled, "*Project Success*" and contains items for measuring the stakeholders' perceptions of the project success.

Burgess (2001) in his guide to designing a questionnaire recommended that the researcher selects a suitable software to be used for the statistical tests and analysis, and considers it an essential element in the questionnaire design. This phase of the study will utilise the quantitative computer software tool SPSS (Statistical Package for the Social Sciences) to enter and process data collected from the surveys. Descriptive statistical analysis and tests of validity will be performed firstly on the collected data to ensure the quality and suitability of the data for statistical testing. In addition to that SPSS AMOS Version, 20 will be used for SEM modelling, hypothesis testing and confirming relationships among the study's variables.

4.3.2.5 Statistical Data Analysis

The ability to provide robust outcomes for any research, data preparation and analysis shall be given special attention by the researchers (Burgess 2001; Abeyasekera 2005), all of the statistical tests and data preparation shall be known and conducted before proceeding to the next stage of analysis. In this research, statistical procedures and tests will be used to analyse the data collected in the following manner:

1. Descriptive statistics analysis
2. Data preparation and evaluation
3. Structural equation modelling (SEM)
4. Confirmatory factor analysis (CFA)
5. Hypothesis testing and path analysis.

Descriptive statistics: Researchers use this type of test in giving a clear picture of the sample used in the research, as well as enables the researcher to describe/compare variables numerically (Elliott & Woodward 2007; Saunders et al. 2009). According to Sekaran (2003), frequencies and percentages of the used sample for the research can be shown in a tabular format to provide the researchers with a comprehensive picture of the participants and their properties. For this study, descriptive statistics will be used to describe the data collected from the respondents in a statistical format and explains the means and standard deviation of the constructs in the study as recommended by Patel (2009) that includes a section on demography to explain to the reader a quick briefing about the respondents' gender, work location, job type, experience, organisation type, and the number of projects executed.

Data Preparation and Evaluation

This step is needed before conducting any statistical analysis and we make reference to Jackson et al. (2009) for the checklist and procedures to examine the data and prepare it. According to Shah and Goldstein (2006), the researcher must review the data for completeness and consistency before any statistical analysis, especially SEM analysis. This will cover data screening followed by the handling of missing values and outliers, then assessment of common method biases and finally the assessment of the data's normality and reliability.

Data Screening

In this step, the data is screened for human mistakes and visual errors as it is considered important for further data analysis that includes SEM (Samson & Terziovski 1999; Shah & Goldstein 2006). For this we refer to Pallant (2007) for the process of the data filtering where we first checked for errors, then identification of the data's errors, and finally removing the errors.

Missing values

It is important for the researcher to report missing data and report the method of handling it and final results (Jackson et al. 2009). This was further emphasised by Shah and Goldstein (2006) that missing values is problematic for multivariate analysis. Usually missing data will occur due to poor data collection or data entry. To handle the missing values existing in this current research dataset, we make reference to (Lombardi et al. 2012) in using case deletion method, which is popular for data missing handling. It is also called listwise deletion (LD), so this method was applied in the current study.

Outliers values

Outliers are case represented by values significantly large or small, and it differs from other cases in the dataset (Elliott & Woodward 2007). In this research, SPSS software will be used to identify outliers cases and will be removed as needed.

Assessing Common Method Bias

In this step of assessment, Harman's single-factor test will be conducted using unrotated factor analysis for all the questionnaire items and will be forced to single factor using eigenvalue greater than one (Sariola & Martinsuo 2016).

Assessing Univariate Normality

In this step, assessment for normality will be carried out for all of the study's items using descriptive analysis and the values of Skewness and Kurtosis. Descriptive statistics will be used to measure the data normality, where normality refers to the distribution of metric variable compared to a normal distribution. Here we would like to note that Yang et al. (2006) stated that normality tests are not required to be conducted for SEM analysis when the dataset contains a large sample size. However, Shah and Goldstein has clearly argued that *“assessing data normality (along with skewness and kurtosis) is important because many model estimation methods are based on an assumption of normality. Non-normal data may result in inflated goodness of fit statistics and underestimated standard errors”* (Shah & Goldstein 2006, p. 157).

For the descriptive statistics analysis to measure and compare the Skewness and Kurtosis of the study variables, visual inspection will be checked for the histograms of all the items and values will be presented in tabular formatting, where skewness and kurtosis for all

the items used in this study and their observed factors, and as reference to Joslin and Müller (2015) the values for skewness and kurtosis should be within the limits of ± 2 and ± 3 , respectively.

Assessing Multivariate Normality, Linearity and Homoscedasticity

In this step, assessment of the multivariate normality (MVN), linearity and homoscedasticity for the research data set as part of the data evaluation for SEM analysis (Osborne & Waters 2002). This study examines a complex relationship of operational readiness and project success and for that assumption for multivariate normality is required. It is recommended by (Jackson et al. 2009; Byrne 2016) to check for the multivariate normality (MVN) before conducting any structural equation modelling analyses, as prior research indicated that an overestimation of the chi-square statistic due to failing to meet MVN assumption. To do this, we utilised SPSS v.20 in this study assessment of the data using regression function. Next, assessment of linearity and homoscedasticity (homogeneity of variance) will be analysed for the assumption of this research. The assessment will be carried out in SPSS v.20 and used the regression function to regress the four factors that predict project success (Tabachnick & Fidell 2007).

Assessing the Reliability of the Measures for the Constructs

To evaluate the internal consistency of the variables in the study, Cronbach's Alpha will be used to analyse the reliability. The value of alpha ranges from 0 to 1. The closer the

value to 1, the higher the reliability. It is recommended that the value for construct reliability is over .70 (Low et al. 2015).

Structural Equation Modelling (SEM):

With reference to the statements of Shah & Goldstein, “*(SEM) has more recently become one of the preferred data analysis methods among empirical OM researchers*” (Shah & Goldstein 2006, p. 148). This study, in particular, used the SEM to confirm the suitability of the study model suggested in Chapter 3 and hypothesis, generated from it.

This sub-section will provide justifications for the selected statistical tests and analysis. The analyses of the collected data were conducted using statistical package software called SPSS (Statistical Analysis for Social Scientists) Version 20 and SPSS AMOS Version 20 was used for SEM modelling, hypothesis testing and confirming relationships among observed and latent study variables.

Researchers use a special statistical software called AMOS for the Structural equation modelling in the data analysis. It is one of the statistical methods for investigating causal relations by combining the qualitative causal modelling with the data (Yang et al. 2012). SEM builds upon multiple regressions and incorporates and integrates path analysis and factor analysis. In particular, SEM analyses the data using confirmatory factor analysis (CFA) to assess the proposed measurements and using path analysis in confirming any structural relations that were hypothesised by the researcher. This is considered one of the powerful features of SEM, where it combines both measurement and structural estimation in a complete model (Zafar et al. 2012). Previously, and in project management

research, Zafar et al. (2012) used the structural equation modelling testing to test the research hypotheses. This study adopts the same technique to test the constructed operational readiness model and its relationship with project success.

To perform SEM analysis for this study, reference was made to Anderson and Gerbing's (1988) two-step approach. The first step consisted of the measurement model, where a confirmatory factor analysis (CFA), using AMOS 20, will be performed. The second step will describe the study's variables in a structural model and conduct a model fit analysis. Finally, the hypothesis of the study will be tested to confirm the proposed framework and analyse the relationship between the dependent and independent variables of the model.

SEM's Model Fit Indices:

In this section, model fit indices will be discussed, where the indices are measures of how the model fit the data collected also known as the model fit (Hooper et al. 2008). In this research study, three types of indices will be measured for the model fit analysis which includes absolute fit indices, incremental fit indices and parsimony fit indices.

- **Absolute fit indices:** these indices, in general, provide an indication of how well the hypothesised model represent the collected data of the study (Shah & Goldstein 2006). Four indices will be used in this study to measure the absolute fit of the model, Root Mean Squared Error of Approximation (RMSEA) and the Standardized Root Mean Squared Residual (SRMR) as indicators of absolute fit as recommended by Elbanna (2015), Chi-square (χ^2) and Goodness of fit (GFI) as recommended by Froehle and Roth (2004).

- **Incremental fit indices:** these indices provide an indication of the measuring the study model with reference models (Lei & Wu 2012). For this study, two indices will be measured and compared in this study, Tucker–Lewis Index (TLI) and comparative fit index (CFI) as recommended by Shah and Goldstein (2006).
- **Parsimony fit indices:** these indices measure the relation of the model fit to model complexity (Ika 2015). In this study, one indices will be used to measure the parsimony, Adjusted Goodness-of-fit Index (AGFI) as recommended by Nimako and Ntim (2013).

Regardless of the ongoing debate over the correctness of one model fit index (Ika 2015), there are currently many fit indices without any consistent values that can be used for all models. As such, the benchmark fit indices values adopted from (Nimako & Ntim 2013), has to be reported to compare and accept the models of this study.

Confirmatory Factor Analysis (CFA)

In this step, verification of the factor structure for the operational readiness model and project success model will be presented using confirmatory factor analysis (CFA). CFA is the first step in the SEM analysis, and it is used as a statistical method conducted by researchers to confirm the factor structure of a measurement instrument (Shay et al. 1991). One of the main characteristics in structural equation modelling is the representation of the latent factors in relation to the observed items (Santor et al. 2011). It is also used to test hypothesised relationships between observed items and their latent constructs (Shay et al. 1991; Scandura & Williams 2000). As this research uses a second order factor, CFA

has also been used for first order and second order models. Confirmatory factor analysis is an application of SEM that are widely used in operations management (Shah & Goldstein 2006) and was employed in this study to test the scale validity, which represented how well the measures reflected their intended constructs. It was also noted that more studies employed confirmatory factor analysis as a primary data analytical tool when their goal was the development of a new measure (Scandura & Williams 2000), as in the case of this study to develop the measure of operational readiness for airport projects in the UAE. First, the operational readiness model will be tested and then project success model, as the two variables that were used in this study. For this study, CFA analysis will be conducted for both operational readiness model and the project success, followed by an assessment of the model's constructs validity and finally the model fit analysis utilizing the selected SEM's model fit indices as discussed earlier. Creating and analysing the CFA model requires the use of the following flow diagram steps using information from (Hair et al. 2009).

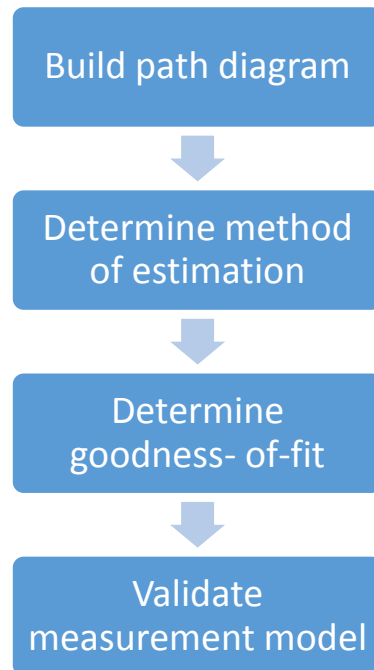


Figure (27) CFA Flow Diagram.

Hypotheses Testing and Path Analysis

With reference to **Figure (20)**, and to this study hypothesised relationships between the operational readiness variable and project success, this step will use path analysis and parameter estimates to estimate the strength and sign of directional relationships for the operational readiness structural model where a causal relationship is hypothesised as follows.

Hypothesis # 1: Facility readiness's factors positively correlated with operational readiness.

Hypothesis # 2: People readiness's factors positively correlated with operational readiness.

Hypothesis # 3: Technology readiness's factors positively correlated with operational readiness.

Hypothesis # 4: Organization readiness's factors positively correlated with operational readiness.

Hypothesis # 5: Operational readiness positively influences project success

The results of the hypothesis from the path analysis will help to indicate a statistical significance and direction of the paths for H₁, H₂, H₃, H₄, and H₅.

After completing the design of the questionnaire and the selection of statistical tests/analysis. A pilot survey is planned to be conducted with ten experts from major operations stakeholders to ensure the correctness of the selected elements and inspect the clarity of the questionnaire before administering it among the participants.

4.3.2.6 Pilot Testing

Since part of this research study involves the design of an operational readiness questionnaire to determine the participants' perceived requirements of readiness and project success. The questions in the newly developed questionnaire need to be tested with a small group of individuals similar to the target population before being administered among the study sample, as recommended by several authors (Burgess 2001; Boynton 2004; Adams & Cox 2008; Lietz 2008). Szulanski described the purpose of the pilot study as a means to, *“get the consultation with subject experts, and the feedback obtained when piloting the questionnaire helps refine the choice of constructs. As well as identifies the most relevant items for those constructs and their proper wording given the empirical context”* (Szulanski 2000, p. 19). As recommended, the pilot study will help to identify and solved

problems more easily than opposed to if this were to be done during the administration of the main questionnaire. Both the pilot study and the final surveys were self-administered online.

To achieve effective analysis of the pilot study, the researcher adopts the following steps:

1. Data collection
2. Data Analysis using the demographic check of respondents, missing data and reliability and correlation.

For the **first step**, data collection will be achieved by a total of 200 online questionnaires sent to participants, which were selected using a purposive sampling technique. Respondents include four project managers, ten end-users, three consultants, and three contractors who are currently working in the operations and projects of Dubai airports. An invitation via Linked-In, as well as e-mails, were sent to each of the potential participants explaining the research aims and objectives so that they would be aware that they were evaluating the questionnaire's quality and clarity, and if they encountered any difficulties while completing it online. The pilot survey was developed using SurveyMonkey™ online survey tools.

For the **second step** of the pilot study, data analysis will be conducted by demographic check for the responses, check for missing data and check for the reliability and correlation of the variables and items measured in the pilot study to ensure suitability for the main questionnaire. The demographic analysis of this pilot study are to be used here to ensure accurate data for the research from the targeted population as recommended by (Sekaran 2003). While missing data analysis is to be conducted to ensure the suitability of the data and validity of the response rate for the select sample as recommended by

(Jackson et al. 2009). Correlation and normality analysis was the last part in this step; reliability and correlation tests will be performed on the data obtained from the pilot survey items within each factor to identify any modification to the items. In the social sciences researches, reliability is achieved when the same results are obtained from the same survey tool regardless of the form and who administer it. In addition to that, researchers use a statistical test in SPSS called “Cronbach’s alpha” reliability test, which measures the extent to which group of items used in the survey can measure the same factor. The alpha values changes depend on the correlation between the items, so greater correlation between items will generate higher alpha values and vice versa. As per Parsian and Dunning (2009), acceptable values of alpha is between (0.5-0.6), but DeVon et al. (2007) have argued that for an internal consistency of the factor the values of alpha shall be 0.7 or higher to allow the survey and its questions to be used in the research. For all the questions measures the items of this survey, we refer to Wood (2002) who stated that Cronbach's alpha scores exceeding 0.7 are considered to have sufficient internal consistency, which in turn suggest that respondents will provide the same answers if the survey was repeated to them again.

Even the newly designed questionnaire will be piloted initially, but a more rigorous validation process will be utilised (Boynton & Greenhalgh 2004). Reference is made to (Parsian & Dunning 2009) with regards to designing and validating a questionnaire; a validation process has been developed for this questionnaire, which will be discussed in details in the next section and as illustrated in **Figure (28)**.

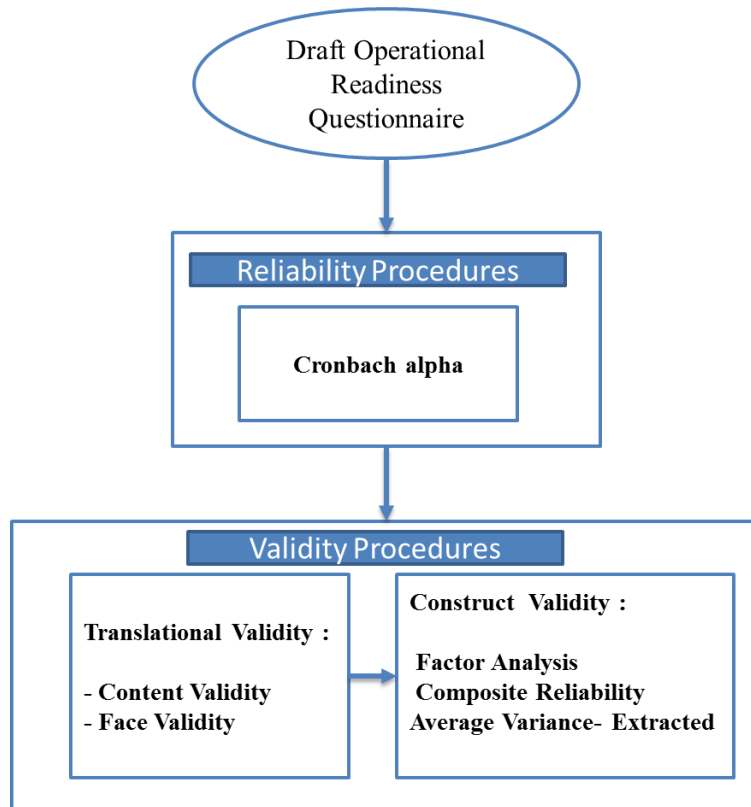


Figure (28) Validation process for the developed questionnaire.

4.3.2.7 The Credibility of Research Findings

For every research when conducted, the demonstration of the credibility of the conclusions of the research is an important aspect (Sutrisna 2009). To demonstrate the credibility of this research, sufficient information has been provided on the methods used for the data collection and the justification for the selection (Boynton & Greenhalgh 2004). Moreover, this research focuses on the instruments used to investigate the relationship of operational readiness and project success, and because the legitimacy of any measurement instrument is embedded in its psychometric properties (Holt, Achilles A Armenakis, et al. 2007; Parsian & Dunning 2009). Holt et al. (2007) have suggested tests and technique appropriate for the analysis of measurement instruments including content validity, predictive validity, construct validity and reliability. In this section, the researcher will discuss the

important aspects of the reliability, validity (Boynton & Greenhalgh 2004) and generalisation (Yilmaz 2013) of the methods and data.

4.3.2.7.1 Validity

This subsection is required to check the extent to which results of this research represent actual processes in real life. That is, whether the results are what they appear to be (Collis & Hussey 1997; Saunders et al. 2009;) and the data give us a true image of what has been studied in the research. To assure the validity of the data, the questions used in the questionnaire should measure what the researcher intends to measure for the research, regardless of the high reliability of the data collected. According to Fraenkel and Wallen, “*the term validity as used in research, refers to the appropriateness, meaningfulness, correctness, and useful of any inferences a researcher draws based on data obtained through the use of an instrument*” (Fraenkel & Wallen 2006, p. 165).

Using mixed-method design as the strategy for this research has considerably supported the validity and reliability of it with triangulation of the research finding, where the focus on questions selection and the process of interlinking them from phase 1 to phase 2. With reference to Parsian and Dunning (2009), the following methods will be used to validate the questionnaire designed for this study: translation validity and construct validity.

Translational validity, which includes both face and content validity (Hardesty & Bearden 2004; Weiner & Lee 2008; DeVon et al. 2007; Parsian & Dunning 2009) has been used by the researcher to ensure the validity of the data in this study.

- **Content validity:** the researcher conducts this validity to ensure that questions provided within the questionnaires represent actual and relevant to the problem under study for the research. For this study, it indicates that the content of the questionnaire measures a complete range of the items for the operational readiness factors and project success, which is under the study of this research. This validity is usually performed by more than seven subject matter experts (DeVon et al. 2007). Specifically, the researcher estimated the content validity of the operational readiness questionnaire, by clearly defined the conceptual framework for operational readiness and project success, by undertaking a thorough review of the literature and conducting the Delphi session; these have assured the content validity of the questionnaire items.
- **Face validity,** which ensures the appropriateness, readability and clarity of the language used in the questionnaire and developed items. The importance of face validity has been reported by (Hardesty & Bearden 2004). It is considered the easiest and weakest form of validity that can be taken by the researchers. To determine the face validity of the operational readiness questionnaire, an evaluation of the questionnaire was taken by experts during the pilot testing to check the wording for misspelled and mistakes, the ease on understating and answering the questions as well as the layout and style.

Construct validity: it is used to test hypotheses based on a conceptual framework, and it is supported if the scores adequately reflect the model. It also refers to the degree to which the items developed by an instrument are related to the conceptual construct (DeVon et al. 2007). It is important to note here that construct validity depends upon the conceptual soundness of the formal conceptual definitions, and it required substantive

significance before statistical significance (Wacker 2004). This validity measures quantitative numbers, which differs from the qualitative decisions of validity (Parsian & Dunning 2009). It also measures the relations between the variables of the study (Lowry & Gaskin 2014). Construct validity can use factor analysis technique to confirm the data (Cronbach & Meehl 1955).

- **Composite reliability** and **Average Variance Extracted (AVE)** will also be measured in phase 2 of this study to ensure the reliability of the latent variables and how well the measured variables (MV) can measure their Latent variable (LV) (Shah & Goldstein 2006). These two measures will ensure the convergent reliability of the where the two constructs of this study will be considered convergent when the value calculated for the composite reliability is higher than (0.7) and values of the average variance extracted is higher than (0.5) (Hernandez & dos Santos 2010).

4.3.2.7.2 Reliability:

To ensures the reliability of the research outcomes; other researchers shall end up with the same outcomes if conducted the same research in the same settings (Collis & Hussey 1997; Saunders et al. 2009). According to Boynton & Greenhalgh (2004), a questionnaire with reliability will be able to provide consistent results from the different researchers over time. Easterby-Smith et al. (1991) have provided the following three questions to assess the reliability of the research:

- *Will the measures yield the same results on other occasions?*
- *Will other observers reach similar observations?*

- *Is there a transparency over how sense was made from the raw data?*

For this research, the reliability of the questionnaires' data will be tested using Cronbach's alpha with a significance value of 0.7 or higher. According to (Takim 2009; Randeree & Faramawy 2011; Cano & Lidón 2011; Badewi & Shehab 2016), as the acceptable value of alpha should be greater than 0.7 for the scale to be reliable.

4.3.2.7.3 Common Method Bias (CMB)

In this study, the questionnaire used to collect data for the independent and dependent variables at the same time from the same respondent, which may distort the data collected (Lowry & Gaskin 2014). To avoid such distorting to data, Harman's single-factor test will be conducted to ensure that there is no single factor's variance explain the whole model (Sariola & Martinsuo 2016).

4.3.2.7.4 Generalizability

This refers to the generalisation of the results for all the similar cases of the research sample, (Collis & Hussey 1997). The context of this study is on airports settings and projects of terminal and facilities, and in this research, we are exploring the operational readiness phenomena on airports completed projects and its impact on projects success. So, efforts were made nonetheless to attain generalizability for at least the same airport settings, project type and assured that if other researchers conducted the same study in other airports around the world, the similar outcome would result.

4.3.2.8 Ethical Considerations

Many ethical elements have to be considered before and during the research process. These elements include the confidentiality of documents and information, informed consent and the anonymity of subjects and organisations. A draft sample of the participant consent form is available in Appendix D. Participants will be briefed and provided with the research information page, which includes its objectives, aims and knowledge contributions. Part of this study's ethical consideration is signing confidentiality agreements with organisations; such agreements and maintaining information's confidentiality are considered an essential component of the research (Weerd-Nederhof 2001). A draft sample of the confidentiality agreement can be viewed in Appendix E. For this stage of the research, survey participants will be informed, and a confidentiality agreement signed by the researcher will be provided to their organisation when requested, to ensure the anonymity and confidentiality of the participants' identities.

4.4 Summary

This chapter contained the major elements of the research methodology and design. Specifically, the research strategies and methods adopted to answer the research questions and understand the research phenomena. The chapter starts with a review of this study aims and objectives, then provides a detailed research design flow chart. Furthermore, the research philosophy and approach was discussed in details including the justification of their selection. Based on the philosophies and approaches, research methods were selected and data collection with the justification and detailed discussion of each phase. The first phase involved the identification of the items that are needed for creating an operational readiness state for airports projects to operate. This was achieved by reviewing the

available literature and conducting Delphi session. Based on this, a questionnaire prepared and piloted before administering it with the research respondents. Sampling techniques and size concerning the research have been discussed and justified. Finally, the selected statistical data analysis techniques for this research included descriptive statistics and SEM analysis as stated followed by the validation, reliability and ethical consideration of the research. In the following chapter, the findings of the two phases will be analysed and presented.

Chapter 5

Analysis of the Data

5.1 Introduction

This chapter records the finding of the methodology as discussed in Chapter 4 and applies it to the answers that were received from the research's targeted subjects. The chapter presents the outcomes of the research to answer the research questions and verify the research's proposed hypotheses. First, analysis of the qualitative part, which is phase 1, is presented that includes the Delphi sessions and outcome from the final rounds. Results of this phase was a confirm list of operational readiness items that will be used to design the questionnaire for phase 2. Second, analysis of the pilot study is presented, and the correction is made to the questionnaire to be used in phase 2. Finally, analysis of phase 2 is presented and the output of the SEM analysis, which has confirmed the operational readiness framework, based on the data collected in this phase. Hypotheses were tested on this chapters which will be discussed in more details in the coming sections.

5.2 Phase 1 (Qualitative) Data Analysis and Discussion

In this section, a detailed analysis and discussion of the Delphi method will be presented. It will also present the data generated from the sessions, which entails selecting the expert panel, the questions to be used for the rounds, and running the rounds.

As recommended by Day and Bobeva (2005), the researcher discussed the Delphi's questions with selected airport's managers, operations managers, and academics with relevant experience on the Delphi and the research subject to ensure the appropriateness and clarity of the questions, and the rounds to be used with the expert panel. Reference is also

made to (Pawlowski, Suzanne, & Okoli 2004; Day & Bobeva 2005; Skulmoski & Hartman 2007) with regards to the steps to be taken to be able to conduct the Delphi rounds, which specifies that three main components are required: (1) the selected expert panel; (2) the question and the rounds; and (3) Delphi-panel analysis and results.

5.2.1 The Selected Expert Panel

To have a successful Delphi method, the researcher must pay careful attention to the selection of the experts to be used. Since the information under exploration requires detailed information and practical experience on the operation and construction works of airport projects, a purposive sampling technique was used to select the experts (Ojiako et al. 2008a; Denscombe 2010; Chih & Zwikael 2014). As identified by (Welty 1972), an expert is someone who has more data and information than the average man in the area of expertise has. For this Delphi study, ten experts were selected based on the recommendation from those involved in the construction and operations of airports in UAE. E-mails were sent to the experts to obtain their approval to participate in the Delphi group. The ten expert panels were senior operations manager, directors, senior project managers and managers selected for their experience of past and present airports projects both local and overseas, as well as three academics with expertise in the field of project management and operations management from UAE universities.

5.2.2 The Questions

In this section, discussion of the questions used for each round will be presented, and the details of each round in the next sub-sections.

5.2.2.1 *Delphi Round 1*

The first questionnaire consisted of 14 facility readiness factors, 16 people/human capital readiness factors, 25 systems/technology readiness factors, and 40 organisation readiness factors as shown in **Table (16)**. The experts were asked to indicate the requirements of each statement by ticking the appropriate box based on their criticality. They were asked to add additional comments at the end of the questionnaire. There was 80% response, with eight experts out of 10 responding to the questions; two dropped out due to personal commitments.

Table (16) Factors and Items for Delphi round 1.

1.0 Facility Readiness		Items
1.1	Ensure that regulatory and compliance requirements for all the new facilities are met.	
1.02	Coordinate and support building commissioning activities and integrate it with operational trials.	
1.03	Ensure the preparedness and schedules of all the inspection and regulatory licensing for the facility and associated systems.	
1.04	Ensure that all the new small fit out and furniture installation and acceptance are completed.	
1.05	Ensure pre-occupancy stocking of all maintenance and operational supplies for all stakeholders.	
1.06	Ensure adequate building cleaning and security during operational readiness activities and trials.	
1.07	Ensure the availability of the contractor building turnover schedules.	
1.08	Availability of the facility operational and maintenance procedures and processes.	
1.09	Availability of all the new airport facilities operating dependencies and move sequences.	

1.10	Availability of supporting department from contractors and consultant for the new facilities during the initial phase of operations.
1.11	Operational trials and simulation for the new facility with critical stakeholders.
1.12	Facilitate accurate budgeting for start-up activities and ongoing operations of the new airport facilities.
1.13	Manage the impact caused by the new facilities might have on existing facilities operations.
1.14	New facility's processes and forms shall be created and sign off by the airport operational stakeholders.
2.0 People/Human Capital Readiness	
2.01	Airport's operational services training is essential for the operational readiness.
2.02	Activation and operational readiness team shall be established early in the airport projects.
2.03	Local media shall be involved in the operational readiness program.
2.04	Airport's airlines shall be included in the operational readiness program.
2.05	Airport's public users shall be fully involved in the operational readiness program.
2.06	Arrange orientation of staff to new facilities, including new operational plans and practices.
2.07	Airport's government agencies such as police, immigration, and customs shall be involved in the operational readiness program.
2.08	Arrange and ensure staff training on new building systems.
2.09	New airport's system training material should be accessible to the maintenance and operation team.
2.10	New systems understanding and familiarisation shall be provided to the maintenance and operations team.
2.11	Availability of all the new airport staff operating dependencies and move sequences.
2.12	Ensure and maintain staff's safety and security during the initial move and operations.
2.13	Organise and support stakeholders move of existing operational employees and suppliers.
2.14	Equip operational teams with the necessary knowledge and tools to effectively complete their work. This may include training in meeting facilitation as well as specific orientation to project objectives, macro schedules, and guiding principles.

2.15	Facilitate accurate budgeting for start-up activities and ongoing operations of the new staff hired and temporary human capital support.	
2.16	Ensure that regulatory and compliance requirements from airport security for all the new hired staff are met.	
3.0 System/Technology Readiness		
3.01	All the system manuals and documentation to be made available during operational readiness and before actual operations.	
3.02	The arrangement of maintenance and operational plans for the critical systems.	
3.03	Adequate recruitment of operations and maintenance staff for all the new systems.	
3.04	Ensure appropriate training and familiarisation is provided for all the new systems maintenance and operational staff.	
3.05	Ensure full testing and commissioning and integration of the critical systems of the new facility in the airport project.	
3.06	Ensure the completion of the Implementation of the IT/telecom program.	
3.07	Ensure adequate skills and competencies for all the system's maintenance and operations staff of the new facility.	
3.08	Ensure and test all the systems integration of the new facility to the existing systems.	
3.09	Support and ensure the relocation of stakeholders existing equipment as planned, with minimal operating disruptions.	
3.10	Ensure pre-occupancy stocking of all maintenance and operational supplies (spares) for the critical systems of all stakeholders.	
3.11	Ensure system integration of the new facility to existing systems in the airport.	
3.12	Ensure the validation and communication of the new phone numbers; new computer addresses to all relevant stakeholders and airport users.	
3.13	Ensure that all the airport users sub-networking is completed to support all stakeholder's operations.	
3.14	Ensure ordering and installing IT/telecom equipment for all the operational stakeholders of the airport.	
3.15	Ensure that regulatory and compliance requirements for all the new and critical systems are met.	
3.16	Ensure financial and budget coverage for all the new facility operations and maintenance.	

3.17	Availability of all the systems operational and maintenance procedures and processes.
3.18	Availability of all the new airport's systems operating dependencies and move sequences.
3.19	A plan for specialty equipment and systems disconnect/ reconnect requirements.
3.20	Availability of supporting department from suppliers and vendors for the systems during the initial phase of operations.
3.21	Organise and help stakeholders move of existing operational equipment and systems.
3.22	Operational trials and simulation for the new systems with critical stakeholders.
3.23	Facilitate accurate budgeting for start-up activities and ongoing operations of the systems.
3.24	Manage the impact caused by the new systems might have on existing systems operations.
3.25	Manage the safety and operational risks associated with the activation of the new systems.
4.0 Organization Process/Culture Readiness	
4.01	Ensure that plans for the operation <u>are developed</u> in accordance with the vision and operating stakeholder's priorities.
4.02	Documentation of the escalation process and communicating it to all relevant stakeholders of the new facility.
4.03	Confirmation of an escalation process to higher management during operational readiness.
4.04	Ensure all roles and responsibilities (operator, maintainer and user) documentation are signed off by relevant airport's stakeholders.
4.05	Confirmation of all roles and responsibilities (operator, maintainer and user) <u>are fully documented</u> and communicated to all the airport stakeholders.
4.06	All the new standard operating procedure (SOP) and irregular operating procedure (IOP) shall <u>be documented</u> and communicated to all operational stakeholders.
4.07	All the new airport operational process should <u>be documented</u> and communicated to all operational stakeholders.
4.08	New facility objectives and performance outcomes shall <u>be documented</u> and signed off by the operations team.
4.09	Airport's project should have phased (soft) opening as part of its operational readiness plan.

4.10	Airport's project should have fixed date for an opening as part of operational readiness plan.
4.11	Activation and operational readiness plan shall <u>be established</u> early in airport's projects.
4.12	Operational readiness program should <u>be led</u> by the operations team of the airport.
4.13	Operational readiness program should <u>be led</u> by Project team of the airport.
4.14	A checklist/reporting mechanism is necessary to <u>be used</u> for the operational readiness program.
4.15	Progress update on operational readiness plan shall be managed and communicated to all airport stakeholders.
4.16	Operational readiness plan should be part of the project overall planning schedule
4.17	A clear protocol for, issue identification/resolution during the operational readiness program is required
4.18	A clear protocol for communication during the operational readiness program is required.
4.19	A formal charter or mission statement for the operational readiness program/team is required
4.20	A formally dedicated activation and operational readiness team are required.
4.21	Effectively manage the administrative and economic risks associated with the activation.
4.22	Minimising of the time from construction completion to the start-up of operations.
4.23	Ensure that regulatory and compliance requirements for all the processes and procedures <u>are met</u>
4.24	Manage the impact caused by the new activation might have on existing operations.
4.25	Use multidisciplinary teams to drive the activation planning process and Ensure that cross-functional processes, as well as enabling elements (e.g., information technology, human resources), are clearly integrated within the process and activation plans.
4.26	Equip airport activation teams with the necessary knowledge and tools to effectively complete their work. <u>This</u> may include training in meeting facilitation as well as specific orientation to project objectives, macro schedules, and guiding principles.

4.27	Provide consistent, real-time communication of project schedules and plans to all relevant Airport stakeholders including constituencies, including planning teams, medical staff, employees, and the community.
4.28	Develop a database of airport activation issues, questions, and answers that are accessible to all relevant stakeholders.
4.29	Assign stakeholders to project single point of contact (SPOC) to coordinate, facilitate, and drive all aspects of activation planning and implementation, and ensure that this individual has adequate time allocated to fulfil this role.
4.30	Timely manner decisions making shall be taken by the activation team and communicate the decisions across the planning organisation.
4.31	Establishing Joint control room with all the stakeholders for the move sequence and new operations.
4.32	Ensure and maintain passenger safety and security during the initial move and operations.
4.33	Define and communicate the supporting department responsibilities during the initial phase of operations that includes the contractor and consultant as part of the stakeholders.
4.34	Maintain lines of communication with all the stakeholders during initial start-up and operations.
4.35	Prepare and communicate the grand opening activities.
4.36	Adequate arrangement for the public and speciality tours and events to the new airport facilities.
4.37	Arrangement and agreement on the public communications, including service-scheduling impact.
4.38	Availability of new business and administration operational procedures and processes for all stakeholders.
4.39	Prepare and communicate all the new policies and procedure to stakeholders of the new facility.
4.40	A formal activation and operational readiness program.

5.2.2.2 Delphi Round 2

Round two of the study provided the expert panel with the numbers of responses for each factor from round one. To achieve consensus, the experts were asked to discuss their selection of rating in consideration of the scores produced by round one. A detailed discussion has taken place between the panel experts regarding the choices of answers and the validity of factors.

5.2.2.3 *Delphi Round 3*

Round three was based on round two's discussions and clarifications of factors, and the panel with the numbers of responses for each factor from round one based on the scale of criticality. To achieve consensus, the experts were asked to review their rating again in consideration of the scores produced by round one. The second questionnaire was given, and there was an 80% response with eight experts answering the questionnaire. Most of the experts had reconsidered and made adjustments to their scores and commented on additional factors to be considered.

5.2.3 **Delphi-Panel Analysis and Results**

The responses were analysed by providing numerical scores for each scale of criticality with 5 points for factors deemed to be extremely critical (5), 4 points for factors deemed to be critical (4), 3 points for factors neither considered critical nor less critical (3), 2 points for factors deemed to be less critical (2), and 1 points for factors deemed to be not critical (1). These scores were then transformed into importance indices to determine the relative ranking of the attributes. A Relative Importance Index (RIX) was then developed to convert the scores into a decimal figure using the following formula taken from (Kometa et al. 1994):

$$\sum W / A \times N, \text{ where:}$$

w = weighting given to each factor in the scale;

A = the highest weight applied; and

N = total number in the sample.

W= is the weighting given to each factor by the respondents and ranges from 1 (1 points) to 5 (5 points) where “1” is not critical and “5” is extremely critical. A is the highest weight (i.e., 5 points on in this case) and N is the total number of the sample (8). The importance index ranges from 0 to 1. The responses were then compiled and analysed using the above procedure and formula. The relative importance indices ranking and percentage are shown in **Table (17)**.

Table (17) Operational readiness factors identified from third round (final) of Delphi method.

1.0 Facility Readiness	Scoring	RX I	Ran k
Operational trials and simulation for the new facility with critical stakeholders.	35	0.88	1
Ensure pre-occupancy stocking of all maintenance and operational supplies for all stakeholders.	34	0.85	2
New facility’s processes and forms shall be created and sign off by the airport operational stakeholders.	34	0.85	3
Availability of supporting department from contractors and consultant for the new facilities during the initial phase of operations.	33	0.83	4
Ensure that all the new small fit out and furniture installation and acceptance <u>are completed</u> .	33	0.83	5
Availability of the facility operational and maintenance procedures and processes.	32	0.80	6
Availability of all the new airport facilities operating dependencies and move sequences.	32	0.80	7
Ensure adequate building cleaning and security during operational readiness activities and trials.	31	0.78	8
Ensure that regulatory and compliance requirements for all the new facilities <u>are met</u> .	30	0.75	9
Coordinate and support building commissioning activities and integrate it with operational trials.	26	0.65	10
2.0 People/Human Capital Readiness	Scoring	RX I	Ran k

Airport's government agencies such as police, immigration, and customs shall be involved in the operational readiness program.	40	1.00	1
Activation and operational readiness team shall <u>be established</u> early in the airport projects.	40	1.00	2
Ensure and maintain staff's safety and security during the initial move and operations.	39	0.98	3
Arrange and ensure staff training on new building systems.	38	0.95	4
New systems understanding and familiarisation shall <u>be provided</u> to the maintenance and operations team.	37	0.93	5
Availability of all the new airport staff operating dependencies and move sequences.	36	0.90	6
New airport's system training material should be accessible to the maintenance and operation team.	36	0.90	7
Airport's airlines shall be involved in the operational readiness program.	34	0.85	8
Organise and support stakeholders move of existing operational staff and suppliers.	31	0.78	9
Airport's operational services training is essential for the operational readiness.	31	0.78	10
Arrange orientation of staff to new facilities, including new operational plans and practices.	29	0.73	11
Ensure that regulatory and compliance requirements from airport security for all the new hired staff <u>are met</u> .	17	0.43	12
Equip operational teams with the necessary knowledge and tools to effectively complete their work. <u>This</u> may include training in meeting facilitation as well as specific orientation to project objectives, macro schedules, and guiding principles.	14	0.35	13
3.0 System/Technology Readiness	Scoring	RX I	Rank
Manage the safety and operational risks associated with the activation of the new systems.	39	0.98	1
All the system manuals and documentation to be made available during operational readiness and before actual operations.	38	0.95	2
Manage the impact caused by the new systems might have on existing systems operations.	37	0.93	3
Availability of supporting department from suppliers and vendors for the systems during the initial phase of operations.	36	0.90	4

Ensure full testing and commissioning and integration of the critical systems of the new facility in the airport project.	36	0.90	5
Ensure the validation and communication of the new phone numbers; new computer addresses to all relevant stakeholders and airport users.	36	0.90	6
Ensure system integration of the new facility to existing systems in the airport.	35	0.88	7
A plan for specialty equipment and systems disconnect/reconnect requirements	35	0.88	8
Ensure adequate training and familiarisation <u>is provided</u> for all the new systems maintenance and operational staff.	35	0.88	9
Operational trials and simulation for the new systems with critical stakeholders.	35	0.88	10
Ensure pre-occupancy stocking of all maintenance and operational supplies (spares) for the critical systems of all stakeholders.	35	0.88	11
Support and ensure the relocation of stakeholders existing equipment as planned, with minimal operating disruptions.	33	0.83	12
Ensure and test all the systems integration of the new facility to the existing systems.	33	0.83	13
Availability of all the new airport's systems operating dependencies and move sequences.	33	0.83	14
Ensure adequate skills and competencies for all the system's maintenance and operations staff of the new facility.	32	0.80	15
Facilitate accurate budgeting for start-up activities and ongoing operations of the systems.	31	0.78	16
Availability of all the systems operational and maintenance procedures and processes.	31	0.78	17
Organise and support stakeholders move of existing operational equipment and systems.	31	0.78	18
Ensure that regulatory and compliance requirements for all the new and critical systems <u>are met</u> .	30	0.75	19
Ensure the completion of the implementation of the IT/telecom program.	27	0.68	20
Ensure financial and budget coverage for all the new facility operations and maintenance.	27	0.68	21
The arrangement of maintenance and operational plans for the critical systems.	26	0.65	22

Ensure ordering and installing IT/telecom equipment for all the operational stakeholders of the airport.	26	0.65	23
Adequate recruitment of operations and maintenance staff for all the new systems.	22	0.55	24
Ensure that all the airport users sub-networking is completed to support all stakeholder's operations	20	0.50	25
4.0 Organization Process/Culture Readiness	Scoring	RX I	Rank
Operational readiness plan should be part of the project overall planning schedule.	38	0.95	1
Documentation of the escalation process and communicating it to all relevant stakeholders of the new facility.	37	0.93	2
Establishing common control room with all the stakeholders for the move sequence and new operations.	37	0.93	3
Ensure and maintain passenger safety and security during the initial move and operations.	36	0.90	4
A checklist/reporting mechanism is necessary to <u>be used</u> for the operational readiness program.	36	0.90	5
Activation and operational readiness plan shall <u>be established</u> early in airport's projects.	36	0.90	6
Ensure all roles and responsibilities (operator, maintainer and user) documentation are signed off by relevant airport's stakeholders.	36	0.90	7
Timely manner decisions making shall be taken by the activation team and communicate the decisions across the planning organisation.	36	0.90	8
Confirmation of all roles and responsibilities (operator, maintainer and user) <u>are fully documented</u> and communicated to all the airport stakeholders.	36	0.90	9
A clear protocol for communication during the operational readiness program is required.	35	0.88	10
Maintain lines of communication with all the stakeholders during initial start-up and operations.	35	0.88	11
A formally dedicated activation and operational readiness team are required.	35	0.88	12
Ensure that regulatory and compliance requirements for all the processes and procedures <u>are met</u> .	34	0.85	13
Confirmation of an escalation process to higher management during operational readiness.	34	0.85	14

New facility objectives and performance outcomes shall <u>be documented</u> and signed off by the operations team.	33	0.83	15
Progress update on operational readiness plan shall be managed and communicated to all airport stakeholders.	33	0.83	16
Airport's project should have phased (soft) opening as part of its operational readiness plan.	33	0.83	17
Define and communicate the supporting department responsibilities during the initial phase of operations that includes the contractor and consultant as part of the stakeholders.	32	0.80	18
Prepare and communicate the grand opening activities.	32	0.80	19
Adequate arrangement for the public and speciality tours and events to the new airport facilities.	32	0.80	20
Arrangement and agreement on the public communications, including service-scheduling impact.	32	0.80	21
Availability of new business and administration operational procedures and processes for all stakeholders.	32	0.80	22
Prepare and communicate all the new policies and procedure to stakeholders of the new facility.	32	0.80	23
A formal activation and operational readiness program.	32	0.80	24
Airport's project should have fixed date for an opening as part of operational readiness plan.	31	0.78	25
Operational readiness program should <u>be led</u> by the operations team of the airport.	31	0.78	26
Ensure that plans for the operation <u>are developed</u> in accordance with the vision and operating stakeholder's priorities.	31	0.78	27
A clear protocol for, issue identification/resolution during the operational readiness program is required.	30	0.75	28
All the new airport operational process should <u>be documented</u> and communicated to all operational stakeholders.	30	0.75	29
Assign stakeholders to project single point of contact (SPOC) to coordinate, facilitate, and drive all aspects of activation planning and implementation, and ensure that this individual has adequate time allocated to fulfil this role.	29	0.73	30
Develop a database of airport activation issues, questions, and answers that are accessible to all relevant stakeholders.	29	0.73	31
All the new standard operating procedure (SOP) and irregular operating procedure (IOP) shall <u>be documented</u> and communicated to all operational stakeholders.	29	0.73	32

Operational readiness program should <u>be led</u> by Project team of the airport.	28	0.70	33
Manage the impact caused by the new activation might have on existing operations.	27	0.68	34
Use multidisciplinary teams to drive the activation planning process and Ensure that cross-functional processes, as well as enabling elements (e.g., information technology, human resources), are clearly integrated within the process and activation plans.	25	0.63	35
Provide consistent, real-time communication of project schedules and plans to all relevant Airport stakeholders including constituencies, including planning teams, medical staff, employees, and the community.	22	0.55	36
Equip airport activation teams with the necessary knowledge and tools to effectively complete their work. <u>This</u> may include training in meeting facilitation as well as specific orientation to project objectives, macro schedules, and guiding principles.	21	0.53	37
Effectively manage the administrative and economic risks associated with the activation.	17	0.43	38

It has been stated by Mitchell that consensus can simply mean a “*group opinion, general agreement or group solidarity in sentiment and belief*” (Mitchell 1991, p. 347); panel consensus was achieved on several factors from different groups. The panel selected these factors as being of high importance to the implementation of operational readiness to airport projects in the UAE. These factors scored 0.80 or more on the relative index scale and was considered as very critical operational readiness factors, where if the factors were included, may increase the chance of success but if left out will increase the chance of failure (Adnan & Morledge 2003). The final list of operational readiness has been generated using the Delphi panel method as shown in **Table (18)**, which includes seven factors from the facility readiness, eight factors from the people readiness, 15 factor from the technology readiness 24 factors from organisation readiness. These factors will make up the questions for the questionnaire survey.

Table (18) Final operational readiness factors’ output from the Delphi panel method.

1.0 Facility Readiness	Scoring	RX I	Rank
Operational trials and simulation for the new facility with critical stakeholders.	35	0.88	1
Ensure pre-occupancy stocking of all maintenance and operational supplies for all stakeholders.	34	0.85	2
New facility’s processes and forms shall be created and sign off by the airport operational stakeholders.	34	0.85	3
Availability of supporting department from contractors and consultant for the new facilities during the initial phase of operations.	33	0.83	4
Ensure that all the new small fit out and furniture installation and acceptance <u>are completed</u> .	33	0.83	5
Availability of the facility operational and maintenance procedures and processes.	32	0.80	6
Availability of all the new airport facilities operating dependencies and move sequences.	32	0.80	7
2.0 People/Human Capital Readiness	Scoring	RX I	Rank
Airport’s government agencies such as police, immigration, and customs shall be involved in the operational readiness program.	40	1.00	1
Activation and operational readiness team shall <u>be established</u> early in the airport projects.	40	1.00	2
Ensure and maintain staff’s safety and security during the initial move and operations.	39	0.98	3
Arrange and ensure staff training on new building systems	38	0.95	4
New systems understanding and familiarisation shall <u>be provided</u> to the maintenance and operations team.	37	0.93	5
Availability of all the new airport staff operating dependencies and move sequences.	36	0.90	6
New airport’s system training material should be accessible to the maintenance and operation team.	36	0.90	7
Airport’s Airlines shall be involved in the operational readiness program.	34	0.85	8
3.0 System/Technology Readiness	Scoring	RX I	Rank

Manage the safety and operational risks associated with the activation of the new systems.	39	0.98	1
All the system manuals and documentation to be made available during operational readiness and before actual operations.	38	0.95	2
Manage the impact caused by the new systems might have on existing systems operations.	37	0.93	3
Availability of supporting department from suppliers and vendors for the systems during the initial phase of operations.	36	0.90	4
Ensure Full testing and commissioning and integration of the critical systems of the new facility in the airport project.	36	0.90	5
Ensure the validation and communication of the new phone numbers; new computer addresses to all relevant stakeholders and airport users.	36	0.90	6
Ensure system integration of the new facility to existing systems in the airport.	35	0.88	7
A plan for specialty equipment and systems disconnect/ reconnect requirements	35	0.88	8
Ensure adequate training and familiarisation <u>is provided</u> for all the new systems maintenance and operational staff.	35	0.88	9
Operational trials and simulation for the new systems with critical stakeholders.	35	0.88	10
Ensure pre-occupancy stocking of all maintenance and operational supplies (spares) for the critical systems of all stakeholders.	35	0.88	11
Support and ensure the relocation of stakeholders existing equipment as planned, with minimal operating disruptions.	33	0.83	12
Ensure and test all the systems integration of the new facility to the existing systems.	33	0.83	13
Availability of all the new airport's systems operating dependencies and move sequences.	33	0.83	14
Ensure adequate skills and competencies for all the system's maintenance and operations staff of the new facility.	32	0.80	15
4.0 Organization Process/Culture Readiness	Scoring	RX I	Rank
Operational readiness plan should be part of the project overall planning schedule	38	0.95	1
Documentation of the escalation process and communicating it to all relevant stakeholders of the new facility.	37	0.93	2

Establishing Joint control room with all the stakeholders for the move sequence and new operations.	37	0.93	3
Ensure and maintain passenger safety and security during the initial move and operations.	36	0.90	4
A checklist/reporting mechanism is necessary to <u>be used</u> for the operational readiness program.	36	0.90	5
Activation and operational readiness plan shall <u>be established</u> early in airport's projects.	36	0.90	6
Ensure all roles and responsibilities (operator, maintainer and user) documentation are signed off by relevant airport's stakeholders.	36	0.90	7
Timely manner decisions making shall be taken by the activation team and communicate the decisions across the planning organisation.	36	0.90	8
Confirmation of all roles and responsibilities (operator, maintainer and user) <u>are fully documented</u> and communicated to all the airport stakeholders.	36	0.90	9
A clear protocol for communication during the operational readiness program is required.	35	0.88	10
Maintain lines of communication with all the stakeholders during initial start-up and operations.	35	0.88	11
A formally dedicated activation and operational readiness team are required.	35	0.88	12
Ensure that regulatory and compliance requirements for all the processes and procedures <u>are met</u> .	34	0.85	13
Confirmation of an escalation process to higher management during operational readiness.	34	0.85	14
New facility objectives and performance outcomes shall <u>be documented</u> and signed off by the operations team.	33	0.83	15
Progress update on operational readiness plan shall be managed and communicated to all airport stakeholders.	33	0.83	16
Airport's project should have phased (soft) opening as part of its operational readiness plan.	33	0.83	17
Define and communicate the supporting department responsibilities during the initial phase of operations that includes the contractor and consultant as part of the stakeholders.	32	0.80	18
Prepare and communicate the grand opening activities.	32	0.80	19
Adequate arrangement for the public and speciality tours and events to the new airport facilities.	32	0.80	20

Arrangement and agreement on the public communications, including service-scheduling impact.	32	0.80	21
Availability of new business and administration operational procedures and processes for all stakeholders.	32	0.80	22
Prepare and communicate all the new policies and procedure to stakeholders of the new facility.	32	0.80	23
A formal activation and operational readiness program.	32	0.80	24

5.3 Pilot Survey Analysis

The pilot study was conducted during the months of October and November 2016. The main objectives for conducting the pilot survey was first to ensure that data collection tool (questionnaire), which is developed for Phase 2 of this study is appropriate and free from major errors that may have an effect on the results. It is also important to have the pilot survey to examine the proposed operational readiness model factors and reliability. Based on the results and analysis of the pilot survey, adjustments were made by the researchers on the main questionnaire.

5.3.1 Data Collection

The researcher of this study used an electronic website (SurveyMonkey) to design and administer the pilot survey. A total of 200 operational stakeholders and project managers were targeted as working in the four major UAE airports (Sharjah International Airport, Dubai International Airport, Al-Maktoum International Airport, Abdu-Dhabi International Airport), were used as the subjects for this pilot survey and data were collected based on their answer and comments. Pilot survey subjects were asked to distribute the questionnaire to relevant members within their organisation who are working in or recently completed airport implementation projects.

5.3.2 Data Analysis

In this section, data analysis will be presented for the pilot study that includes, demographic check for the responses, check for missing data and check for the reliability and correlation of the variables and items measured in the pilot study to ensure suitability for the main questionnaire.

5.3.2.1 Demographic Check of Respondents

A total of 150 responses were received out of the 200 invitation sent, which gave us a response rate of 75% , and the pilot survey was concluded. The demographics for subjects working in four different airports projects in UAE were received as shown in **Table (19)**.

Table (19) Pilot survey data.

Statistics							
		Gender of the Subject	Airport working in	Type of Job in Airport	Number of years in the current organization	Type of organisation in the project	Number of projects done in airport
	Valid	149	149	149	149	150	149
	Missing	1	1	1	1	0	1

In **Table (19)**, it can be noted that out of the 150 subjects, data for one respondent was missing. This gave the researcher a good indication of the responses from the survey. The pilot survey was designed to target subjects from the airports, and this study was interested in having subjects with extensive experience that worked on multiple projects in the airport and part of the four airports for this study.

Demographic Criteria #1: Where is subject currently working?

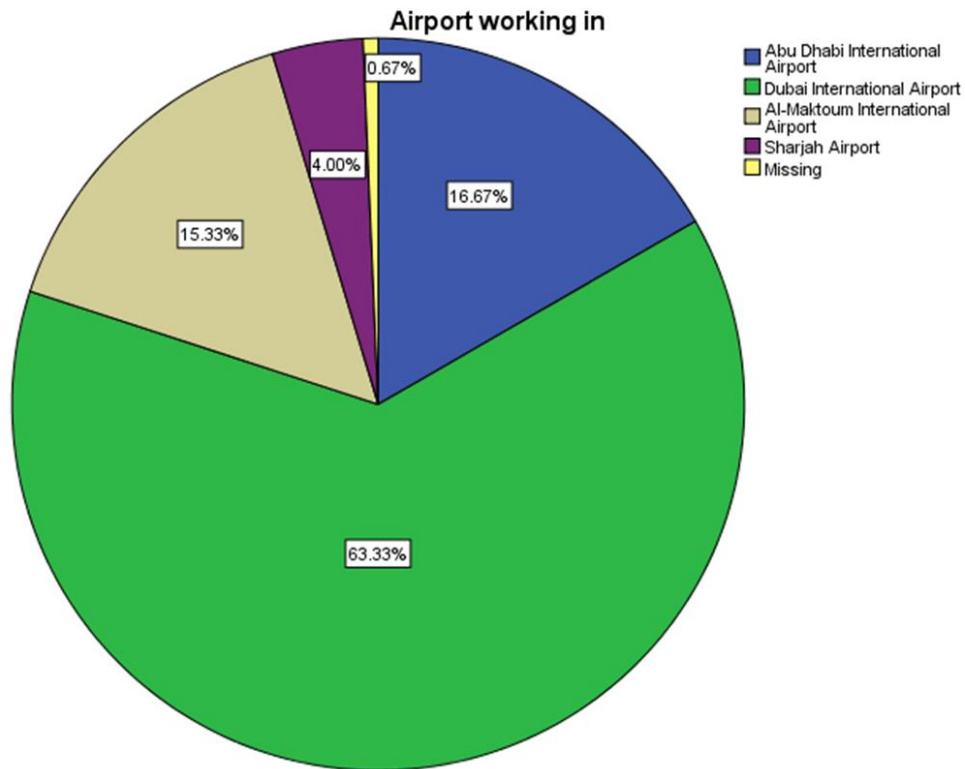


Figure (29) Pilot survey's subjects Airports.

Figure (29) shows the distribution of the pilot respondent about the airports in the UAE, and it can be noted that 63% of the responded were from Dubai International Airport. This may be due to the individual and ease of access to get the data. Improvements for the final survey to reduce this percentage, and ensure sufficient data are collected from the three remaining airports.

Demographic Criteria #2: Type of the work done at the airport?

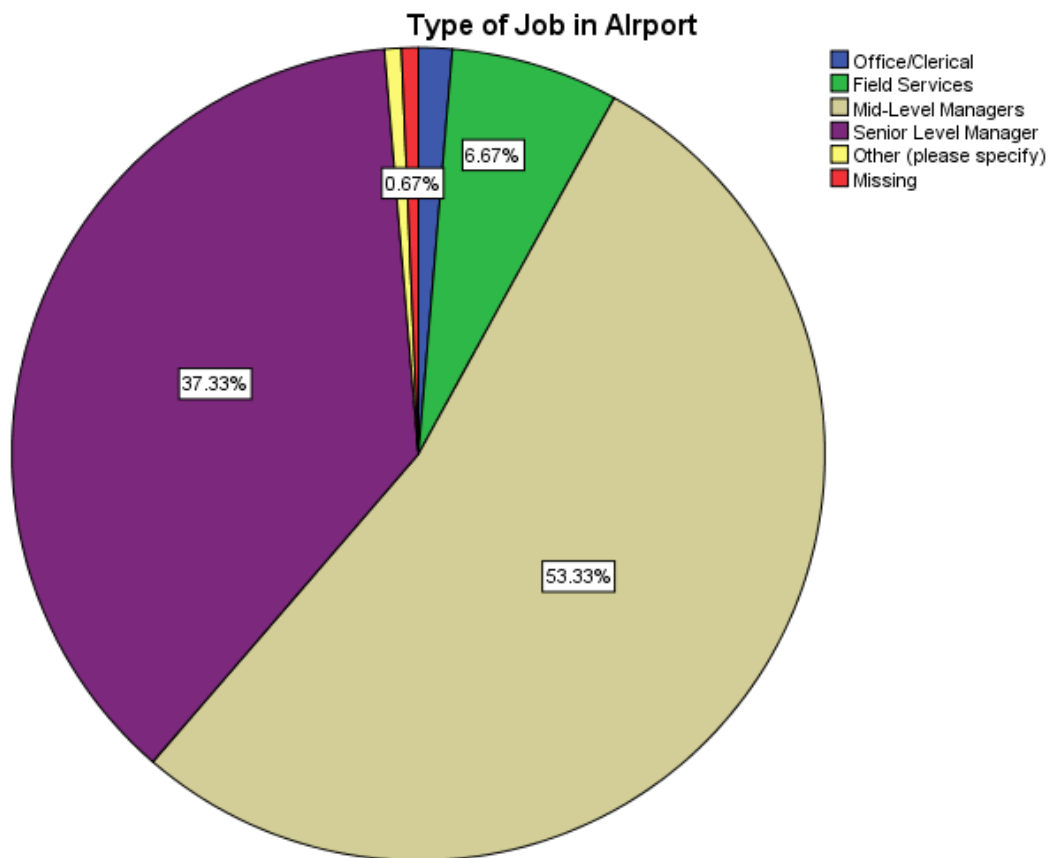


Figure (30) Roles of subjects for the pilot survey.

Figure (30) shows the respondents' roles in their organisation, and the importance of this in ensuring that the survey captures the perceptions of the different level of the organisation. However, the main focus is on middle to senior subjects, as we need to capture their planning and implementation experience with previous projects and their preparation for operating it, which was reflected in the pilot study. Additionally, results of the pilot study indicate that more than 80% of the respondents were middle to senior managers in their organisation.

Demographic Criteria #3: How many years of experience in the current organisation?

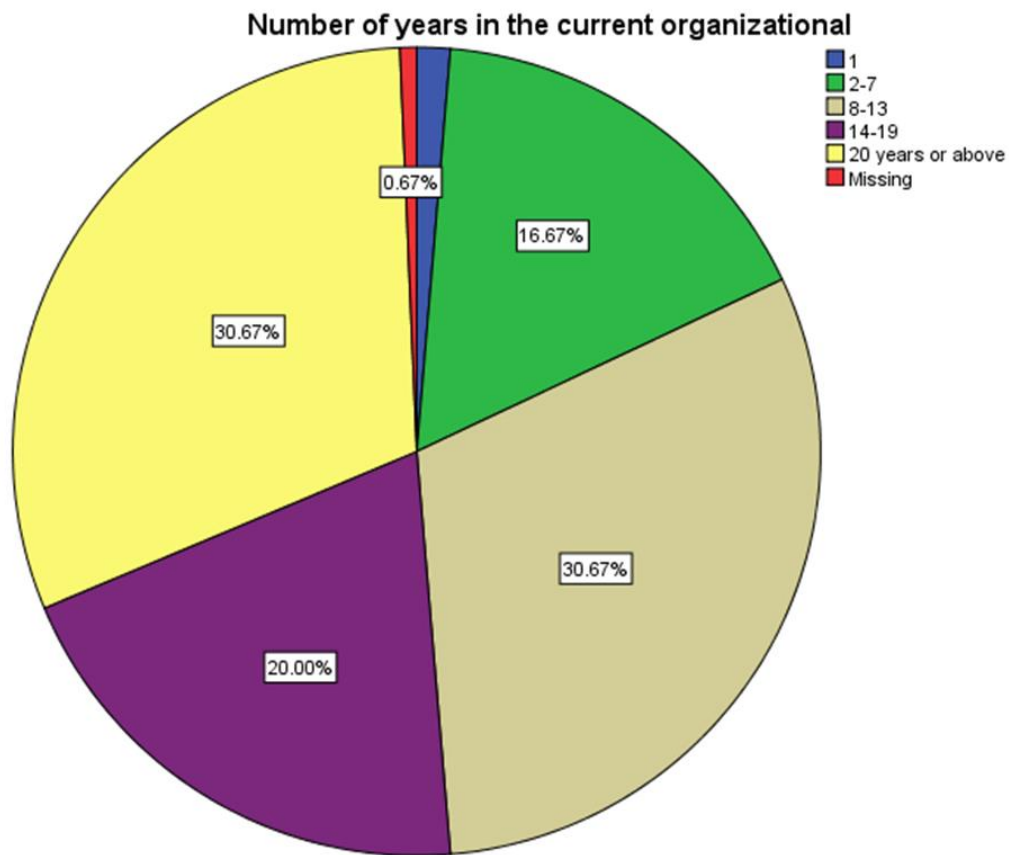


Figure (31) Respondents' number of years of experience.

Figure (31) shows the years of experience that the respondents had in the airport project and operations industry. More than 80% of the respondent had eight years or more experience doing their jobs.

Demographic Criteria #4: What is the organisation role in the airport?

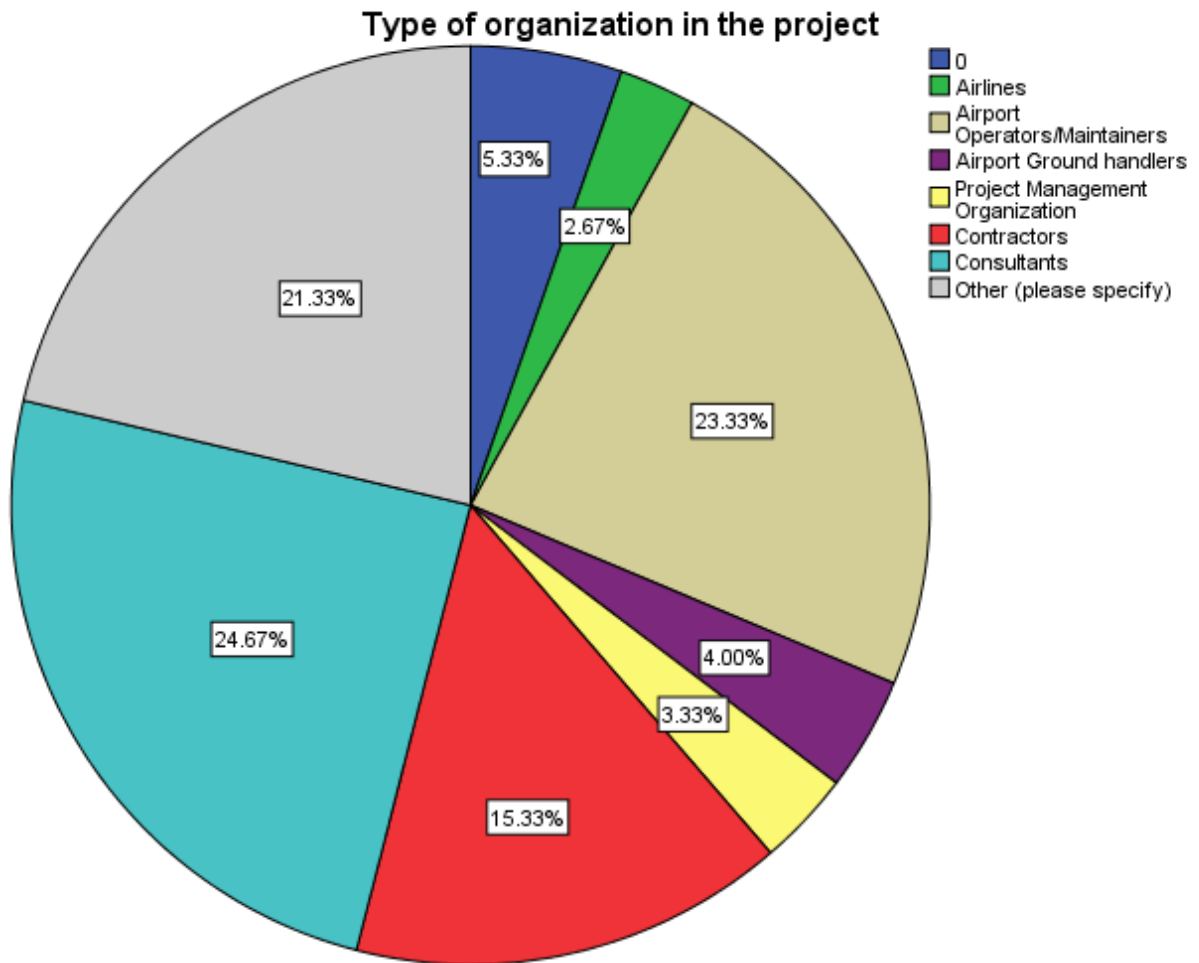


Figure (32) Types of stakeholders Subjects.

Figure (32) shows the diversity of the participant’s organisations role in the airport, and it can be noted that there exists almost a real diversity of key stakeholders of airport projects, except the airlines (only 3% responded to the survey) and this will be improved for the main survey as airlines are one of the major stakeholders of airport projects. It is also to be noted that wrong answers for this question were given due to errors in the question designed online.

Demographic Criteria #5: How many projects worked in?

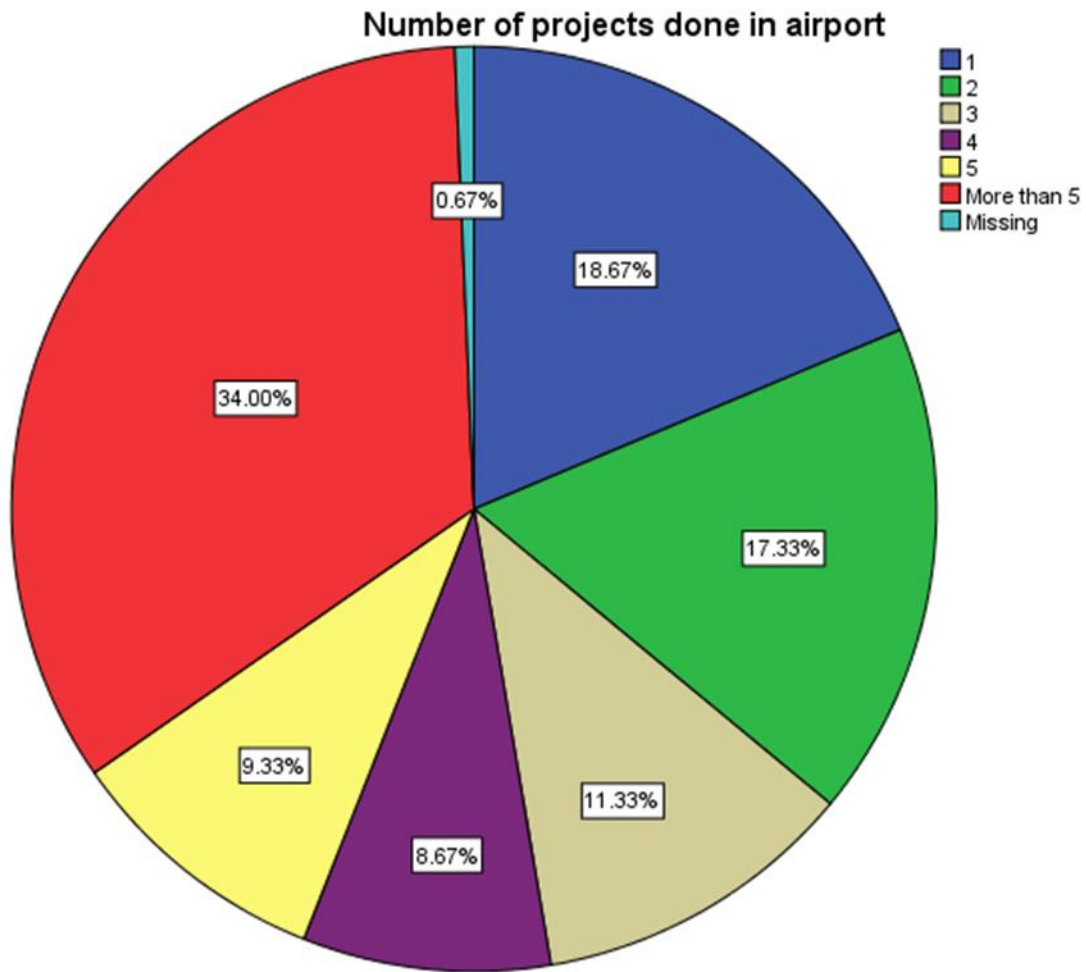


Figure (33) Number of projects executed by the respondent.

Figure (33) shows the number of projects, which the survey respondent has executed or participated in. Approximately 34% of the respondents have completed or participated in more than five airport projects, and more than 50% of the respondents have completed or participated in 4 or more airport projects. Comparing this results to real life situations, airport projects take longer to be executed, and some airports in UAE like Sharjah and Abu Dhabi did not have many projects previously.

The questionnaire consisted of four variables that comprise the operational readiness constructed for facility readiness (7 items), people readiness (8 items), system/technology readiness (15 items) and organisation/processes readiness (24 items) as independent variables, and project success (14 items) as the dependent variable.

5.3.2.2 Missing Data

In this section, analysis of the missing data from the pilot survey will be conducted to ensure the suitability and response rate for the pilot study.

Table (20) Pilot study variables missing items.

Facility Readiness Items									
		FR1	FR2	FR3	FR4	FR5	FR6	FR7	Missing %
	Valid	140	140	140	140	140	140	140	
	Missing	10	10	10	10	10	10	10	
People Readiness Items									
		PR1	PR2	PR3	PR4	PR5	PR6	PR7-PR8	
	Valid	133	132	131	132	132	132	132	
	Missing	17	18	19	18	18	18	18	
Technology Readiness Items									
		TR1	TR2	TR3	TR4	TR5	TR6	TR7-TR15	
	Valid	123	122	122	123	123	122	123	
	Missing	27	28	28	27	27	28	27	
Organisations Readiness Items									
		OR1	OR2	OR3	OR4	OR5	OR6	OR7-OR24	
	Valid	116	116	116	116	115	116	115	
	Missing	34	34	34	34	35	34	35	
Project Success Items									
		PS1	PS2	PS3	PS4	PS5	PS6	PS7-PS14	

N	Valid	114	113	114	114	114	114	114	
	Missing	36	37	36	36	36	36	36	

Table (20) presented the responses from the subjects on the pilot survey where percentages and missing data were captured and analysed. The results of survey questions relating to the “Technology Readiness”, “Organizations Readiness”, and “Project Success” factors indicate low response rates (i.e., 36 out of 150 responses as the worst case). Even though there was a 70% response rate on the completed pilot study survey, which is good enough for the data analysis, adjustments of these variables questions were still needed to increase the response rate, as well as lower the potential for missing data in the final survey.

5.3.2.3 Reliability and Correlation

In this section, reliability and correlation tests were performed on the data obtained from the pilot survey items within each factor to identify any modification to the items. In the social sciences researches, reliability is achieved when the same results are obtained from the same survey tool regardless of the form and who administer it. In addition to that, researchers use a statistical test in SPSS called “Cronbach’s alpha” reliability test, which measures the extent to which group of items used in the survey can measure the same factor. The alpha values changes depend on the correlation between the items, so greater correlation between items will generate higher alpha values and vice versa. As per Parsian and Dunning (2009), acceptable values of alpha is between (0.5-0.6), but DeVon et al. (2007) have argued that for an internal consistency of the factor the values of alpha shall be 0.7 or higher to allow the survey and its questions to be used in the research.

Table (21) Reliability test for pilot survey items.

Constructs	Cronbach's Alpha	No. of Items	Items Deleted
Global: Operational Readiness	0.961	54	-
Global Factor: Facility Readiness	0.852	7	-
Global Factor: People Readiness	0.852	8	-
Global Factor: Systems/Technology Readiness	0.909	15	-
Global Factor: Organizations/Process Readiness	0.923	24	-
Global: Project Success	0.888	14	-
Overall	0.954	68	-

Based on the reliability results of the pilot survey items, no items were removed, and all the items were considered to be used in the final survey questionnaire. Additionally, based on the three checks done for the Pilot data, no major changes were required for the main survey except for linguistic modifications to some of the questions to improve the readability and responses to the questionnaire.

5.4 Phase 2 (Quantitative) Data Analysis

This study has two aims: first is to critically examine, discern and synthesise the notion of operational readiness within operations and project management context. The second is to support organisations to ensure that on the first day of operation (after completion and sign off of construction phase), airport services run smoothly. In effect, the study seeks to ensure that airport services and operations do not fail due to poor or inadequate 'readiness'. Therefore, an operational readiness framework/model for airport services is required for the UAE operational consultants. Such a readiness framework can be used

by the operations managers to analyse, evaluate and develop an awareness of their readiness regarding the implementation of airport services. A survey questionnaire was designed and the data collected was analysed and reported in this phase of the study. This section starts with presenting the descriptive statistics of the survey respondent then a confirmatory factor analysis was conducted. Additionally, measurement and structural models were developed, and fit indices were assessed. To analyse the data, a special statistical software (SPSS package V. 20 and AMOS V. 22) were used to conduct the tests and examine the hypotheses generated in Chapter 3.

5.4.1 Administration of the Main Survey

The targeted respondents of the survey were UAE airport project's stakeholders currently working in the airport construction and operations organisations, such as airlines, airport maintenance, construction organisation and consultancy. The list of targeted respondents was obtained from several sources, i.e., Linked-In, airport magazines, work references and websites. There was a large number of individuals who might be identified as an appropriate target, but it is difficult to ensure they have participated in constructing and operating airport projects. In most cases, even though organisations are working in the aviation industry and airports, not all of their staff will be involved in the operating of the newly constructed facilities in the airport. For this reason, the main survey was administered using the electronic website (Shay et al. 1991), called SurveyMonkey.com. The main benefits of using electronic websites to conduct the survey that it provided the researchers with special tools for the design of the questionnaires, as well as tracking the responses and exporting the final results from the survey in SPSS format. These reasons have motivated the researchers to use the electronic website for the phase 2 questionnaires. Emails with a brief on the study were sent to the survey participant with a link

back to the website, and the same link was used and posted in Linked-In website to attract wider responses. Some of the respondents said that they did not work in constructing or operating new airport projects, so they eventually did not fill out the survey. Follow-up emails and online messages were sent to individuals to encourage them to fill up and complete the online survey. A thank you, email was also sent to those who have completed the survey and to check if they are willing to participate in any follow-up activities for this research.

As this questionnaire survey was conducted using an electronic website, data generated from the survey were exported in SPSS format, which was useful in reducing the time and errors for data entry as the survey collected a large set of data. The data's security and confidentiality were assured as the website SurveyMonkey.com, is one of the well-established companies for this type of research works with approved policies and practices. The main survey was conducted between December 2016 and January 2017, and a total of 720 responses were received.

5.4.2 Descriptive Statistics

Descriptive statistics describes the data that were collected from the respondents in a statistical format and explains the means and standard deviation of the constructs in the study (Patel 2009). The section on demography conveys to the reader a quick briefing about the respondents' gender, work location, job type, experience, organisation type, and the number of projects executed as described in the next subsections.

5.4.2.1 Demographic Variables

In this section, demographic variables' frequencies and percentages will be presented in a tabular format to describe the sample of respondents.

Question #1: Gender

Respondents for the study were asked to provide their gender. In the present study, a total of 77 (12.2%) respondents were female, while 555 (87.7%) were male. One respondent (0.2%) did not disclose their gender. Descriptive analysis for gender is presented in **Table (22)**.

Table (22) Gender descriptive analysis.

	Frequency	Percent %
Female	77	12.2
Male	555	87.7
Missing	1	0.2
Total	633	100.0

Question #2: Working Location

Respondents were asked to provide information pertinent to their working location. A significant majority of the respondents were working at Dubai International Airport (399, 63%), followed by Abu Dhabi International Airport (122, 19.3%). A total of 65 (10.3%) respondents were working at Al-Maktoum International Airport. The least number of respondents in the present study came from Sharjah Airport (47, 7.4%). Descriptive analyses for working location are presented in **Table (23)**.

Table (23) Frequency distribution of working location.

	Frequency	Percent %
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Abu Dhabi International Airport	122	19.3
Dubai International Airport	399	63.0
Al-Maktoum International Airport	65	10.3
Sharjah Airport	47	7.4
Total	633	100.0

Question #3: Type of Job

Respondents were asked to reveal the type of job they performed at the airport. The majority of the respondents were mid-level managers (288, 45.5%); 210 (33.2%) were senior level managers; 115 (18.2%) offered field services, and 20 (3.2%) of the respondents worked in the office at a clerical level. Descriptive analyses for the type of job are presented in **Table (24)**.

Table (24) Type of job frequencies.

	Frequency	Percent %
Office/Clerical	20	3.2
Field Services	115	18.2
Mid-Level Managers	288	45.5
Senior Level Manager	210	33.2
Total	633	100.0

Question #4: Number of Years in the Organization (Tenure)

Respondents in the study were asked to provide information pertinent to their tenure with their current organisation. The majority of the respondents had a total of 8 to 13 years with their present organisation followed by 196 (31%) respondents who had 20 years or

above experience. Tenure and the frequency in each tenure category are shown in the following **Table (25)**.

Table (25) Tenure descriptive statistics.

	Frequency	Percent %
1	8	1.3
2-7	98	15.5
8-13	200	31.6
14-19	131	20.7
20 years or above	196	31.0
Total	633	100.0

Question #5: Type of Organization in the Project

Respondents in the study were asked to provide information pertinent to the type of organisation in the airport. The results of the analysis revealed that the majority of the subjects in the study were from airport operators/maintainers, while the minimum number of respondents belonged to airport ground handlers. The frequency of respondents from a different organisation in the projects is summarised in **Table (26)**.

Table (26) Organization type.

	Frequency	Percent %
Airlines	115	18.2
Airport Operators/Maintainers	184	29.1
Government Entity (Police, Customs, Immigration.)	48	7.6
Airport Ground handlers	43	6.8
Project Management Organization	84	13.3
Contractors	81	12.8
Consultants	78	12.3

Total	633	100.0
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Question #6: Number of Projects

Respondents were asked to provide information pertinent to the number of projects they have been involved in at the airport. The results show that the majority of the respondents had more than five projects, while 120 (19%) of the respondents had one project. The number of projects and the frequency is summarised in the following **Table (27)**.

Table (27) Number of projects.

	Frequency	Percent %
1	120	19.0
2	114	18.0
3	92	14.5
4	42	6.6
5	35	5.5
More than 5	230	36.3
Total	633	100.0

5.4.3 Data Preparation and Evaluating the Distributional Assumptions

Before proceeding further in the analysis, we make reference to Jackson et al. (2009) for the checklist and procedures to examine the data and prepare it as it is an important step for any analysis procedure. According to Shah and Goldstein (2006), the researcher must review the data for completeness and consistency before any statistical analysis and especially SEM analysis. In this section, data screening will take place followed by the handling of missing values and outliers and finally the assessment of the data's normality and reliability.

5.4.3.1 Data Screening

The first step in the data preparing is screening the data for human mistakes and visual errors as it is considered important for further data analysis that includes SEM (Samson & Terziovski 1999; Shah & Goldstein 2006). For this we refer to Pallant (2007) for the process of the data filtering where we first checked for errors, then identification of the data's errors and finally removing the errors. All of this research's data has been screened for errors, and since the data were collected and transported to the SPSS and AMOS software electronically, minor errors were found and corrected.

5.4.3.2 Handling of Missing Value and Outliers

In this section, handling of the missing values from the data set and handling the outliers will be discussed in detail and the results will be reported.

Missing values: It is important for the researcher to report missing data and report the method of handling it and the final results (Jackson et al. 2009). This was further emphasised by Shah and Goldstein (2006) that missing values is problematic for multivariate analysis. Usually missing data will occur due to poor data collection or data entry. In this research study, a pilot study was conducted first using the electronic website of [SurveMonkey.com](https://www.surveymonkey.com). There was no restriction placed on the respondents, which have resulted in a large number of missing values in the entries. This was corrected in the main survey, as respondent were not allowed to leave any questions without an answer, which has helped in reducing the missing values. Therefore, the main questionnaire of the online survey was completed with less missing data due to stoppage of the survey and closing the site before completions. To handle the missing values existing in this current research dataset, we make reference to (Lombardi et al. 2012) in using case deletion method, which is popular for data missing handling. It is also called listwise deletion (LD), so this

method was applied in the current study. The final version of the data was collected from 724 subjects out of 1000, which give a 72% response rate, and from this data 91 rows were deleted due to significant missing values from the data using the listwise deletion method. The LD method for deletion of complete cases for this study's data set poses no harm to the analysis due to the large sample size collected in this study. The final results after the missing values deletion are $n = 633$.

Outliers values: Outliers are case represented by values significantly large or small, and it differs from other cases in the dataset (Elliott & Woodward 2007). Even though these outliers are harmful and could mislead the statistical analysis, however, Tabachnick and Fidell (2007) argued for large sample size like the current research ($n = 633$) outliers are expected to appear and normal within the data. Therefore, no data cases were removed from the dataset.

5.4.3.3 Assessing Common Method Bias

To assess for the possibility of common method bias, Harman's single-factor test was conducted using unrotated factor analysis for all the questionnaire items and this was forced to single factor using eigenvalue greater than one (Sariola & Martinsuo 2016). Results of the test are presented in **Table (28)**.

Table (28) Results from the Single factor test.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	22.830	33.574	33.574	22.830	33.574	33.574
2	5.507	8.098	41.673			
3	2.351	3.458	45.130			
4	1.924	2.830	47.960			

5	1.643	2.416	50.377			
6	1.343	1.975	52.351			
7	1.297	1.908	54.259			
8	1.199	1.763	56.023			
9	1.131	1.663	57.686			
10	1.078	1.585	59.271			

The results are shown in **Table (28)** confirmed that no single factor accounted for more than 50% (Williams et al. 2015) of the variance. Therefore, the data is not distorted by the common method bias.

5.4.3.4 Assessing Univariant Normality

In this section, assessment for normality will be carried out for all of the study's items using descriptive analysis and the values of Skewness and Kurtosis.

For this assessment, we used descriptive statistics to measure the data normality, where normality refers to the distribution of metric variable compared to a normal distribution. Here we would like to note that Yang et al. (2006) stated that normality tests are not required to be conducted for SEM analysis when the dataset contain large sample size. However, Shah and Goldstein has clearly argued that “*assessing data normality (along with skewness and kurtosis) is important because many model estimation methods are based on an assumption of normality. Non-normal data may result in inflated goodness of fit statistics and underestimated standard errors*” (Shah & Goldstein 2006, p. 157).

For these descriptive statistics was analysed to measure and compare the Skewness and Kurtosis of the study variables. Visual inspection was checked for the histograms of all the items and values have been presented in tabular formatting. The tables below demonstrate the mean, standard deviation, skewness and kurtosis for all the items used in this

study and their observed factors, where reference is made to Joslin and Müller (2015) that the values for skewness and kurtosis should be within the limits of ± 2 and ± 3 , respectively.

Facility readiness

Facility readiness construct evaluates the perception of the subjects pertinent to the readiness of the facilities in the airport project to operate. Descriptive statistics for each of the items in facilities readiness scale are summarised in **Table (29)**.

Table (29) Facility readiness's mean, st.dev, skewness and kurtosis ($n = 633$).

Variable Name	Mean	Std. Deviation	Skewness	Kurtosis
Facility Readiness				
FR1	4.43	.767	-1.422	2.338
FR2	4.15	.776	-.817	.980
FR3	4.25	.809	-.941	.650
FR4	4.21	.849	-.997	.855
FR5	4.04	.799	-.673	.387
FR6	4.34	.770	-1.109	1.250
FR7	4.21	.765	-.744	.374

The results of the descriptive statistics for normality did not show any violation to normality, and as such, none of the items from the facility readiness was removed.

People readiness

People readiness construct evaluates the perception of the subjects pertinent to the readiness of the facilities in the airport project to operate. Descriptive statistics for each of the items in people readiness scale are summarised in **Table (30)**.

Table (30) People readiness's mean, st.dev, skewness and kurtosis ($n = 633$).

Variable Name	Mean	Std. Deviation	Skewness	Kurtosis
People Readiness				
PR1	4.33	.842	-1.132	.834
PR2	4.31	.821	-1.474	3.045
PR3	4.39	.808	-1.202	1.067
PR4	4.39	.794	-1.130	.801
PR5	4.38	.797	-1.130	.819
PR6	4.15	.777	-.636	.252
PR7	4.22	.813	-.875	.577
PR8	4.14	.950	-1.107	.899

The results of the descriptive statistics for normality did not show any violation to normality except for PR2 item, which showed small violations; we decided to keep it for further analysis of reliability, so none of the items from the people readiness was removed.

Technology/system readiness

Technology/system readiness construct evaluates the perception of the subjects pertinent to the readiness of the technology/system readiness at the airport project to operate. Descriptive statistics for each of the items in technology/system readiness scale are summarised in **Table (31)**.

Table (31) Technology/system readiness's mean, st.dev, skewness and kurtosis ($n = 633$).

Variable Name	Mean	Std. Deviation	Skewness	Kurtosis
Technology Readiness				
TR1	4.25	.776	-.631	-.460
TR2	4.21	.799	-.632	-.377

TR3	4.18	.786	-.492	-.661
TR4	4.13	.851	-.670	-.040
TR5	4.38	.813	-1.004	.020
TR6	4.19	.803	-.561	-.572
TR7	4.28	.794	-.745	-.202
TR8	4.11	.820	-.460	-.541
TR9	4.29	.797	-.765	-.345
TR10	4.25	.800	-.666	-.485
TR11	4.07	.811	-.470	-.419
TR12	4.14	.788	-.507	-.322
TR13	4.25	.815	-.780	.033
TR14	4.17	.758	-.454	-.542
TR15	4.24	.789	-.624	-.499

The results of the descriptive statistics for normality did not show any violation to normality, and thus, none of the items from the technology/system readiness was removed.

Organization readiness

Organisation readiness construct evaluates the perception of the subjects pertinent to the readiness of the organisation at the airport projects to operate. Descriptive statistics for each of the items in organisation readiness scale are summarised in **Table (32)**.

Table (32) Organisation readiness's mean, st.dev, skewness and kurtosis ($n = 633$).

Variable Name	Mean	Std. Deviation	Skewness	Kurtosis
Organisation Readiness				
OR1	4.26	.854	-.822	-.126
OR2	4.15	.778	-.476	-.405
OR3	4.13	.831	-.492	-.595
OR4	4.37	.817	-.878	-.528

OR5	4.21	.803	-.582	-.499
OR6	4.11	.835	-.456	-.732
OR7	4.19	.804	-.518	-.710
OR8	4.15	.799	-.401	-.959
OR9	4.19	.779	-.474	-.733
OR10	4.24	.785	-.486	-1.094
OR11	4.23	.802	-.628	-.450
OR12	4.19	.816	-.568	-.522
OR13	4.24	.789	-.550	-.792
OR14	4.14	.799	-.402	-.815
OR15	4.12	.812	-.454	-.564
OR16	4.14	.802	-.518	-.384
OR17	4.08	.854	-.439	-.681
OR18	4.13	.813	-.519	-.396
OR19	4.09	.813	-.468	-.414
OR21	4.05	.826	-.361	-.643
OR22	4.06	.771	-.311	-.594
OR23	4.16	.790	-.416	-.950
OR24	4.24	.789	-.547	-.792

The results of the descriptive statistics for normality did not show any violation to normality, and thus, none of the items from the organisation readiness was removed.

Project success

Project success construct evaluates the perception of the subjects pertinent to the success of the project at the airport project. Descriptive statistics for each of the items in project success scale are summarised in **Table (33)**.

Table (33) Descriptive statistics for project success.

Variable Name	Mean	Std. Deviation	Skewness	Kurtosis
Project Success				
PS1	3.56	.923	-.149	-.491
PS2	3.58	.954	-.292	-.391
PS3	3.65	.898	-.399	-.102
PS4	3.89	.812	-.264	-.468
PS5	4.02	.771	-.204	-.754
PS6	3.95	.793	-.314	-.196
PS7	3.79	.829	-.182	-.429
PS8	3.88	.789	-.227	-.405
PS9	3.83	.808	-.093	-.627
PS10	3.94	.808	-.182	-.737
PS11	3.91	.808	-.072	-.882
PS12	4.05	.775	-.269	-.697
PS13	4.04	.789	-.281	-.703
PS14	4.02	.807	-.360	-.440

The results of the descriptive statistics for normality did not show any violation to normality, and thus, none of the items from the project success was removed.

5.4.3.5 Assessing Multivariate Normality, Linearity and Homoscedasticity

In this section, assessment of the multivariate normality (MVN), linearity and homoscedasticity for the research data set as part of the data evaluation for SEM analysis (Osborne & Waters 2002). This study examines a complex relationship of operational readiness and project success and for that assumption for multivariate normality is required. It is recommended by (Jackson et al. 2009; Byrne 2016) to check for the multivariate normality (MVN) before conducting any structural equation modelling analyses as prior re- search

indicated that an overestimation of the chi-square statistic due to failing to meet MVN assumption.

For this, we utilised SPSS V. 20 in this study assessment of the data using regression function. The results of the regression are shown in **Figure (34)**, where the points of standardised residuals are grouped around the normal probability line.

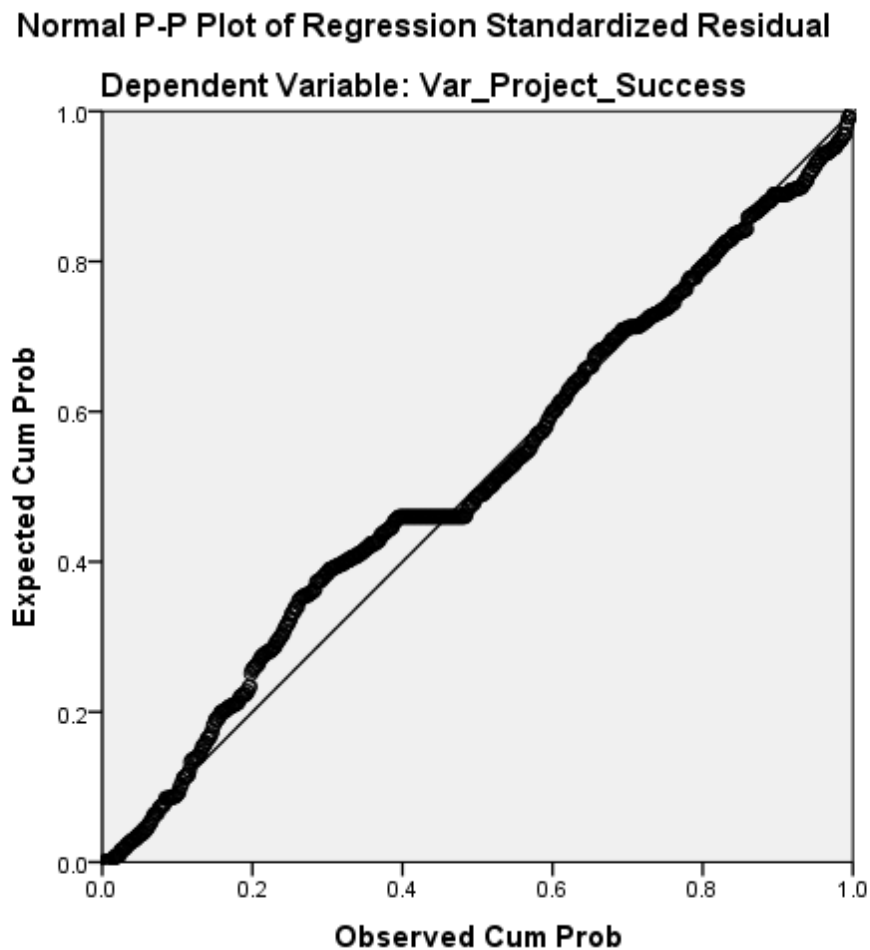


Figure (34) Standardised residuals' plot for normality.

For **Figure (34)**, we make reference to Elliott and Woodward (2007) and Kim (2014), who is arguing that fulfilment of the MVN is established when the points in the normal probability plots are clustered around the line. While we acknowledge that some of the

points in **Figure (34)** are not inline but it is also not far away from the normality line. Thus, the assumption of multivariate normality was met for this study dataset.

Next, assessment of linearity and homoscedasticity (homogeneity of variance) were analysed for the assumption of this research. The assessment was carried out in SPSS v.20 and used the regression function to regress the four factors that predict project success (Tabachnick & Fidell 2007). Results of the regression are presented.

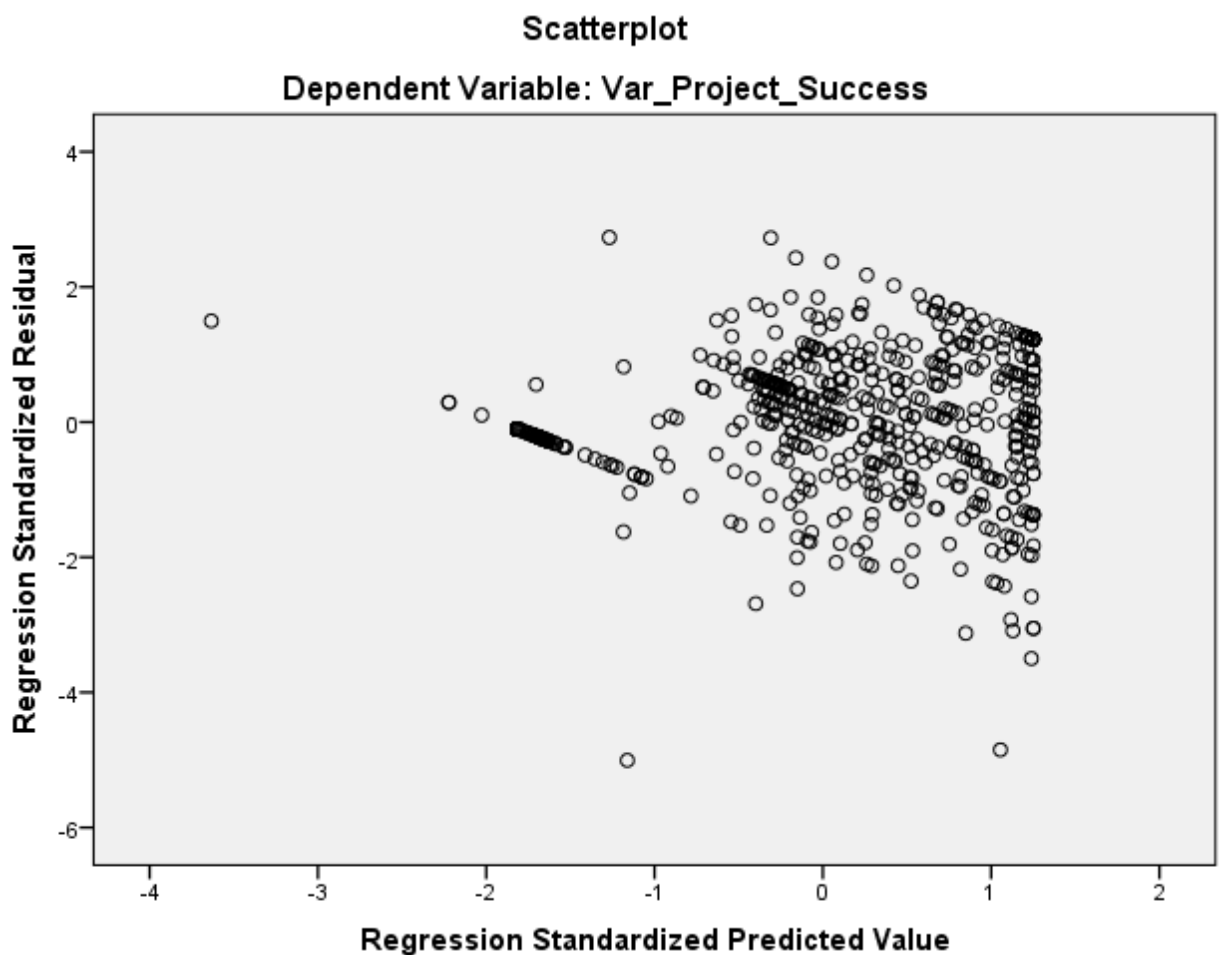


Figure (35) Scatterplot of the standardised residuals.

As shown in **Figure (35)**, a random scatter of points are plotted rather than a U-Shape, which establish the assumption of linearity and homoscedasticity for this research's data (Tysseland 2008).

5.4.3.6 Assessing the Reliability of the Measures for the Constructs

To evaluate the internal consistency of the variables in the study, Cronbach's Alpha was used to analyse the reliability. The value of alpha ranges from 0 to 1. The closer the value to 1, the higher the reliability. It is recommended that the value for construct reliability be over .70 (Low et al. 2015). In the present study, the value of alpha ranged from .928 to .987. Two items (PR2 and PR8) were removed from people readiness to improve the reliability of the construct. All constructs showed great reliability statistics. The Alpha value for each construct is summarised in **Table (34)**.

Table (34) Reliability test.

Constructs	Cronbach's Alpha	No of Items	Items Deleted
Global: Operational Readiness	0.987	54	2
Global Factor: Facility Readiness	0.900	7	-
Global Factor: People Readiness	0.933	8	2
Global Factor: Systems Readiness	0.971	15	-
Global Factor: Organization Readiness	0.928	23	-
Global: Project Success	0.951	14	-
Overall	0.987	68	66

- Facility readiness has an excellent value of 0.90; therefore, no items were deleted.

- People readiness achieved an excellent value of 0.933. After removing two items from the sub-scale, which are (PR2, PR8), it should be noted that PR2 has been observed earlier for higher kurtosis, but was left for further analysis, which requires us now to remove it.
- System readiness has an excellent value of 0.9710; therefore, no items were deleted.
- Organisation readiness has the value of 0.928; therefore, no items were deleted.
- Project success has an excellent value of 0.987; therefore, no items were deleted.

According to Parsian and Dunning (2009), the reliability values of alpha for factors and items should be above the acceptable standard of (0.70). Therefore, this research data and study constructs were reliable to proceed for further statistical analysis. In summary, we note here that the data are now ready for SEM analysis after screening the data, handling of missing and outliers, the assumption of normality and finally reliability of the constructs.

5.4.4 Structural Equation Modelling

In this section, Structural Equation Modelling (SEM) analysis will be carried out to confirm the factors of the study and test hypothesised relationship as per the proposed conceptual framework developed in Chapter 3.

According to Ika , “*structural equation modelling is a statistical method for measuring simultaneous hypothesised causal relationships between multiple latent and observed variables*” (Ika 2015, p .6). To perform SEM analysis for this study, reference was made

to Anderson and Gerbing's (1988) two-step approach. The first step consisted of the measurement model, where a confirmatory factor analysis (CFA), using AMOS 20, was performed. The second step will describe the study's variables in a structural model and conduct a model fit analysis. Finally, the hypothesis of the study will be tested to confirm the proposed framework and analyse the relationship between the dependent and independent variables of the model.

5.4.5 Confirmatory Factor Analysis

In this section, verification of the factor structure for the operational readiness model and project success model will be presented using confirmatory factor analysis (CFA). CFA is the first step in the SEM analysis, and it is used as a statistical method conducted by researchers to confirm the factor structure of a measurement instrument (Shay et al. 1991). One of the main characteristics in structural equation modelling is the representation of the latent factors in relation to the observed items (Santor et al. 2011). It is also used to test hypothesised relationships between observed items and their latent constructs (Shay et al. 1991; Scandura & Williams 2000).

As this research uses a second order factor, CFA has also been used for first order and second order models, which has been tested earlier using CFA (Chen et al. 2005). Confirmatory factor analysis is an application of SEM that are widely used in operations management (Shah & Goldstein 2006) and was employed in this study to test the scale validity, which represented how well the measures reflected their intended constructs. It was also noted that more studies employed confirmatory factor analysis as a primary data analytical tool when their goal was the development of a new measure (Scandura &

Williams 2000), as in the case of this study to develop the measure of operational readiness for airport projects in the UAE. First, the operational readiness model will be tested and then project success model, as the two variables that were used in this study.

5.4.5.1 Operational Readiness Model

The operational readiness model consisted of second order construct that is represented by four factors with 52 items. Facility readiness had a total of 7 items, there were six items in people readiness, 15 items in technology readiness, and organisations readiness had 24 items, which has been developed in AMOS 20 as shown in **Figure (36)**.

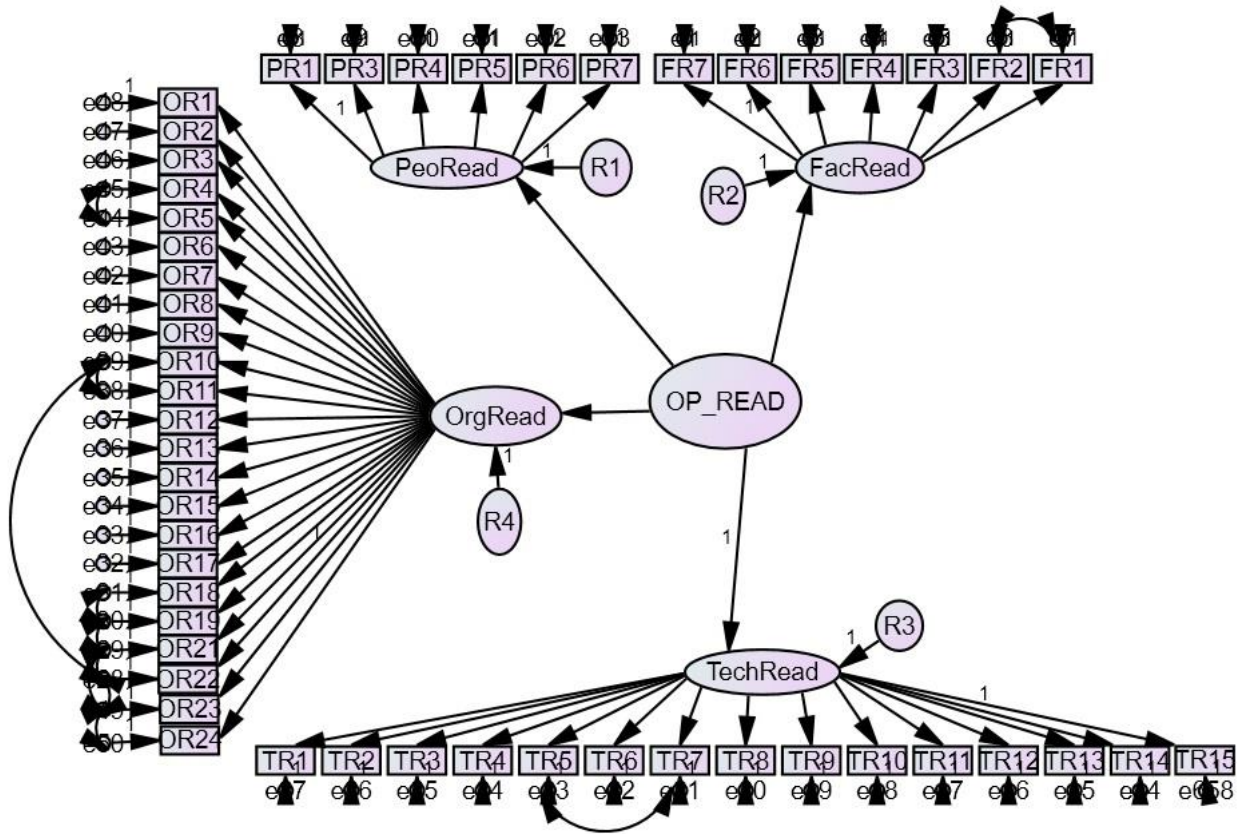


Figure (36) Operational Readiness Model.

The operational readiness model was subjected to confirmatory factor analysis with maximum likelihood (ML). The results showed a good fit to a four-factor model: ($\chi^2/df = 3160.360/1209$ (CMIN = 2.613), SRMR = 0.02; CFI = 0.943, TLI = 0.940, RMSEA = 0.05). It complies with commonly accepted thresholds for the evaluation of measurement models (Salvador et al. 2014).

Regardless of the ongoing debate over the correctness of one model fit index (Ika 2015), there are currently many fit indices without any consistent values that can be used for all models. As such, the following benchmark adopted from (Nimako & Ntim 2013), has to be reported to compare and accept the model. Operational readiness measurement model fit statistic is presented in **Table (35)**.

Table (35) Operational Readiness Model measurement indices.

Chi-square (χ^2) = 3160.360, $p = .000$								
	Absolute Fit Measures					Incremental Fit Measures		Parsimonious Fit Measures
	DF	χ^2/df	GFI	RMSEA	SRMR	TLI	CFI	AGFI
Benchmark		< 3.00	≥ 0.900	< 0.08	≤ 0.08	≥ 0.90	≥ 0.90	≥ 0.80
Operational Readiness Model	1209	2.61	0.83	0.05	0.02	0.94	0.94	0.81

For absolute measures of fit, the chi-square statistic was provided (CMIN; and its statistical significance, $p > 0.05$). And it should be noted that p -value for the large sample size does not meet this criterion as the case in our study as for large samples ($n > 250$); a significant p -value would be expected (Groenl & Stalpers 2012). In this model, the CMIN value was reported as acceptable (2.61) (Chandra et al. 2012b). The goodness-of-fit index (GFI), measures the relative amount of variance in the data that is jointly explained by the hypothesised model (Baker 1976) was found to value (0.83) and was slightly below the target cut-off value of 0.90 but has been reported acceptable (Joshi et al. 2007; Yen et al. 2008; Luo & Liberatore 2009). Root mean square error of approximation (RMSEA) is calculated to evaluate the model fit to the empirical data. For our measurement model, the RMSEA value was reported to be (0.05); which is less than (0.10) in value as recommended by (Ika 2015). Standardized Root Mean Squared Residual (SRMR) has also been estimated to be valued as (0.05); values of 0.05 or below has

been considered acceptable as a good fit by Bender et al. (2016), and since there is a large sample of data ($n > 250$), the acceptable value reported by Groenland and Stalpers (2012) was below 0.8.

For incremental fit indices, we reported the Tucker-Lewis index (TLI) (Hu & Bentler 1998), and for the model, it was reported with a value of (0.94), which is above the benchmark recommendations (Groenland & Stalpers 2012; Liu et al. 2004), as well as a measure for the comparative fit index (CFI) (Ika 2015), taking into account the sample size of this data. CFI is used to compare the current model to a baseline model by comparing the chi-square values respectively (Ika 2015). Models with a CFI values higher than 0.90 are indicative of good fit (Battilana et al. 2010), and for this model, CFI was above the benchmark with a value of (0.94).

For parsimonious fit indices, we report the adjusted goodness-of-fit index (AGFI), which was measured with a value of (0.81); this was above the 0.8 minimum recommended value (Liu et al. 2004; Zhang & Li 2016). AGFI is used to relate the model fit to the model complexity.

Additionally, following (Salvador et al. 2014), we used the proportion of variance explained (R^2) statistics, which are all greater than 0.40. Providing additional empirical support that each item is significantly linked with its theoretical construct with only one item (OR20) has been removed from the organisation's readiness factor, while none of the items was removed from the other factors. Standardised regressions weights, t-values composite reliability average variance, extracted and are reported in **Table (36)**.

Table (36) Confirmatory factor analysis with standardised regressions.

Items	Standardized loadings	<i>P</i>	<i>t</i> -Value	Composite Reliability	Average variance extracted
Operational Readiness				0.99	0.68
FR	0.757	***	18.270		
PR	0.890	***	21.251		
TR	0.99	***			
OR	0.912	***	24.518		
FR "Facility Readiness"				0.90	0.56
FR1	0.777	***	20.98		
FR2	0.711	***	18.763		
FR3	0.787	***	21.385		
FR4	0.705	***	18.655		
FR5	0.634	***	16.446		
FR6	0.838	***	23.137		
FR7	0.79				
PR "People Readiness"				0.93	0.70
PR1	0.768				
PR3	0.858	***	23.68		
PR4	0.879	***	24.424		
PR5	0.878	***	24.365		
PR6	0.829	***	22.678		
PR7	0.817	***	22.262		
TR "Technology Readiness"				0.97	0.70
TR1	0.845	***	29.814		
TR2	0.776	***	25.424		
TR3	0.826	***	28.543		
TR4	0.766	***	24.875		
TR5	0.866	***	31.346		
TR6	0.817	***	27.915		
TR7	0.839	***	29.386		

TR8	0.816	***	27.847		
TR9	0.871	***	31.804		
TR10	0.852	***	30.313		
TR11	0.78	***	25.696		
TR12	0.836	***	29.22		
TR13	0.862	***	31.051		
TR14	0.88				
TR15	0.867	***	31.497		
OR "Organization Readiness"				0.98	0.70
OR1	0.812	***	25.259		
OR2	0.883	***	28.989		
OR3	0.79	***	24.231		
OR4	0.857	***	27.562		
OR5	0.874	***	28.487		
OR6	0.801	***	24.762		
OR7	0.878	***	28.731		
OR8	0.832	***	26.277		
OR9	0.896	***	29.733		
OR10	0.847	***	25.137		
OR11	0.87	***	28.279		
OR12	0.844	***	26.882		
OR13	0.897	***	29.806		
OR14	0.861	***	27.778		
OR15	0.86	***	27.737		
OR16	0.84	***	26.688		
OR17	0.73	***	21.578		
OR18	0.834	***	26.357		
OR19	0.746	***	22.275		
OR21	0.774	***	28.153		
OR22	0.829				
OR23	0.837	***	31.765		
OR24	0.882	***	28.947		

From **Table (36)**, it can be concluded that the factor loading of items for the first order and second order constructs, which is above 0.5 as per Shah and Goldstein (2006) shows a good indication of items on its latent variables for all the model. Moreover, all the operational readiness constructs showed strong composite reliability (CR) > 0.7, as the threshold of composite reliability should be at least 0.70 (or 0.60 for exploratory study) as recommended by (Ika 2015; Low et al. 2015). The high values of CR indicate an excellent reliability for the internal items within their respected factors and an acceptable level of convergent validity of all the factors due to average variance extracted (AVE) values for each construct exceeding the acceptable threshold of 0.5 as recommended by Low et al. (2015).

5.4.5.2 Project Success

The project success model consisted of first order construct that is represented by one variable with 14 items, which has been developed in AMOS 20 as shown in **Figure (37)**.

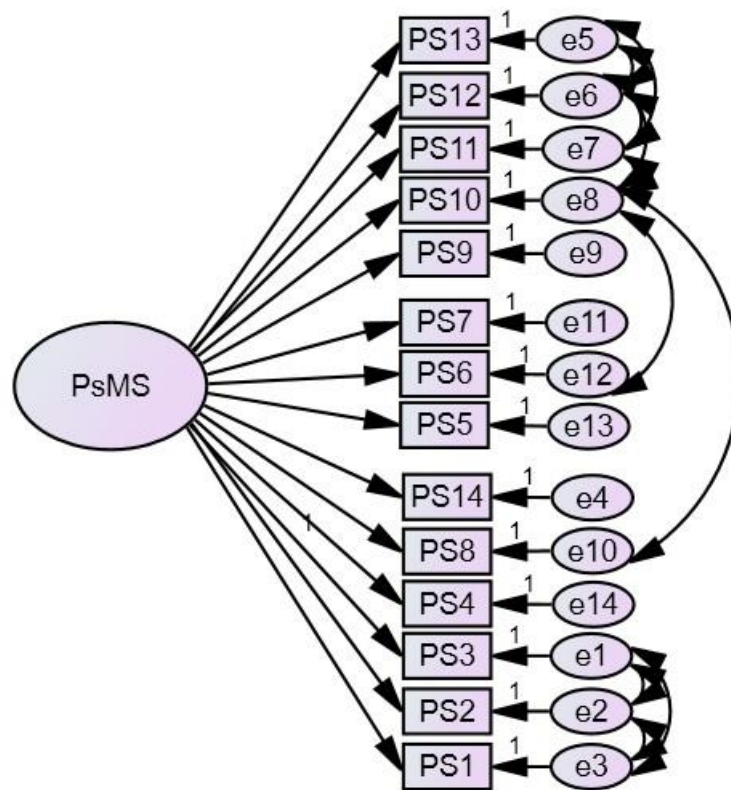


Figure (37) Project Success Model.

The project success model was subjected to confirmatory factor analysis with maximum likelihood (ML). The results showed a good fit to a single factor model: ($\chi^2/df = 256.847 / 67$ (CMIN = 3.83), SRMR = .03; CFI = .974, TLI = .965, RMSEA = .067. This complies with commonly accepted thresholds for the evaluation of measurement models (Salvador et al. 2014). Regardless of the ongoing debate over the correctness of one model fit index (Ika 2015), there are currently many fit indices without any consistent values that can be used for all models. As such, the following benchmark adopted from (Nimako & Ntim 2013), has to be reported compare and accept the model. Project success measurement model fit indices are presented in **Table (37)**.

Table (37) Project Success Measurement Model indices.

Chi-square (χ^2) = 256.847, $p = .000$								
	Absolute Fit Measures					Incremental Fit Measures		Parsimonious Fit Measures
	DF	χ^2/df	GFI	RMSEA	SRMR	TLI	CFI	AGFI
Benchmark		< 3.00	≥ 0.900	< 0.08	≤ 0.08	≥ 0.90	≥ 0.90	≥ 0.80
Project Success Model	67	3.83	0.941	0.067	0.03	0.96	0.97	0.904

For absolute measures of fit the chi-square statistic (CMIN; and its statistical significance, $p > 0.05$) was provided, and it should be noted that the p -value for large sample size does not meet this criterion, as the case for this study. For large samples ($n > 250$) a significant p -value (Groenland & Stalpers 2012) would be expected. In this model, the reported CMIN value is (3.83), and it shows a higher value than the benchmark presented, while others have accepted numbers below 5, such as (Chandra et al. 2012b; Xue et al. 2014). The goodness-of-fit index (GFI), it measures the data's variance that supposed to explain the model (Baker 1976) was found to be (0.941), which is above the target benchmark value of 0.90. Root mean square error of approximation (RMSEA) is calculated to evaluate the model fit to the empirical data. For our measurement model, the RMSEA value was reported to be (0.067); which is less than (0.10) in value as recommended by (Ika

2015; Liu and Cross 2016). Standardised Root Mean Squared Residual (SRMR) has also been estimated to be valued as (0.03), which is below the benchmark value and has also been considered acceptable as a good fit by Bender et al. (2016). And since there is a large sample of data ($n > 250$), the acceptable value reported by Groenland and Stalpers (2012) was below 0.8.

For incremental fit indices, the Tucker-Lewis Index (TLI) (Hu & Bentler 1998) was reported, and for project success model, it was reported with a value of (0.96), which is above the benchmark recommendations (Groenland & Stalpers 2012; Liu et al. 2004), as well as a measure for the comparative fit index (CFI) (Ika 2015), taking into account the sample size of this data. CFI is used to compare the current model to a baseline model by comparing the chi-square values respectively (Ika 2015). Models with a CFI values higher than 0.90 are indicative of good fit (Battilana et al. 2010), and for this model, CFI was above the benchmark with a value of (0.97).

For parsimonious fit indices, we report the adjusted goodness-of-fit index (AGFI), which was measured with a value of (0.904), this was above the 0.8 minimum recommended value (Liu et al. 2004; Zhang & Li 2016). AGFI is used here to relate the model fit to the model complexity.

Additionally and following (Salvador et al. 2014), the proportion of variance used explained (R^2) statistics, which are all greater than 0.40, to provide additional empirical support that each item is significantly linked with its theoretical. Standardised regressions weights, t -values composite reliability and average variance, extracted and are reported in **Table (38)**.

Table (38) Confirmatory factor analysis with standardised regressions.

Items	Standardized loadings	<i>P</i>	<i>t</i> -Value	Composite Reliability	Average variance extracted
PS "Project Success."				0.95	0.59
PS1	0.598	***	16.10		
PS2	0.597	***	17.27		
PS3	0.649				
PS4	0.783	***	17.30		
PS5	0.82	***	17.95		
PS6	0.832	***	18.13		
PS7	0.79	***	17.44		
PS8	0.83	***	18.09		
PS9	0.737	***	16.48		
PS10	0.814	***	17.75		
PS11	0.743	***	16.54		
PS12	0.816	***	17.86		
PS13	0.824	***	18.03		
PS14	0.844	***	18.38		

From **Table (38)**, we can conclude that the factor loading of items, which is above 0.5 as per (Shah & Goldstein 2006) shows a good indicating of items on its latent variable for all the model. Moreover, project success as a construct showed strong composite reliability (CR) > 0.7 as the threshold of composite reliability should be at least 0.70 (or 0.60 for exploratory study) as recommended by (Ika 2015; Low et al. 2015). The high value of CR indicates an excellent reliability for the internal items within their respected factor and an acceptable level of convergent validity the project success factor due to average

variance extracted (AVE) value exceeding the acceptable threshold of 0.5 as recommended by Low et al. (2015).

5.4.5.3 Assessment of the Model's Constructs Validity

According to (Jung et al. 2003; Liu & Cross 2016), CFA supports the researchers in assessing the validity of the construct of the measurement models. For this study, to validate the model constructs, we utilise convergent validity and discriminant validity. Convergent validity is supported when the study's constructs are related to each other. The researcher calculates the average variance extracted (AVE) for all the research constructs, values of AVE of (0.5) or higher is require for the convergent validity to be established (Low et al. 2015). **Table (39)** present the calculated values of the AVE for this research's constructs and confirm the convergent validity is established for all the constructs of this research.

Table (39) Convergent validity table.

Construct	AVE
Operational Readiness	0.68
Facility Readiness	0.56
People Readiness	0.70
Technology Readiness	0.70
Organizational Readiness	0.70
Project Success	0.59

The square root of the research construct's AVE is calculated, and the values are compared to the intercorrelations values between the constructs. **Table (40)** compares square root of AVE of the two variables of the study (operational readiness represents a variable

with second order construct and project success represent variable with first order construct) and the inter-construct correlations. The results indicate that the square root of AVE was greater than the inter-construct correlation. Therefore, the model constructs had discriminant validity and indicated that all constructs shared more variance with their indicators than with other constructs.

Table (40) Discriminant validity table.

	Operational Readiness	Project Success
Operational Readiness	0.82	
Project Success	0.73	0.76

With the first step of the SEM analysis concluded with confirmation of the measurement model fit indices and establishing both convergent and discriminated validity of the constructs. The next step now is testing the study structural model. In this step, we refer back to the conceptual model developed in Chapter 3 to be tested and confirm its structure and relationship among the model's variables. In this step, the focus will be on the SEM key variables, which are also called latent constructs (Jackson et al. 2009). The latent construct cannot be measured directly and are only measured by their indicators (Fellows & Liu 2003). In structural equation modelling, there are two types of latent constructs; the first type is called exogenous construct, which is also referred to as the independent variable. The second type is the endogenous construct which is the dependent variable of the model (Garson 2008). For the operational readiness structural model of this study, this step will focus on the relationship between the operational readiness as an exogenous construct and project success an endogenous construct (Hair et al. 2009) as presented in **Figure (38)**.

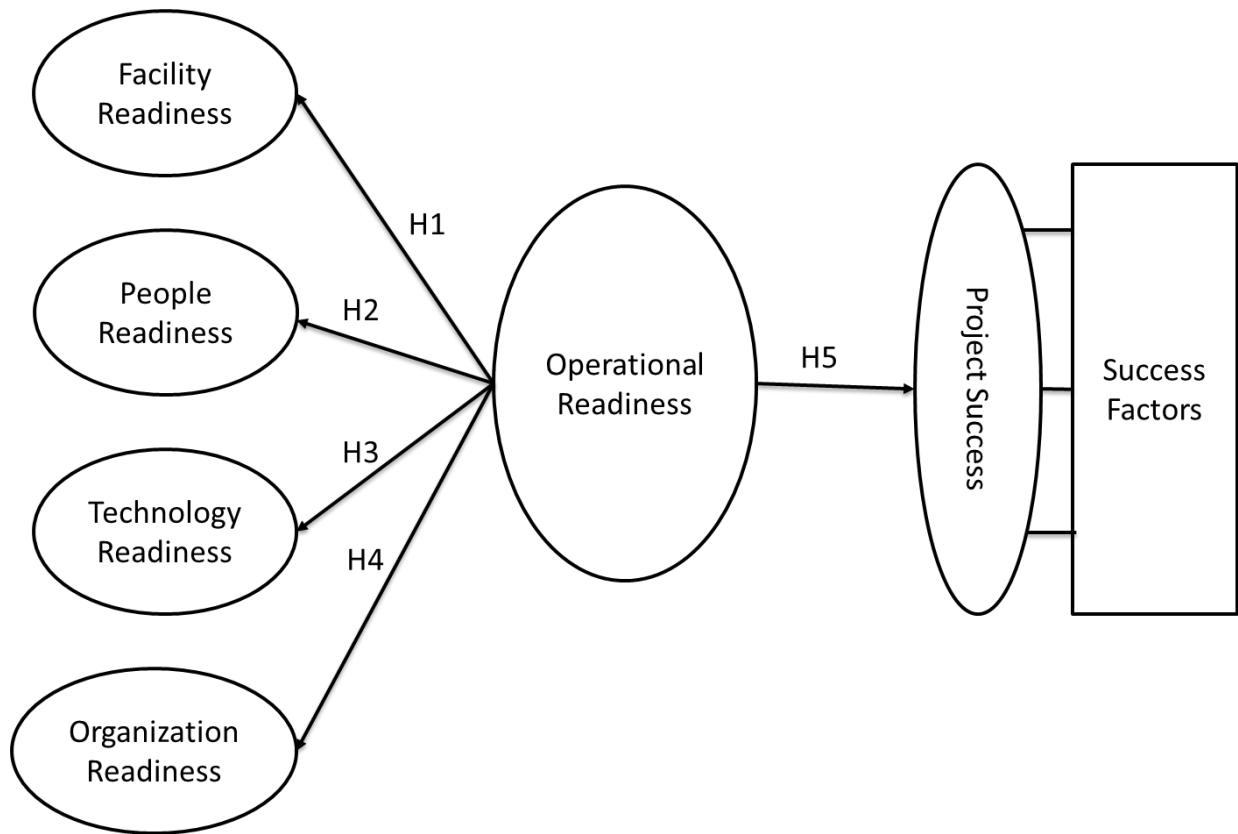


Figure (38) Hypothesised relations between the operational readiness variables and project success.

In **Figure (38)**, casual paths are presented based on the proposed relationships between the study variables and used to test it. The second-order reflective model was chosen since it was assumed that observed factors are a reflection of the operational readiness as a variable, project success (Nimako & Ntim 2013). Operational readiness factors are considered reflective indicators where they tap into the same overall variable and covary with each other (Boh 2008). This implies that the model shall not have a direct connection between each and every one of the operational readiness factors (facility readiness, people readiness, technology/system readiness, organisational readiness) and project success variable. For example, it was confirmed earlier that people readiness have a positive influence on project success (Dvir 2005). In SEM, this is called second-order model where

the four operational readiness factors are related but seemingly distinct are having a collective influence on project success rather than individually. They all form a common higher-level operational readiness variable.

5.4.5.4 Model Fit Assessment

The airport's operational readiness model consisted of second order construct of operational readiness variable that is consisted of four factors and first order constructs of project success that are represented by one variable with 14 items, which has been developed in AMOS 20 as shown in **Figure (39)**.

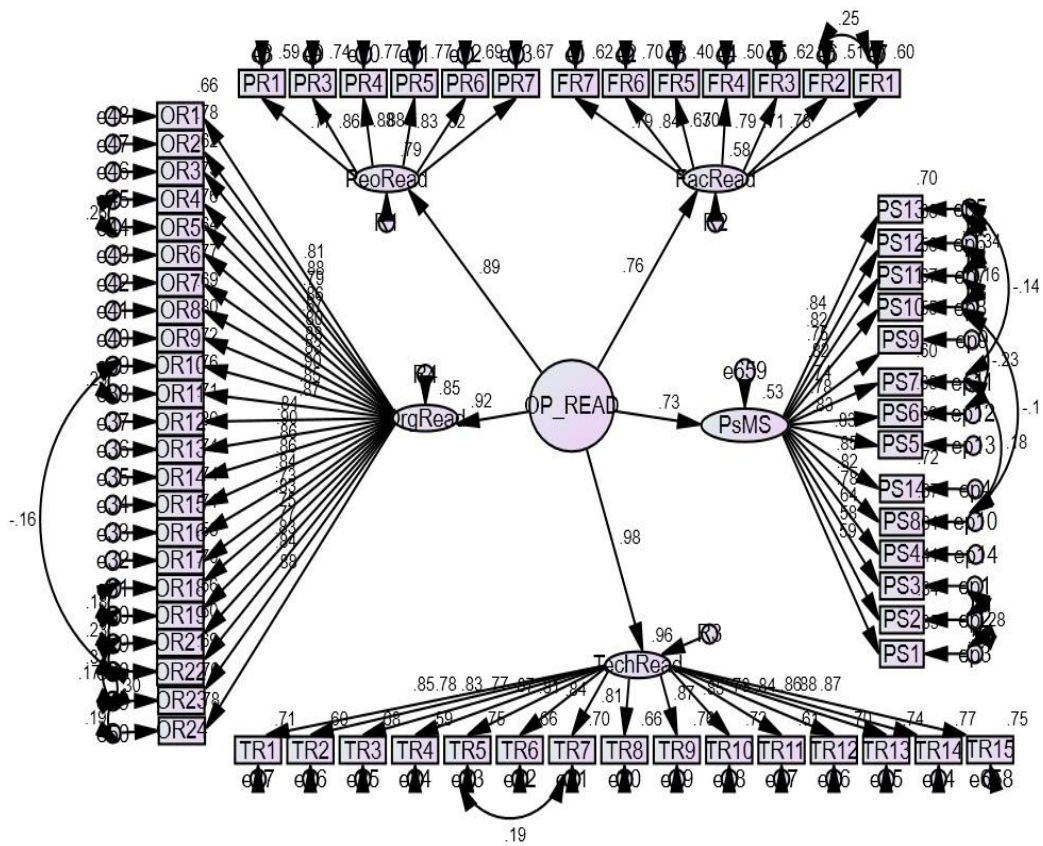


Figure (39) Operational readiness final structural model.

The structure model was subjected to analysis with maximum likelihood (ML). The results showed a good fit as a structure model: ($\chi^2/df = 4790.630/ 1987$ (CMIN = 2.411), SRMR = .0437; CFI = .935, TLI = .932, RMSEA = .067. This complies with the commonly accepted thresholds for the evaluation of models (Salvador et al. 2014). Regardless of the ongoing debate over the correctness of one model fit index (Ika 2015), there are currently many fit indices without any consistent values that can be used for all models.

As such, the following benchmark adopted from (Nimako & Ntim 2013), has to be reported compare and accept the model. The final operational readiness structural model fit indices are presented in **Table (41)**.

Table (41) Structure model Chi-square results and GOF indices.

Chi-square (χ^2) = 4790.630, p= .000								
	Absolute Fit Measures					Incremental Fit Measures		Parsimonious Fit Measures
	DF	χ^2/df	GFI	RMSEA	SRMR	TLI	CFI	AGFI
Benchmark		< 3.00	≥ 0.900	< 0.08	≤ 0.08	≥ 0.90	≥ 0.90	≥ 0.80
Airport's Operational Readiness Model	1987	2.411	0.806	0.067	0.043	0.932	0.935	0.791

For absolute measures of fit the chi-square statistic (CMIN; and its statistical significance, $p > 0.05$) was provided, and it can be noted that p -value for a large sample size does not meet this criterion, as the case in our study. As for large samples ($n > 250$), a significant p -value (Groenland & Stalpers 2012) would be expected. In this model, the reported CMIN value is (2.411), and it is a good value compared to the benchmark presented. The goodness-of-fit index (GFI) measures the data's variance, which is supposed to explain the model (Baker 1976) was found to value (0.806). This is below the target benchmark value of 0.90, and has been reported acceptable (Joshi et al. 2007; Yen et al. 2008; Luo & Liberatore 2009). Root mean square error of approximation (RMSEA) is calculated to evaluate the model fit to the empirical data. For our measurement model, the RMSEA value was reported to be (0.067); which is less than (0.10) in value as recommended by (Ika 2015; Liu & Cross 2016). Standardised Root Mean Squared Residual (SRMR) has also been estimated to be valued as (0.043), which is below the benchmark value and also considered acceptable as a good fit by Bender et al. (2016). Since this study has a large

sample of data ($n > 250$), the acceptable value reported by Groenland and Stalpers (2012) was below 0.8.

For incremental fit indices, the Tucker-Lewis index (TLI) (Hu & Bentler 1998) was reported, and for our model, it was reported with a value (0.932), which is above the benchmark recommendations (Groenland & Stalpers 2012; Liu et al. 2004), as well as a measure for the comparative fit index (CFI) (Ika 2015), taking into account the sample size of this data. CFI is used to compare the current model to a baseline model by comparing the chi-square values respectively (Ika 2015). Models with a CFI values higher than 0.90 are indicative of good fit (Battilana et al. 2010), and for this model, CFI was above the benchmark with a value of (0.935).

For parsimonious fit indices, we report the adjusted goodness-of-fit index (AGFI), which was measured with a value of (0.791); this was above the 0.8 minimum recommended value (Liu et al. 2004; Zhang & Li 2016). AGFI is used to relate the model fit to the model complexity.

Based on the benchmark adopted from Nimako and Ntim (2013) all the model fit indices shows a good model fit of the conceptual model with the data collected.

5.4.6 Hypotheses Testing and Path Analysis

With reference to **Figure (38)**, and reference to this study hypothesised relationships between the operational readiness variable and project success. Path analysis and parameter estimates are used in this section to estimate the strength and sign of directional relationships for the operational readiness structural model where a causal relationship is hypothesised. The results of the path analysis are presented in **Table (42)** with 65 measurement items identified the two latent constructs.

Hypothesis # 1: Facility readiness's factors positively correlated with operational readiness.

Hypothesis # 2: People readiness's factors positively correlated with operational readiness.

Hypothesis # 3: Technology readiness's factors positively correlated with operational readiness.

Hypothesis # 4: Organization readiness's factors positively correlated with operational readiness.

Hypothesis # 5: Operational readiness positively influences project success

Table (42) Path analysis for the operational readiness model.

Hypothesis	Hypothesis Paths			Estimate	S.E.	C.R.	P	β
H1	Facility Readiness	<---	Operational Readiness	0.70	0.04	18.34	***	0.76
H2	People Readiness	<---	Operational Readiness	0.88	0.04	21.19	***	0.89
H3	Technology Readiness	<---	Operational Readiness	1.00				0.98
H4	Organizations readiness	<---	Operational Readiness	0.90	0.04	24.75	***	0.92
H5	Project Success	<---	Operational Readiness	0.64	0.04	14.93	***	0.73

Note: Estimate = standardized regression weights (path estimate), S.E = standard error,

C.R. =critical ratio (*t*-value), P = critical (*p*-value) = significance value. *** *p* < 0.001

Results of the hypothesis presented in **Table (42)**, indicate a statistical significance and direction of the paths. In H₁, H₂, H₃, H₄ all of the readiness factors are positively significant and predicting the second order variable of operational readiness, whereas, the relationship between operational readiness and project success is positively significant and predicting the project success with a CR value of 14.93 (>1.96).

Also correlation analysis was conducted among the operational readiness factors shown in **Table (43)**, where it indicates that the operational readiness factors are positively correlated, some of the bivariate correlations are above 0.60 (Ika 2015).

Table (43) Correlation Matrix.

	Facility Readiness	People Readiness	Technology Readiness	Organization Readiness
Facility Readiness	1			
People Readiness	.717**	1		
Technology Readiness	.687**	.841**	1	
Organization Readiness	.648**	.757**	.886**	1

$p < .01$.

From the results of the above table, the four operational readiness factors show a positive correlation between them and all of them have values higher than (0.60), which support H₁, H₂, H₃, H₄ hypotheses and the existence of an operational readiness variable as second order latent.

5.4.6.1 H5: Operational readiness positively influences project success.

The strong positive impact on operational readiness on project success supported H₂. Finally, we present the finding of the research in the final structure model as shown in **Figure (40)**.

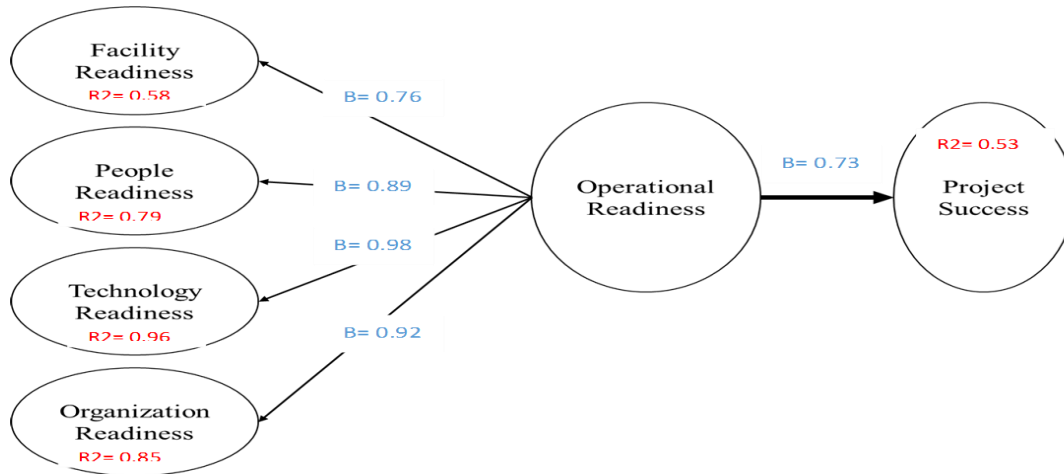


Figure (40) Results of the 65-item structural equation model.

We summarised the results here based on the squared multiple correlations (R^2) as recommended by Hair et al. (2009), where it measures how good one variable is in predicting the other. The results of squared multiple correlations are shown in **Table (44)**. The value is between 0 and 1, and the closer to 1 the closer the model will be to predict the results and make a trend. Specifically, we learnt that operational readiness significantly, positively influences and can predict project success.

Table (44) Squared multiple correlations.

R ²

Project Success	0.53
Facility Readiness	0.58
People Readiness	0.79
Technology Readiness	0.96
Organizations Readiness	0.85

5.5 Summary

This chapter presented an introduction and the four main sections of the data collection and analysis of this research in the sequence of phase 1 data collection and analysis, pilot study and phase 2 data collection and analysis.

The first section: presented the aim and objective of this chapter.

The second section: presented the first phase of this study, where it is qualitative and the first approach of the mixed-method sequential exploratory study. In this section, Delphi method data collection and analysis were presented for the three rounds; it started with the selection of the expert panels with justification. Then it moved to the design of the questions to be used for the Delphi session, and finally presented the results and analysis. The main outcome of this phase was first to select the items that are relevant to the operational readiness in airport's project to design the main questionnaire for this study.

The third section: presented the pilot study for the main questionnaire. It discussed the data collection and analysis of the 150 subjects. Analysis of the data was performed that

included demographic analysis of the data, missing data analysis and reliability and correction. The reliability of the two constructs of this research exceeded 0.70, and this has assured us to continue using them in the final phase of the study.

The main outcome of this section was to ensure the appropriateness and reliability of the measures for the main questionnaire and prepare the final questionnaire to be used in phase 2.

The fourth section: presented phase 2 of this study, which is the quantitative and the second approach of the mixed-method sequential exploratory study. In this section, a detailed discussion was carried on the administration of the main questionnaire, followed by descriptive statistical tests and analysis to understand the demographic representation of the sample. Next, was a discussion on the data preparation and evaluation steps that were taken by the researcher, which included data screening, handling of missing data and outliers, assessing normality, and assessing reliability and validity of the data. The data preparation was an important step to confirm the assumption of the data before proceeding with further analysis and especially before conducting SEM analysis. After data preparation, statistical analysis was conducted using SEM, which was divided into three steps. SEM measurements and structural models were tested using AMOS version 20. The first SEM step was to analyse the measurement models of the operational readiness and project success, followed by structural model fitting of the proposed conceptual model designed in Chapter 3. Univariate normality test was conducted by assessing the skewness and kurtosis of each item. Values were checked against the common values of $[\pm 2.58]$ and the data was concluded to be normally distributed. Once all of the model fit has been confirmed that included the reliability and validity of the constructs, research proposed hypothesis was tested and analysed. The main outcome of this section was the

confirmation of the second-order latent variable of operational readiness and its contributing factors of (facility readiness, people readiness, technology readiness, organisation readiness). This section confirmed that operational readiness has a positive and significant impact on project success in the context of airport's projects. Finally, this chapter has confirmed empirically the proposed framework of the operational readiness to be used in airport projects.

Chapter 6

Discussion and Framework Validation

6.1 Introduction

The aims of this study were to: firstly, critically examine, discern and synthesise the notion of operational readiness within the context of operations and project management; and secondly, to support organisations to ensure that on the first day of operation (after completion and sign off of construction phase) that airport services run smoothly. In effect, this study seeks to ensure that airport services and operations do not fail due to poor or inadequate 'readiness'. Therefore, the development of an operational readiness framework for airport services is required for the operational consultants in the UAE. Having the operational readiness framework, operations managers can analyse, evaluate and develop an awareness of their readiness in term of the implementation of airport services. Chapter 6 presents the results of the analyses conducted in Chapter 5, where it has been found positive and significant relationships between operational readiness and project success and the validation of the operational readiness variable as a second-order construct that consisted of four readiness factors (facility, people, technology, organisation). In this chapter, the discussion will take place over the significance of the finding of and results of Chapter 5, implications for theory, practice and cross reference with relevant literature. The main findings of this chapter will be used to finalise a framework/model for airport's project operational readiness. Additionally, this chapter seeks to discuss the results of this study to achieve the research objectives and answer the proposed research questions and confirm the conceptual model. Initially, a summary of this study's research elements will be provided, followed by a detailed discussion of the main findings that

include the discussion of the results of the hypothesis analysis with cross reference to the available literature. The discussion will provide information on the response rate of the survey and the demographic characteristics of the subjects. This will be followed by a discussion of the impact of operational readiness perceived. Answers to the research questions of the study will be presented with a discussion on the implication of this study from both practical and theoretical perspectives. Finally, this chapter will present the validation session carried out with industrial experts to examine the applicability and usability of the validated model and provide any suggestions for improvement. Thus, the importance of this chapter on the development of the framework is that it cross analyses the findings of the survey on operational readiness factors with the existing literature.

6.2 Synopsis of the Theoretical Background Findings

The research's proposed model was based on Weiner (2009) integrated theoretical model, which provides the determinants and outcomes of organisational readiness for change. The model of Weiner was modified to suit this research study and included other readiness diminutions, such as facility readiness, people readiness, technology readiness and organisational readiness to provide the required operational readiness and to measure project success as a construct for the implementation effectiveness.

The four factors measured by operational readiness that was used to specifically examine the perceptions of the airport's stakeholders for operational readiness were: (i) facility readiness; (ii) people readiness; (iii) technology readiness; and (iv) organisations readiness. The analysis of Chapter 5 has empirically validated the operational readiness's conceptual model developed in Chapter 3 as the data has perfectly fit the model. Furthermore, this research study has achieved its objectives by empirically evaluating the impact

of operational readiness on project success and proposing a framework for operational readiness. The main objectives of the research were to:

- Explore, define and review the relevant literature related to the operational readiness with a focus on large infrastructure projects (Airports). Refer to Chapter 3.
- Identify and categorise factors from the existing literature that constitute the major theory behind operations readiness. Refer to Chapter 3.
- Identify and characterise key elements of operational readiness in the context of large infrastructure projects (Airports). Refer to Chapter 3.
- Develop a Theoretical framework that can improve project success in large infrastructure projects (Airports). Refer to Chapter 4.

To start with, this study initially reviewed the relevant and available academic and industrial literature, where it has helped in identifying the research problem and gap to be investigated. This review has also contributed in achieving the aim and objectives of this study and extended the knowledge in operational readiness in airport projects in the UAE. Next, an identification process has taken place to gather and collect all of the operational readiness items and its contributing factors that were available in the relevant research areas (i.e., IT, oil & gas, chemical plants and construction) to be applied to the context of airport projects. Based on the literature review, a research problem was articulated and from it stems the two aims of this study, which were also divided into the research objectives and then sub-divided further into three research questions:

RQ1: Within the context of project management, what is operational readiness?

RQ2: How do scholars and practitioners perceive operational readiness and contributing factors?

RQ3: What is the relationship between operational readiness and project success?

In Chapter 3, a conceptual model was developed based on the literature of operational readiness and its influence on project success. A methodology chapter was provided next to design the process of collecting and analysing the data to test this model. From the analysis of data, the findings of this research were in line with the developed theoretical foundation and model and it was found that operational readiness as a second-order latent variable in operating new airport facility does have a significant, positive and strong impact on the success of that project ($t = .73$; $R^2 = .53$). The study also provided evidence that operational readiness as a second-order latent variable is reflected by four readiness factors (facility, people, technology and organization); it was shown by the significant and positive standardised regression weights (t) between operational readiness and each of the four readiness factors, technology readiness (.98), organisations readiness (.92), people readiness (.89), and facility readiness (.76) are worth mentioning.

6.3 Discussion of the Main Findings

This research is a sequential exploratory mixed method, where it uses both qualitative methods to induce knowledge from expert panels, and quantitative deduction of information to validate the conceptual model. Based on the research problem and objectives presented in Chapter 1, this study adopted both positivism and interpretivism paradigms. A Delphi session was conducted to evaluate and select the most appropriate items to measure the readiness factors of airport projects with selected experts from airport operations and project managers. The expert panel also included academics with operations

management expertise, and the final output of the session was the list of questions to be used for facility readiness, people readiness, technology readiness and organisations readiness. A pilot study was conducted to verify the design and appropriateness of the main survey beforehand and correct all observations. An online questionnaire using SurveyMonkey.com was administered by the researcher to collect data from the four main airports in UAE. The descriptive statistical testing analysis was conducted on the initial list of items (68) and resulted in (51) items to measure the second-order construct of operational readiness including the four readiness factors and 14 items measured project success construct.

The main questionnaire, which was used in phase 2 of the study was designed and divided into four major sections. The first section gave the respondents an overview of the research and the purpose of conducting this research. The second section, provided the respondents with closed-ended questions to capture the demographic characteristics such as gender, occupation, type of organisation, job tenure, and a number of airport projects executed and operated. The third section of the questionnaire provided the respondents with questions to obtain readiness measure for the facility, people, technology, and organisation for operating newly completed projects to construct the operational readiness latent variable and model. The fourth section provided the respondents with questions on how do they perceive project success on the airport's projects based on their experience.

This research finding contributes to the project and operations management by showing that operational readiness as a variable overseeing four critical readiness factors, facility readiness, people readiness, technology readiness and organisation readiness. The usage of SEM has been adopted over the multiple regression tests to analyse the complex rela-

tionships between operational readiness factors and the impact of the second order variable on project success in airports context. Two software were used to analyse the collected data of phase 2. SPSS version 20 was used to provide descriptive analysis, check for missing values and conduct reliability tests. On the other hand, AMOS version 20 was used for the SEM measurements, construct model analysis and model fit. For the structural equation modelling analysis, the study adopted the recommended two-step approach. The first step, was confirmatory factor analysis to check the fitness of the measurement models of the study and the second step was to construct the structural model as per the proposed conceptual model specifying the independent and dependent variables of the study. Based on the analysis provided in Chapter 5, discussion and interpretation of the findings will be presented in the following sub-sections in more details.

6.3.1 Response Rate

The data for the second phase of this study was collected from four different UAE's airports with a total of 663 respondents. The research's population sample was from major airport's stakeholders that included operations project manager, client representatives, airlines, contractors, and consultants who were familiar with previous airport projects execution and operation. It is to be noted here that, it was difficult to get responses from all the airport's stakeholders due to the geographical limitations and access to such database is restricting. To improve the data and eliminate biases from the sample, random purposive sampling technique were adopted for this study. The respondents of the survey were able to complete the questionnaire using the online survey tool on SurveyMonkey.com. This study targeted 1,000 respondents from the four airports stakeholders, but responses

were received only from 720, giving us a response rate of 72%, which provided the researcher with an assurance of the survey effectiveness (Klassen & Jacobs 2001).

6.3.2 Participants' Demographic Characteristics

The first section of the questionnaire provided the researcher with the respondents' demographic characteristics to ensure accurate data for the research from the targeted population. The majority of respondents were dominated by males (87.7%), and this finding is normal in the UAE since women are not heavily involved in the project management, and construction industry (Al-Ali 2008) with similar findings being observed earlier (Suliman & Al-Junaibi 2010). A significant majority of the respondents worked at Dubai International Airport (399, 63%), followed by Abu Dhabi International Airport (122, 19.3%). A total of 65 (10.3%) respondents were working at Al-Maktoum International Airport, and the least number of respondents worked at Sharjah Airport (47, 7.4%). The high number of respondents from Dubai International Airport was due to a large number of airports projects executed in Dubai airports (Murel & O'Connell 2011); this provided rich data from these experienced respondents.

Furthermore, 33% of the respondents were senior-level managers, while mid-level managers represented 45% of the total. This provided rich data from strategic and operational experienced respondents. Additionally, 18.2% of the respondents in the study are from field services, while 3.2% of the respondents worked in offices at the clerical level. With regards to years of experience in the airport operations and projects, the majority of the subjects had a total of 8 to 13 years' experience with their present organisation, while 31% had 20 years or above experience. Almost 30% of those respondents worked in airports operational services and maintenance, while 18% worked as airline staff that used

the facilities of the airports. The remaining 52% were contractors, consultants, airport authority personnel and project managers. Also, more than 61% of the respondents participated in three or more airport projects, while the rest participated in less than three projects.

The demographic characteristics of the respondent presented in the results showed that the data were collected from respondents with enough experience, worked on multiple projects, and from the major stakeholders of the four airports. With this, we can confirm that the survey sample used for this researched had satisfied the research requirements for knowledge and management expertise to yield a useful set of data.

6.3.3 Relationship between operational readiness and project success

This section will provide a detailed discussion of the two proposed hypotheses for this research, which shall be sufficient to satisfy the objective that developing a conceptual framework can improve project success in large infrastructure projects (Airports), as well as answer, RQ3, What is the relationship between operational readiness and project success?

6.3.3.1 H₁, H₂, H₃, H₄: *Given that the four operational readiness factors are positively correlated, there exist a higher-level of construct that capture overall operational readiness.*

H₁, H₂, H₃, H₄ examines the correlation of operational readiness as a second-order variable with the four readiness factors. The four operational readiness factors included in the study are (i) facility readiness; (ii) people readiness; (iii) technology readiness; and (iv) organisations readiness. These factors will be further discussed in detail in the next sec-

tions to understand their influence on operational readiness as a second-order latent individual factor, as well as part of the overall operational readiness second-order latent variable. The findings show important observations that operational readiness as both planning and activities by the airport stakeholder and also an implementation concept that is needed to ensure the readiness as planning alone does not serve the purpose, and demonstrating that it consists of four factors, facility readiness ($\beta = .76$), people readiness ($\beta = .89$), technology readiness ($\beta = .98$), and organizations readiness ($\beta = .92$). This shows that operational readiness is a second-order variable consisting of four readiness factors as presented in **Figure (41)**.

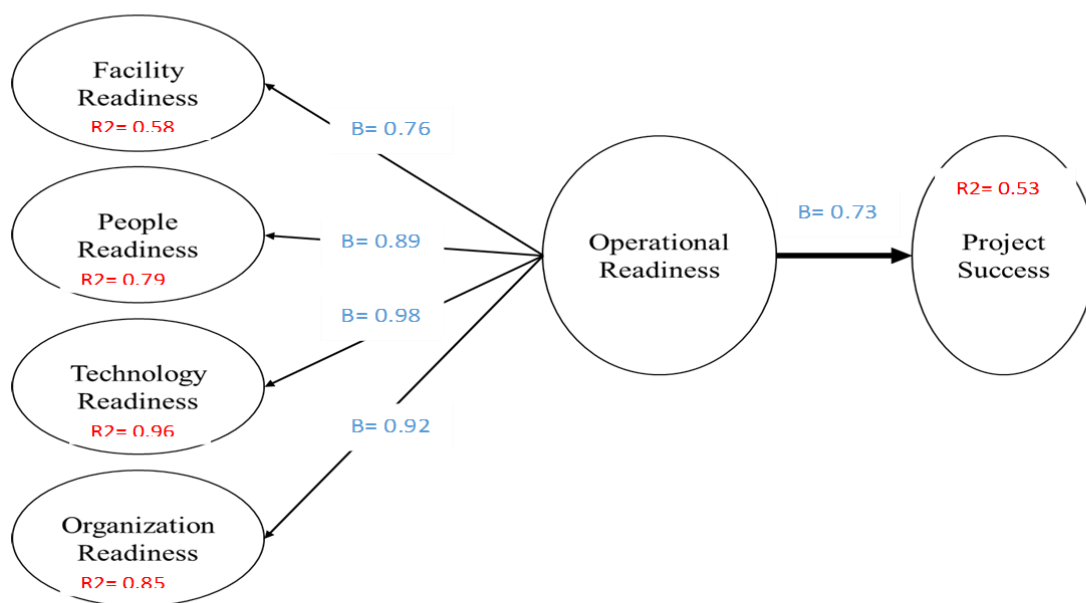


Figure (41) Operational readiness factors.

An earlier study by Main et al. (2015) identified organisation's readiness as one of the reasons why the operations are slower than it should be. They identified the component that may influence the readiness via several articles and journals and categorised them into two categories: (i) physical factors, such as planning, equipment and cost; and (ii) human factors, such as knowledge, training and motivation. Their study provided confirmation for the results of this study, with the exception that this study is grouping these factors into a second-order variable called operational readiness and has been empirically investigated and for which the hypothesis is established.

Hypothesis # 1: Facility readiness's factors positively correlated with operational readiness.

The readiness of the facilities to be operated within projects is considered an important factor for operational readiness (Gardner 2001; Wilson et al. 2004; Hickey 2008; Lyons & Powell 2010; Nossair et al. 2012; Brereton & Papp 2013; Krauss 2014; Kidd & Howe 2014). The importance of the facilities readiness in airport projects stems from the need to have world-class services for the passenger from day one for the airlines and the airport operators (Arif et al. 2013; Gupta et al. 2014).

In this study, an investigation of the facility readiness factor as part of the operational readiness has been carried out. The findings indicated significant, positive and strong standardised regression weights (t) between operational readiness and facility readiness (.76), which implies a significant correlation with the second-order construct of operational readiness. This is not an unexpected result, as previous studies and literature have given similar importance to facilities readiness, such as Brereton and Papp (2013), where facility readiness receive the same emphasis as the operational team who will operate the

project. Additionally, in a study conducted by Lyons and Powell (2010), facility readiness was identified as an important element of operational readiness by the participant of the study. Potential benefits are expected from replacing or creating new facilities in airports (Zaneldin 2006; Arif et al. 2013), which includes an improvement in customer services provided by this facility. In addition to that airport project's owners such as government will not only expects the new facility to resolve long-standing service problems but will also assure the best-in-class services (Wilson et al. 2004; Gupta et al. 2014).

In the study of Arif et al. (2013), with regards to the model for UAE airports customer satisfaction, facilities and the pleasure of having a comfortable environment within the airport premises were recommended. This has also been found as part of this study analysis with regards to the facilities influence on the project success and how airport organisations service it. We note here, the lack of available studies on airport projects in general and in the UAE in specific, with regards to success factors that make it hard to draw comparisons with the results achieved in this study. Nevertheless, we can compare the results to similar types of projects of the same kind (large infrastructure projects). For example, Masrom et al. (2015) proposed that facilities be a critical success factor in their framework, which will lead to project's stakeholder's satisfactions and thus, will ultimately increase project success. The only difference in this study is that the readiness of the facility for the stakeholders is ensured from a wider perspective before operations rather than just having the facility available.

In conclusion, analysis of the findings showed a strong correlation between facility readiness and other readiness factors of the study, as well as the strong, positive significance to operational readiness. This combined with the cross references of the available literature, strengthens the presence of facility readiness as an important factor of operational

readiness that will contribute to change of project success in airport projects, and will also be used to develop the operational readiness framework for airport projects at the end of this chapter.

Hypothesis # 2: People readiness's factors positively correlated with operational readiness.

While facility readiness is associated with the readiness of the facilities produced by the project. The facilities in the airport alone were not sufficient to provide the level of services required by the airport and the airline's authorities (Yeo 1995; Vos & Santos 2015), which led up to the readiness of the people who will be using the airport facilities and systems to deliver world class services. The readiness of the people in this study provided insight on the importance of the recruitments of organisational staff before operating newly constructed facilities in the airport. It also discussed the importance of the training and familiarisation of those staff and the accessibility of information and documents when needed. The readiness also measured participation among the end users on the trials and any operational simulations of the newly constructed facility in the project that includes the final project users and supporting agencies.

The people readiness is important because an operational team of all the airport organisations and airlines that are 'ready', requires that all be staffed with a sufficient number of skilled personnel. These staff should also have sufficient training and familiarization with the facilities and equipment produced by the projects to ensure people know how to operate their equipment to enable them to achieve world-class airport status (Mumford 1976; Gardner 2001; Dvir 2005; Kingston et al. 2007; Deloitte 2011; Brereton & Papp 2013; Kidd & Howe 2014; Ventre et al. 2014; Verhoeff et al. 2015).

In this study, an investigation of the people readiness factor as part of the operational readiness was carried out. The findings indicated strong, significant and positive standardised regression weights (t) between operational readiness and facility readiness (.89), which implies a significant correlation with the second-order construct of operational readiness. This is also not an unexpected result as previous studies and literature have given similar importance to the people readiness, such as Kidd and Howe (2014), where the researcher have given the training of both new and existing staff a significant readiness importance to operating a new hospital facility. The training program also provided an opportunity to review the original vision and corporate goals for the new facility to ensure the level of services rendered. It is also to be noted here that staffing and organisational resources were used by Weiner (2009) as determinants factors for organisations readiness for successful changes implementation, and the development of his theory of organisational readiness for change. The results of people readiness also confirmed by an earlier study of Jones et al. (2005) that reshaping the capabilities of the employees in organisations exerted a positive main effect on readiness for change and better system usage. Comparing this to the present study where training and familiarisation should reshape the capabilities of the new airport staff, shows a positive effect on project success.

Results of the analysis show a higher significant correlation for people readiness that is greater than the results obtained for the facility readiness factor. This indicates the importance of people readiness by the operational organisations that participated in the survey, especially airlines, airport operators and authorities. Similarly, Ventre et al. (2014) concluded that staffing among other factors had been identified as operational deficiencies in new children hospital projects, which has allowed them to take corrective action before opening to the public to ensure the best level of service.

In conclusion, the analysis results of the influence of people readiness on the overall operational readiness, combined with cross-referencing of the available literature and studies. This strengthens the presence of the people readiness as an important factor of the operational readiness that will contribute to changes in project success in airport projects, and will also be used to develop the operational readiness framework for airport projects at the end of this chapter.

Hypothesis # 3: Technology readiness's factors positively correlated with operational readiness.

In airport projects, special airport systems and technologies are used, which are not found in any other construction projects. These systems include the baggage and materials handling systems, airport security systems, airport operating system, as well as the radar and other navigation aids systems. Having these systems available and ready along with other supporting systems are essential in ensuring the operability of the new airport facility (Gardner 2001; Cosenzo et al. 2007; Kingston et al. 2007; Deloitte 2011; Brereton & Papp 2013; Emerson Reliability Consulting 2014; Del et al. 2015). For this study, systems and technology readiness was considered an important factor of operational readiness for the airport's project due to the quantity and complexity of the systems in these projects. While facility readiness and people readiness are essential factors of the airport operations (Sarkis 2000; Kozlowski 2015), the facilities and people in the airport alone is not sufficient to provide the safe operational level of services required by the airport, airlines and the regulation authorities. This leads up to the readiness of the systems/technology being able to deliver a safe operating world-class services airport. The readiness of the system/technology in this study provides an insight into the importance of the training on the new systems. By having the required regulatory approval on these safety and security

systems, as well as ensuring the right level of spares and consumable availability to support the systems when needed and documentation of such critical systems and its availability when needed. The readiness also measures the importance of the trials and operational emulation of these critical systems before using them with public passengers.

In this study, an investigation of the system/technology readiness factor as part of the operational readiness has been undertaken. The findings indicated significant, positive and very strong standardised regression weights (t) between operational readiness and technology readiness (.89), which implies a significant correlation with the second-order construct of operational readiness. This results also support earlier studies on large complex systems in construction (Wiendahl et al. 1996), where the technology/system and their documentation have been identified as part of the problems that occurred during the initial start-up and operation of the new system. In this study, the significant of the systems and technology is higher due to the dependencies of the operations on such critical systems and the passengers' experience, as well as the financial impact that will ultimately lead to less project success for not having these systems ready for operations. Hastings (2015) recommended having operational readiness as part of the asset integration and management, as well as the operational and maintenance documentation of the systems ready for operations. This is in line with the new International Industrial Standards (ISO55000); the difference in this study is related to the criticality and risks associated with the airport systems that are present in the project and its importance in providing safe and world-class services to the passengers and airports users.

Comparing the results of this study with similar risk industries like Oil and Gas, it was found that Integrated Readiness Assurance Program (IRAP) (Nossair et al. 2012) has created a framework to ensure the operational readiness of the newly constructed oil and gas

projects, as well as the system's readiness of spares and operational and maintenance manuals, and the availability of all the legal documents. This study has similar attributes, but it is also different as this study investigates airport projects. On the other hand, the program conducted by Al-bidaiwi et al. (2012) also among oil and gas projects, have involved the maintenance team to ensure all the systems are ready for most of the items used for system readiness construct in this study. The two studies did not have any empirical measure of the magnitude of systems readiness, but rather a practical measure of their success on their projects.

For the airport projects comparison, the findings also revealed similar agreements with the findings of Lee (2000), where significance issues arose between the project management team and the airport's operations team, all of which whose collaboration were crucial to the success of the project to ensure systems and technology readiness. As such, this indicates the criticality of the system/technology readiness by the operational organisations that participated in the survey, especially airlines, airport operators and authorities. It also explains the results and recommendations concluded by others in the airport projects (de Neufville 1995; Szyliowicz & Goetz 1995; Prather 1998; Nijkamp & Yim 2001; Quilty 2003; Lyons & Powell 2010; Gil et al. 2012; Ventre et al. 2014)

In conclusion, the analysis results of the influence of the technology readiness show a significant correlation with operational readiness along with the cross-referencing of the available literature and studies. This strengthens the presence of the system/technology readiness as an important factor of the operational readiness variable that will contribute to change of project success in airport projects and will also be used to develop the operational readiness conceptual framework for airport projects at the end of this chapter.

Hypothesis # 4: Organization readiness's factors positively correlated with operational readiness.

Managing and preparing for changes is required in all organisation that are expecting a new project to be delivered as part of their strategic vision (Gardner 2001). The impact of these changes will vary depending on the type of project and size of the final delivered products; airport organisations are no different (Davies & Gann 2009). In fact, airport projects are more complicated due to the multi-stakeholders involved in its operations and the degree of involvements and participation in the operations (Lyons & Powell 2010). Airport's organisations and operations are run by a multi-cultural team from a different background of countries, languages and disciplines This gives it another degree of complication to cooperate and coordinate closely to ensure that world-class services are delivered through their airport facilities, staff and operations (Arif et al. 2013; Gupta et al. 2014).

For this study organisation's culture and processes, readiness was considered an important factor of the operational readiness for the airport's project due to the diversity of the people, cultures and processes needed to operate airport projects, while facility readiness, people readiness and technology readiness are essential factors of the airport operation. These factors alone are not sufficient enough to provide the safe operational level of services required by the airport, airlines and the regulation authorities. As such, this leads up to the readiness of the organisation's culture/processes to deliver a safe operating world-class services airport, which cannot be achieved without connecting them with an organisational, operational model with processes for normal and abnormal operations, as well has to have the organisational and operational culture.

The readiness of the organisation's culture/processes in this study provides an insight into the importance of the development of new operational processes that need to be ready and accepted by all parties. The organisation's plan to operate the new facilities, an overall activation and readiness plan for the whole project, roles and responsibilities of organisations and its member in the new project facilities, new regulations and policies communications along with other items. The organisation culture/processes readiness factor had the largest items of the four factor of operational readiness factors as it combined both internal and the overall stakeholder readiness processing and plan.

In this study, an investigation of the organisation's culture/processes readiness factor as part of the operational readiness has been undertaken, as well as the individual factor influence on project success. The finding indicated significant, positive and very strong, standardised regression weights (t) between operational readiness and organisation's readiness (.92), which implies a significant correlation with the second-order construct of operational readiness. This results also support earlier studies on success ERP implementation system in construction by (Ahmadi et al. 2015), where the organisation readiness and social readiness was significant and supported the total readiness and implementation success. However, this study deals with the operational readiness of airport project with multiple organisations rather than one organisation. Carver (2012) examined the relationship between organisational culture and readiness to change in among U.S. army officers in Japan and concluded that by addressing the organisational culture readiness, leaders in the military were able to increase employees' readiness to change with positive organisational effects. This, in turn, implements changes and provide high operational readiness status. His study focused on the military though, which is similar in criticality as the airport operations. The results from a comparative case study of four firms conducted by

Motwani et al. (2005) that implemented an ERP system suggests that cultural readiness among other factors have a positive impact on several ERP implementations. Moreover, it can be noted that with regards to this study, reference is made to the ERP implementation projects because of the availability of rich literature and studies on its readiness, which also emphasises mainly on organisational culture readiness and processes to change.

For the airport projects comparison, the findings also revealed similar agreement with the study conducted by Lyons and Powell (2010). The study covers 14 international airports activation and readiness plans to operate new airport terminals and concluded that processes and organisational culture among different operational stakeholders resulted in successful airport terminal facility activations. A recent empirical research was conducted by Zerjav et al. (2014) to investigate the challenges faced by the airport's stakeholders when converting the project from construction to operation. The study suggested focusing on the '*progressive confidence*' to allow the smooth transition and operations of the newly constructed airport facility. This progressive confident can be achieved by having a healthy organisational culture and confidence in the new processes developed for the new facility.

In conclusion, the analysis results of the influence of the organisational readiness indicates a significant correlation with operational readiness along with the cross references of the available literature and studies. This strengthens the presence of the organisation's culture/processes readiness as an important factor of the operational readiness that will contribute to change of project success in airport projects and will also be used to develop the conceptual framework.

H # 5: Operational readiness positively influences project success.

This hypothesis seeks to answer RQ3, What is the relationship between operational readiness and project success? In broad terms, this study proposed a combination of facility readiness, people readiness, technology readiness and organisations readiness (operational readiness factors), which can potentially influence project success and can in turn significantly impact the success or failure of the airport's project.

Findings from the analysis indicated that operational readiness for airport projects had a significant, positive impact on project success. These results strongly supported the hypotheses of the relationship between operational readiness as an independent variable in this study and project success as the dependent variable with ($\beta = .73, p = .000$) accounting for 53 percent of its variance. Overall the results indicate the 53% change in project success can be attributed to operational readiness as indicated by the structural modelling equation shown in **Figure (41)**. The results suggest that operational readiness activities as viewed by the airport projects stakeholders from key organisational entities in four different airports have a statistical influence on how they recognise the success of the project.

These findings are similar to those of other studies (Eby et al. 2000; We et al. 2002; Jones et al. 2005; Wesensten et al. 2005; Holt, Armenakis, et al. 2007; Self & Schraeder 2009; Stevens 2013; Haron 2013; Krauss 2014; Waziri et al. 2014), which have identified operational readiness or one of its factors as significantly enhancing the chance for project success by preparing the facilities people, technology, and organisation readiness not as an afterthought, but as an integral part of project management (Gardner 2001; Chang

2009; Lyons & Powell 2010). According to Zerjav et al., on Heathrow T5 airport's project, it was concluded that a *"....specific form of high-reliability focus, which our participants called 'progressive confidence' is essential for the smooth transition from project to operations. The emergent findings suggest that this process comprises specific aspects of organisational learning, the notion of the "flip" between the project and operations and approaches for dealing with change. The findings suggest the importance of further research into the issues of operational readiness and transitioning towards the handover of complex infrastructure projects"* (Zerjav et al. 2014, p. 53)

Past study of Jones et al. (2005) has also confirmed the results of the empirical study on employees of the governments on using new systems, where operational readiness implementation has a high positive impact on the successful usage of the system. Specifically, their conclusion revealed that preparation readiness for change provides a positive main effect on satisfaction. The only difference regarding this study is that this study focuses on dealing with the full facility of the airport rather than a system.

Other studies for the construction projects of buildings in Malaysia by Takim and Adnan (2008) have concluded that operational assurance results indicate a 12.15% change in project success. The operational assurance model consisted of five factors: (1) excellent warranties for the systems and facilities, (2) comprehensive commissioning activities, (3) smoother process of close-out and handover, (4) Operational fit for purpose simulations, and (5) Quick rectification of constructions defect and issues. While operational assurance has similar factors to this study's operational readiness, it lacks other dimensions such as people readiness and organisational processes readiness, which are considered an important factor for project operations and ultimately project success in airports.

It is also worth noting here that operational readiness may take different names and concept in the literature of various industries and contexts. Mathew et al. (2014) consider preparedness for organisational change (operational readiness) and associated factors are essential to the successful implementation of the projects in public sector organisations. Meanwhile, Wiendahl et al. (1996) have considered the stage of preparation, which includes all activities of previous project phases and planning activities. Including documentation are pre-conditions for the start-up and tuning phase; the results of these activities if inaccurate, incomplete or unfinished have a direct retarding impact on the start-up of the project. The importance of the coordination of these preparations and proper planning for operations (operational readiness) are also recognised by Brereton and Papp (2013) who believed in a dedicated personnel, along with a supportive management to ensure successful operations of the project. While this was a recommendation from industry, this study has confirmed these conclusions with empirical data, as this study recognised a gap in the literature for a unified operational readiness variable with its contributing factors and the availability of operational readiness factors for airport projects. It is hard to compare similar studies to this study; similar available studies use one or more factors of the operational readiness variable and test its influence on project success.

6.4 Conceptual Framework Development and it's Usage

The four operational readiness factors formulated earlier in the literature and confirmed in this research for UAE's airports were discussed, cross-analysed with relevant literature and theoretically validated in the previous sections and based on that a conceptual framework is proposed in **Figure (42)**.

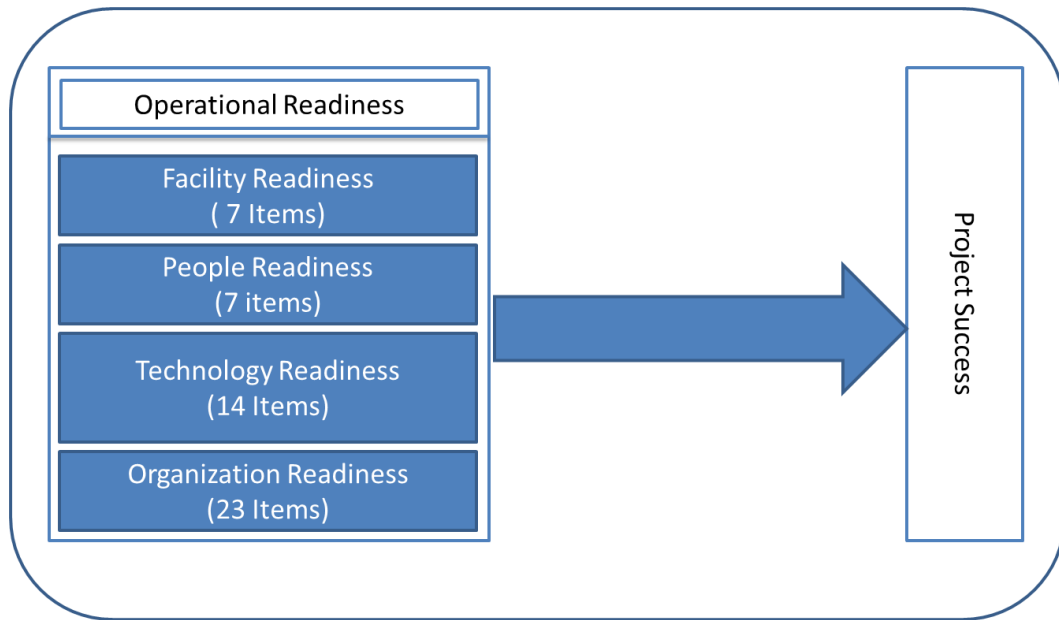


Figure (42) Airport’s operational readiness conceptual framework.

The framework illustrates the relationship between operational readiness factors and project success in airport projects, as well as the correlational relationship between the factors themselves that make up the overall operational readiness variable. Items used to measure these four factors can be further referred to in Appendix F. The operational readiness framework, which is produced and validated by this research, will explain and provide an understanding of the impact of operational readiness on project success and what organisations can do to improve the project success level in airport projects at the organisation level. The framework outlines four factors of operational readiness (facility, people, technology/systems, organisation culture/processes), and each of the factors represent readiness criteria that organisation needs to ensure its occurrence to increase the level of their operational readiness, which will ultimately lead to increase chances of project success. The framework is generic in nature allowing organisations working on the airport project to plan and gauge their operational readiness when planning to operate the new facility within the airport. It allows airport operation teams to utilise scoring or score cards for

each item to measure the factors and the state of readiness in a quantitative method. Hence, we suggest that evaluation members for the operational readiness should be equipped with the relevant pierce and understanding of the airport operations processes, as well as the new project design and philosophy. To have such a team, a recommendation to be made that a team of projects and operations members shall be formed to plan and assess the operational readiness status of the project. By assessing the readiness gap for the project to be operational, the assessment team can direct organisations and the government to prioritise the missing items and their operational readiness development plan to suit the needs of the project and its stakeholders based on the final framework developed in **Figure (42)**, and to be able to use this framework in real cases of the airport. Validation of the framework is essential to be conducted with airport practitioners to provide constructive feedback and improvements from a practical point of view in the next section.

6.5 Validation of the Operational Readiness Framework in Airport Projects

In this section, the validation method, process and results of the airport project operational readiness's framework will be presented. A brief explanation of the reason behind conducting the validation process will be discussed, while we acknowledge that the operational readiness framework was developed to ensure successful operations of airport projects after construction is completed. The validation process and methodology will be discussed in the following sub-sections, providing guidance on the quantitative and qualitative approaches that will be carried out during the focus group session with the valida-

tors. Based on the focus group outcome and results from validators, the analysis and discussion will be provided, and finally, suggestion and recommendation for improvements will be presented.

6.5.1 Objectives of Framework Validation

The researcher conducted the validation session for this framework to determine the applicability, appropriateness and practical usability. It is important for the researcher to validate with the airport's projects stakeholders who might be the future users of this model/framework. Specifically, the validation will:

- Evaluate the application and effectiveness of the operational readiness framework/model to be used by airport projects stakeholders.
- Evaluate the facilitation and support project success elements and criteria for airport projects.
- Evaluate framework's help in achieving operational readiness state of operating agencies in airport projects.
- Evaluate the extent to which the framework can assist governments decision makers and airport project owners in operating newly constructed airport projects.
- Gather relevant suggestion and improvements recommendations from validators of the framework, which are expected to be expert in the project management and operations of airport projects including the obstacles in using such framework in real cases of airport projects.

6.5.2 Validation's Methodology and Process

For this research and since there are no formal guidance on how to validate frameworks (Landry et al. 1983), for the methodology and process of the framework validation in project management research, we refer and adopt the methodology used by Molwus (2014) who have used this methodology and process in validating a framework for stakeholder management in construction projects. According to Landry et al. (1983), frameworks are supposed to be validated to ensure they address their specific problem. It should also be noted that frameworks are validated, researchers are not expected to generate new knowledge from the end-users as it is not part of the research's main approach and the validation shall be used only to inspect the framework applicability in serving its objectives. Moreover, Sargent (2013) recommend the links of the validation to the intended use and objectives of the final framework in real life.

Thus, for this study, two approaches were combined to validate the conceptual framework of operational readiness as recommended by Sargent (2013) to accomplish the best result. The first approach recommended by Sargent (2005) is to engage the final users of the frameworks in the validating process of the framework, where possible users of this framework will determine the validity of the framework aspects. This will create confidence in the end-users once the framework is found to be valid to use in real life applications and practical purposes. The second approach is recommended by Martis (2006), is the utilisation of a scoring model to evaluate the framework, where the validity will be considered based on the overall score results. Validity and credibility will be measured using the results from the scoring sheet, and the framework will be considered valid and credible if all the scores are rated high by the validators.

The operational readiness framework for airport projects was developed using the two phases of this current study with airport projects managers and operations managers from

the four main airports in UAE, and the same members will be contacted to validate the framework. Phase 2 of this research study used survey questionnaires with various stakeholders' groups that included construction management, architecture, airport operations, airline representative, and government's agencies. The researchers' selection was based on covering the major practitioners of airport projects and professional operations members. For this validation process, researchers also use the same group with minimum experience years of four for the target validators to ensure sufficient knowledge and feedback while validating the framework, which will make reliable results and analysis of this section. The validators list included professionals working the four major UAE's airports.

A total of 19 validators were selected for the focus group session. **Table (45)** presents the details of the validators' who were involved in the focus group. **Table (45)** confirms that years of experience of the validators ranges from 3-26 years; the airport projects completed were a minimum of 3 and a maximum of 20.

Table (45) Validators list.

No.	Job title	Company type	Trade	Experience (Years)	Number of airports projects
1	Product Development Specialist	Airlines	Developments and Customer Experience	15	6
2	Construction Manager	Client representative	Construction	13	20
3	Head of construction	Project Management	Architecture	26	4
4	Operations Manager	Government Project Management representative	Operations and project delivery	8	3

5	Operations Manager	Airport operations	Operations	8	5
6	Project Delivery Manager	Client representatives	Project management	15	6
7	Head of ORAT	Airport Operations	Operations	25	16
8	Quality Manager	Construction management	Civil Engineering	25	4
9	Quality Assurance Manager	Construction management	MEP	14	4
10	Operations Management Manager	Airport Operators	Strategy	12	8
11	Head of Project Delivery	Project Management	Project Delivery	13	10
12	Project Manager	Consultant	MEP	20	10
13	Head of ORAT	Project Management	Project delivery/ close out	10	3
14	Operations Assistance	Project Management	Project Delivery	3	3

Due to the time constraint, the validation was carried out using a focus group interview (Jamil et al. 2015) to validate the framework. The validation session was designed to last for 2 hours with five main sections as illustrated in **Figure (43)**.

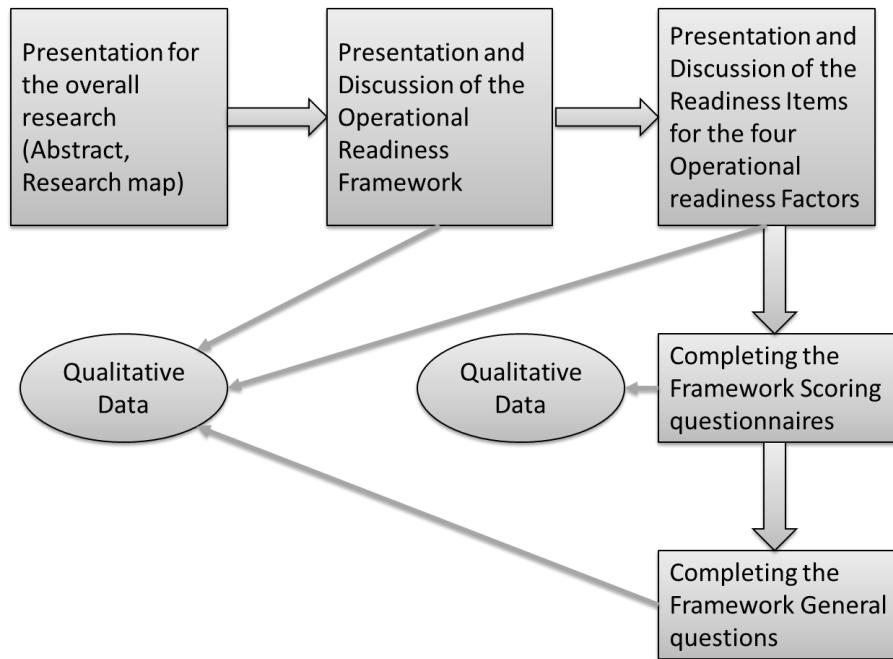


Figure (43) Framework validation process.

The five sections of the validation process includes the following:

1. A brief summary of the research aims and objectives, finding of the research, the methodology used to generate and analyse the data and the final output which is designed to last for 25 minutes.
2. Presentation of the operational readiness framework for the airport and this lasted for 20 minutes.
3. A 30 minutes' time was allowed for discussions on the items for each operational readiness factor.
4. The validators completed a framework-scoring questionnaire for 20 minutes.
5. General suggestion and comments about the framework are answered at the end of the session for 30 minutes.

A paper pack hand-out (available in Appendix C) was prepared and given to each validator in the focus group that contained the following documents:

- Validator's details page to be filled by the validators to capture their details.
- Research summary that gives an overview of the research and how we derived the framework from it, to provide them with a clear idea of the research.
- Research map showing the research problem, aims, objectives, research questions, rational and theories, to give detailed information on the research and to gain further understanding.
- Final results of the operational readiness map that will be discussed in the focus group.
- List of the focus group aims and objectives to ensure that all validators know the purpose of the session and to get reliable answers.
- Four pages are showing the final items for each of the operational readiness factors; space was left for them to add any items that they think were important.
- The framework validation questionnaire, which they need to complete based on their opinion.
- General questions sheet that contains any extra comments or suggestions for improvements and barriers to its use.

6.5.3 Framework Validation Results

The results of the validation focus group provided the researcher with three sets of qualitative and quantitative data that were collected from validators. Jick (1979) recommended the triangulation of the two kinds of data in the process of validation. Qualitative data

provided the researchers with detailed information while the quantitative reduced the biases in the results. In this sub-section, the researcher will present the results of the framework validation's data collected during the focus group; this will include the thematic analysis of the qualitative data along with the quantitative statistical analysis.

6.5.3.1 Results from the review of the framework factors and associated items (qualitative data)

After presenting the final framework and its contributing factors, a lengthy discussion was conducted with the validators regarding their understanding and perceptions of the framework. Five themes have been utilised for this analysis, 'missing factors from the framework', 'facility readiness factor', 'people readiness factor', 'technology readiness factor', and 'organisation readiness factor'.

Missing factors from the framework

The validators were asked about any other main factors that could be added to the framework, which may have an impact on operational readiness. Their suggestions included:

- To have to sequence of the operational readiness activities or items for each factor.
- To have external factors readiness as a separate factor for the operational readiness of airports projects.
- Dedicated HSE factor with all of the related elements of safety, security and environments.
- Dedicated risk factors that include all types of risk with their mitigations.
- To have a separate factor called "Products readiness", discuss the actual products readiness and its availability for all the stakeholders in the airport.

Facility readiness

The validators were asked about any other items that they think should be part of the facility readiness factor that could be added to the framework, which may have an impact on the operational readiness. Their suggestions included:

- Emphasis on the environment factors to be assured before operations and to be added to the items of the facility readiness factors.
- Emphasis on special needs attention that should be made ready for operations and an item should be considered as part of the facility readiness factor.
- To have facility life and safety readiness item as part of the facility readiness factor. Sustainability and environment assurance of the facilities to be also considered as an item in the facility readiness factor.
- Emphasis on the completion of handing over of spaces inside the facilities before operations, which was recommended to be added as an item in the facility readiness factor.
- To have escape routes, facility emergency plans, assembly points, NOCs to operate, authority's clearance for operations as items that needed to be added to the facility readiness factor.
- The spaces handing over should be an item in the facility readiness.
- To have a transition plan of facility ownership as an item in the facility readiness factor.

People readiness

The validators were asked about any other items that they think should be part of the factor of people readiness that could be added to the framework, which may have an impact on the operational readiness. Their suggestions included:

- The addition of a strong communication platform to be part of the people readiness.
- To have the assurance of who will be trained to be the one operating the systems in the people readiness factor.
- To have workforce planning as an item in the factor.
- To have an assurance of the supplier/contractor's commitments after operations as an item in the people readiness factor

Technology readiness

The validators were asked about any other items that they think should be part of the factor of technology readiness that could be added to the framework, which may have an impact on the operational readiness. Their suggestions included:

- That O&M supplier for the airport project should be bonded into a responsibility matrix, and this matrix readiness should be an item in the technology readiness factor.
- A transition plan for the ownership of the system to be an item for the technology readiness factor.

To have an item as an action plan for systems failures to be included in the factor of readiness.

Organization readiness

The validators were asked about any other items that they think should be part of the factor of organisation readiness that could be added to the framework, which may have an impact on the operational readiness. Their suggestions included:

- To have an item for organisational politics impact resolution to be added to the organisation readiness factor.

6.5.3.2 Results from the answers of the validators to the closed questions (quantitative data)

In this sub-section, qualitative analysis of the validator’s responses collected from the framework-scoring questionnaire using ten closed questions adapted from Molwus (2014), will be presented. Likert scale was used to evaluate the questions, where 1 represents poor, and 5 represent excellent. **Table (46)** presents the statistical summary of the results.

Table (46) Responses on the scoring of the framework aspects.

Responses to the questions (n=14)	Poor	Fair	Satisfactory	Good	Excellent	Mean	Skewness	Kurtosis
	1	2	3	4	5			

Q1	How useful would you rate the overall Operational readiness framework for airport projects?	0	7%	7%	29%	57%	4.36	- 1.25	1.40
Q2	How easy would it be to follow the process of the framework (clarity of the framework)?	0	7%	14%	43%	36%	4.07	- 0.75	0.16
Q3	To what extent can following the framework help in carrying out operational readiness to open new airport?	0	7%	7%	57%	29%	4.07	- 0.95	1.9
Q4	How effectively can the framework facilitate the overall success of Airport projects?	0	7%	21%	21%	50%	4.21	- 0.97	- 0.02
Q5	How effectively does the framework focus on readiness management issues relevant to airport projects?	0	0%	21%	36%	43%	4.21	- 0.53	- 0.86
Q6	How well does the framework establish links between the factors of airport projects?	0	7%	7%	50%	36%	4.14	- 1.01	1.49
Q7	How would you rate the applicability of the framework in airport projects?	0	7%	7%	29%	57%	4.36	-1.4	1.70
Q8	How would you evaluate the comprehensiveness of the framework?	0	7%	14%	36%	43%	4.14	- 0.85	- 0.01
Q9	How would you rate the logical structure of the framework?	0	7%	7%	36%	50%	4.29	- 1.25	1.40
Q10	How useful would you consider the framework in decision making?	0	7%	14%	21%	57%	4.21	- 0.73	- 0.92

A quick analysis of the statistical results presented in **Table (46)** indicates the positive acceptance of all the validators that no one has scored 1 (Poor) from the ten questions provided. On the other hand, it was found that most of the responses ranged from 3-5, which is satisfactory to excellent.

The mean scores were calculated and found to be satisfactory for all ten questions, where the mean ranged from (4.07) to (4.37). This is considered acceptable and way above the 3.5 value in five points of the Likert scale. Distribution of the scores was also measured

by calculating skewness and kurtosis values (Pallant 2007) for the ten questions and found to be satisfactory and acceptable; skewness were towards the high value of the scale, while kurtosis grouped around the middle of the scale. Usefulness and applicability of the framework scored the highest among other aspects by validators.

6.5.3.3 Results from the open questions and general comments on the framework (Qualitative data)

In this sub-section, the analysis is presented with three themes that were collected from the open questions answered by the validators. These themes are ‘main benefits of the framework’, ‘recommended improvements on the framework’ and ‘barriers to the use of the framework’, which will be discussed in brief.

Main benefits of the framework

Participants were requested to answer the question regarding the main benefits and advantages, all of the answers from the validators stated that the framework was very comprehensive and high level, and they liked it because it gave a broad view of the readiness needed. Moreover, they all agreed that the framework was well structured and defined a very logical path to success that should be followed in all airports projects. They also stated the following:

- The framework cover 90% of the readiness needed for airports project except for HSE factors should be considered.
- The framework clearly shows that the scope of the operational readiness is more than traditional construction delivery.

- The framework will provide a better understanding of the operational requirements for operations by contractors and consultants.
- The framework should support the entire project delivery so the manager can have smoother handing over to operations.
- The main benefit of the framework is that all efforts of readiness are oriented towards the overall operational readiness status.
- The four factors of the framework cover all the readiness globally.
- The framework will help organise the transition process and identify rules and responsibilities.
- The framework covers most of the needed factors for operations.
- The framework shall reduce the risks and problems that might happen on the first day of operations.

Recommended improvements for the framework

The validators gave their views and suggestions towards improving the framework, which includes:

- All risks can be grouped under one factor called risk readiness (mitigation).
- There should be a separate HSE factor that has many items related to safety, security and environment related to airports operations.
- Sequencing of the readiness activities to be included to improve it with details.
- It should contain simple operational language in the items. Also, the framework should span over the project life cycle.

- Generalising the framework to cover all large infrastructure projects and not only airports in the UAE.
- Need for a more comprehensive framework that shows step-by-step instruction to create an operational readiness plan.

Obstacles to using the framework

The validators listed the obstacles that might be faced during the implementation of the operational readiness framework for airport projects, which included:

- It is a new way of integration for the airport users/manager, and it will have required some training on its benefits before use.
- Resistance from external factors.
- There might be some resistance from Government authorities, and it may also be rejected by the project contractors, as it may seem like changes and interference into their site works.
- Lack of awareness of the operational readiness scope and activities, traditional constructions roles and responsibilities of project managers.
- Awareness of some of the operational stakeholders on the benefits of the framework.
- Integrated awareness and simple implementation might prevent this adaptation from the users.
- Resistance from people on accepting such frameworks in their projects.

- Financials needs to implement it and under who is budget?

Probably, the main barriers identified by the validators are the resistance and financial burden factors that could be hindered by the implementers of this framework. Some of the above obstacles can be mitigated by training and cultural awareness's while others are difficult to mitigate due to its financial burdens.

6.6 Theoretical Implications

The findings of this study have major theoretical implications. Firstly, we apply and analyse the relatively new and less researched construct of operational readiness in a specific context. To derive potential antecedents of this construct, we integrated research and theories from three different realms: project management, operations management organisation readiness theory (Weiner 2009), and readiness to change model (Armenakis et al. 1993). The integration of these different backgrounds and theories appears to be challenging but also fruitful to grasp the various aspects of operational readiness. We show that operational readiness is composed of four main factors: facility readiness, people readiness, technology readiness and organisations readiness, and this has not been presented in prior studies. Secondly, as this study conducted empirical research on airport projects, it recognises the significant and critical theoretical relationship between operational readiness and project success. The study also implies that operational readiness is a multi-dimensional construct influenced by an array of factors (Holt, A. A. Armenakis, et al. 2007), which may affect together the project success construct of complex projects, such as airports. Thirdly, the second-order construct of operational readiness emerged in this study could be used to derive a meaningful gauge of readiness that the project owner can

use, also the development and empirically test a conceptual framework for airport's projects operational readiness.

6.7 Practical Implications

From a practical perspective, the results of this research demonstrate that operational readiness positively influences project success. Governments who are building large infrastructure projects, such as airports, although under the pressure of efficiency and financial constraints of budgets, should adopt and utilise operational readiness plans to ensure a higher level of project success, as operational readiness plans and implementations cost money. While operational readiness is often treated as a project “add-on”, it is an integral and critical success factor for project delivery (Krauss 2014). To ensure a successful execution, operational readiness must be integrated from the earliest stages of the project organisation. Operational readiness's comprehensive reach requires an organised interface, both with other project disciplines and different organisations, such as EPCs and equipment suppliers (Emerson Reliability Consulting 2014).

Other practical implications from this study relate to project manager training and development and should focus not only on technical and management skills but also on the operational side of the final products, as well as how to support operational readiness to coordinate with project management's organisations. In practice, the development of the conceptual model will provide decision makers in governments and project owners with a tool for determining the readiness level and give more attention to the factors and items as detailed in the model. In other words, the conceptual model can be transformed into readiness gauging sheets or coded into software that will calculate the overall readiness to operate the project and improved its project success.

Also, practical implications are in the identification of operational readiness specific factors for projects rather than for organisations and develop a conceptual framework that can be used to develop generic models for different industries projects, as they can use all the factors or select based on the project nature. It is to be noted here in practical terms, the main contribution of this research is highlighting the need and requirements of an operational readiness plan to support both project team and operations team to smoothly transfer and operate the projects from construction to operational environment with full functions working from the first day providing world class services. While this is largely ignored by existing PM bodies of knowledge (Zerjav et al. 2014), this study found high requirements about the importance of achieving operational delivery to encase project success in the context of airport projects.

6.8 Summary

This chapter presented the detailed discussion of the research analysis from the pilot study and the two phases and concluded the main findings of the research. The chapter started with a review of the overall research study and elements. Next, a full discussion of the main finding was presented that included response rate, the participant's demographic characteristics and the hypothesis testing and analysis.

It is found that operational readiness is a second order variable consisted of four factors (facility, people, technology and organisation). It was also found that organisation readiness was the highest out of the four factors followed by technology readiness, people readiness and finally facilities readiness. It was found also that operational readiness as a second order variable had a positive significant impact on the airport's project success in UAE. Meanwhile, operational readiness framework was validated empirically by the data

collected from the two phases and cross analysing it with the literature. Therefore, the framework was established theoretically and empirically and contained four major readiness factors consisting of second order variables of operational readiness.

Finally, the framework was validated with a professional expert from airport practitioners who provided other recommendation and improvements. This will lead us to the final conclusion of this research, limitations faced by the researchers, the contribution of the research to knowledge and finally, the recommendation for future research, which will be presented in the next chapter.

Chapter 7

Conclusion and Recommendation

7.1 Introduction

This chapter will conclude the research discussion and major findings. It starts with a review of the research aims and objectives, followed by a conclusion where discussion of the research's objectives results takes place. Next will be the limitation as highlighted by the researcher followed by a contribution of knowledge and finally recommendations for future research and improvements.

7.2 Review of the Research Aims, Objectives

The current research study started in Chapter 1 by examining the relevant literature to identify a frequent problem within the airport projects, and issues emerged during the start-up. Subsequently, the research aim and objectives were formulated. Recent cases of newly completed airports projects suggest that on the first day of operation (after completion and sign off of construction phase), airport services are unlikely to run smoothly. In numerous cases, airport services and operations have failed due to poor or inadequate 'readiness' and preparation for operations was identified as a possible solution. The researcher was able to identify a research gap on the availability of operational readiness plans and frameworks that can be used by airport project stakeholders. Operational readiness framework and its impact on project success that is specific for airport projects to operate the newly constructed airport in UAE are absent.

The research aims to: first, critically examine, discern and synthesise the notion of operational readiness within the context of operations and project management, and second,

support organisations ensure that on the first day of operation (after completion and sign off of construction phase), airport service run smoothly. In effect, the study seeks to ensure that airport services and operations do not fail due to poor or inadequate ‘readiness’. Therefore, there is a need for an operational readiness framework to support operational consultant in UAE to operate the newly constructed facility at the airport to facilitate the provision of world-class services. Having this operational readiness framework will allow the operations managers to analyse, evaluate and develop an awareness of their readiness in term of the implementation of airport services. Based on the study’s aims, the following research’s objectives were formulated:

Objective 1: To explore, define and review relevant literature related to the operational readiness with a focus on large infrastructure projects (Airports).

Objective 2: To identify and categorise factors from existing literature that constitute the major theory behind operations readiness.

Objective 3: To identify and characterise key elements of operational readiness in the context of large infrastructure projects (Airports)

Objective 4: To develop a conceptual framework that can improve project success in large infrastructure projects (Airports).

To gain a better understanding of the problem setting and context, the researcher conducted a comprehensive literature review presented in Chapter 2. It started with the infrastructure projects characteristics and challenges to understand the current and past challenges and difficulties. After that, a literature review was performed on operations and project management to understand the relationship and borders of each discipline. The major review of the literature was taken on the operational readiness and presented in

Chapter 3, where the concept, definition, contributing items and factors, as well as categorizations were explored and synthesised with a specific focus on airports projects to achieve objective 1, 2 and 3. Based on the literature review presented in Chapter 2 and Chapter 3, the initial conceptual framework was suggested.

Having a conceptual framework for operational readiness helped the researcher in developing the research methodology and the philosophical lenses in identifying airport operational readiness factors and their relationships to project success. Four operational readiness factors consisting of 66 items were identified and mapped to the framework. In Chapter 4, the researcher outlined the research methodology and process based on a review of the literature to guide the development of appropriate methods. This research utilised a mixed-method approach, where it uses two phases in the research process to first identify the relevant factors and items from the first phase, which is qualitative in nature; and the second phase is quantitative in nature as it engages survey questionnaires as a data collection tool. Four airports sites in UAE were used in this research study, namely Sharjah International Airport, Dubai International Airport, Al-Maktoum International Airport and Abu Dhabi International Airports. The four airports span the three major cities of UAE and manage 99% of the passenger and cargo operations in the UAE Aviation Industry.

In Chapter 5, analysis of the pilot survey, and phase 1 and phase 2 of the research results were presented. The survey was conducted online using an instrument developed by the Delphi session and collected from existing four surveys on readiness. Firstly, a pilot survey was performed with a group of 150 subjects to help refine data collection instrument. In conducting the survey study, the importance of different operational readiness criteria was assessed against project success to explore and investigate the relationship between

the two variables to support Objective 4. Subsequently, in Chapter 6, discussion of the results analysis is presented with a literature review of the relevant studies and previous research to cross check and to theoretically validate the findings. At the end of the chapter validation with the industry's experts and a final presentation of the operational readiness framework is presented.

7.3 Operational Readiness Factors and Framework Summary

The aim of this research was first to critically examine, discern and synthesise the notion of operational readiness within the context of operations and project management, and second to support organisations ensure that on the first day of operation (after completion and sign off of construction phase), airport service run smoothly. In effect, the study seeks to ensure that airport services and operations do not fail due to poor or inadequate 'readiness'. Therefore, operational readiness framework is developed to support operational and project managers of UAE's airport projects. Specifically, the research has achieved the following objectives:

Objective 1: *To explore, define and review relevant literature related to the operational readiness with a focus on large infrastructure projects (Airports).*

The findings for Objective 1, were discussed in Chapter 3, operational readiness has not been defined in any literature of project management nor operations management. A systematic review of literature for the operational readiness was undertaken. This review differs from normal reviews by utilising a scientific process, which aims to minimise bias through comprehensive literature searches. The term 'operational readiness' is so broad and varied that such a review may result in missing valuable contributions from books, project management bodies of knowledge, among others that are considered important

for this study. Then, an articulation of the concept of operational readiness was investigated with current project management literature, followed by an investigation of the existing definitions of the concept in academic and industrial literature. We agree that operational readiness may be “*Commissioning*” on steroids or a ‘buffed-up’ version of commissioning, and we use it herein to broaden the conceptualisation of the project management phase of handover/commissioning.

Objective 2: *To identify and categorise factors from existing literature that constitute the major theory behind operations readiness.*

The findings for Objective 2, were discussed in Chapter 3, the conclusion for this objective resulted in a list of operational readiness element based on existing operational readiness models and framework from different industries. We note here from our finding that each industry has its specific enabling factors for the operational readiness of its assets; we also note that some common factors are repeated in many industrial sectors/areas such as training and familiarisation, operational team recruitments, and operational procedures. The results from objective 2, has guided the research for the operational readiness elements in airport projects.

Objective 3: *To identify and characterise key elements of operational readiness in the context of large infrastructure projects (Airports)*

The findings for Objective 3, were discussed in Chapter 5, data analysis. The conclusion for this objective was a list of the 66 readiness items specifically for airport projects that emerged from a Delphi session.

Objective 4: *To develop a conceptual framework that can improve project success in large infrastructure projects (Airports).*

The findings for Objective 4, were discussed in Chapter 6, the Discussion. A statistical model fit has been used to confirm the suitability of the items and variable with the collected data to generate the Airport's conceptual, operational readiness framework. The results of this objective provide the major outcome of this research, which is a conceptual framework for airport projects that can be used by organisations here in the UAE to ensure successful opening and service delivery from day one of operations. The framework is the first of its kind for airport projects and can also be used as a minimum check to gauge operational readiness level for decision makers. A full list of the framework items for each factor can be found in Appendix F.

In conclusion, the results of the study contribute to deepening our understanding of the operational readiness factors that influence the success of airport projects.

Facility readiness factors

The group of facility readiness consisted of 7 readiness factors. Based on the survey results and analysis, the following readiness factors were the three highest as perceived by airport project's stakeholders **FR3** "*New facility's processes and forms shall be created and sign off by the airport operational stakeholders*"; **FR6** "*Availability of the facility operational and maintenance procedures and processes*"; and **FR1** "*Ensure operational trials and simulation for the new facility with important stakeholders*". This findings suggest that operational success of airport projects depends on the availability of new facility's processes development and agreements among the operating stakeholders before the facility construction is completed. It also emphasises on the availability of the facility's operational and maintenance documentations before the start up and the need for the operational team to have quick access to it. The finding also supports the need for

operational simulations and trials for newly constructed facility that will be operated in the airport.

People readiness factors

The group of people readiness consisted of 6 readiness factors. Based on the survey results and analysis, the following readiness factors were the three highest as perceived by airport project's stakeholders: **PR4** "*Arrange and ensure staff training on new building systems*"; **PR5** "*New systems understanding and familiarisation shall be provided to the maintenance and operations team*"; and **PR3** "*Ensure and maintain staff's safety and security during the initial move and operations*". This findings suggest that operational success of airport projects depends on the training and educational session that is provided to the maintenance and operational teams of new before the facility construction is completed. It also emphasises on the availability of the new systems operational training and onsite understanding before the start up. The finding also supports the need to ensure the safety of the operational stakeholders of the new airport during the start up of its operations due to the high risk involve in the airports operations.

Technology readiness factors

The group of technology readiness consisted of 15 readiness factors. Based on the survey results and analysis, the following readiness factors were the three highest as perceived by airport project's stakeholders: **TR14** "*Availability of all the new airport's systems operating dependencies and move sequences*"; **TR5** "*Ensure Full testing and commissioning and integration of the critical systems of the new facility in the airport project*"; and **TR9** "*Ensure adequate training and familiarisation is provided for all the new systems maintenance and operational staff*". This findings suggest that operational success for

airport projects depends on the system's operating dependencies such as maintenance contracts, spares and complete maintenance and operating staff to ensure the operability of these system during the start up of the new airport facility. It also emphasise on the assurance of all the systems testing, commissioning and integrating them to ensure functional system during operational start up. The finding also supports the need to ensure appropriate training and familiarisation for the new system in the new airport project to provide operational continuity for these system and reduce errors and downtime.

Organization readiness factors

The group of organization readiness consisted of 23 readiness factors. Based on the survey results and analysis, the following readiness factors were the three highest as perceived by airport project's stakeholders: **OR13** *"Ensure that regulatory and compliance requirements for all the processes and procedures are met"*; **OR9** *"Confirmation of all roles and responsibilities (operator, maintainer and user) are fully documented and communicated to all the airport stake-holders"*; and **OR2** *"Documentation of the escalation process and communicating it to all relevant stakeholders of the new facility"*. This findings suggest that operational success for airport projects depends on the assurance of having all the required regulatory and legal authorisation and compliance to operate the new airport, this includes all the vertical and horizontal transportation means such as aircraft movements, elevators and train systems. It also emphasise on having a clear roles and accountabilities documented and agreed upon all the airport operational stakeholders to ensure smoother transition and work flow of different operational processes within the airport during the initial start up. The finding also supports the need to provide means of escalation processes during the initial operational phase that might also include the need for a joint control room for all the stakeholders.

7.4 Research Limitations

During this research study, the following limitations were encountered:

- Sparse and limited literature information on operational readiness, as limited resources, was found on readiness in other industries and no operational readiness on airport studies was found. In return, this research has made a contribution to the small body of knowledge already available and current literature context.
- Limited and non-relevance survey instrument tool for operational readiness, which has made the author of this study design a new tool using Delphi method.
- The number of selected airports was restricted to only four. However, this was unavoidable as UAE has only four major airports. There were other smaller airports but no significant passengers traffic nor large projects that this study can use data from.
- The limitation of the academic and airport operational expert for the Delphi panel might restrict the selection and the design for the questionnaire survey questions.
- Bias answers, which could be generated by subjects who may know the author of the study since they author worked in many airport projects in Dubai.
- The researcher was also limited by time and resources; limited sample of cases was surveyed rather than all of the cases.

Limitations should not affect the results of the study or invalidate it, as the selection of participants has been based on their involvement and role in the project. Selection of the

Delphi session participants may not cover all types of the project operations, as multiple senior staff members run some of the organisation's operations.

As the study, will use samples from participants of four large international airports in three main cities of the UAE, these samples will be used to generalise to the whole country. This research will be limited to large infrastructure projects, and its findings may not be applicable for different projects. An important limitation of any relationship between variable studies (including the current study) is that one can only determine correlations and not causes of the relationship; this is valid here as an operational readiness plan may not cause project success, but the study may conclude a relationship between the two.

7.5 Key Research Contributions

The originality of this research lies in the exploration of the operational readiness concept and criteria for the airport projects and the development of an operational readiness framework, specific for airport projects. The need for an operational readiness for airport projects was found to be a knowledge gap in project and operations management. The framework is required by the airport's stakeholders to operate newly constructed airport facilities.

This research also extends the ranges of existing theories such as change management, organisations readiness by providing four readiness factors consisted of 66 items for the operational readiness within the context of airport projects to ensure that airport operates efficiently and deliver world-class services to its customers. To confirm the proposed conceptual framework, a mixed-method approach of qualitative and quantitative methods, used Delphi sessions and questionnaire survey respectively, for data collection, and validated the framework with airports stakeholders using focus group workshop.

Additionally, this research study provides further contribution by:

1. Adding to the field of project management in general and to airport projects and operations management, in specific, the issues surrounding the lack of operational readiness and its impact on the project and stakeholder's contribution. The same will also assist airport operational organisations and government officials, in recognising the operational readiness state of the project and decide on when to operate the newly constructed facility.
2. Hypothesis testing of the different categories of the readiness for the airport, which has shown the impact on project success for UAE's airports that was measured using four airports and more than 600 participants.
3. The outcomes of this research could also be used for modifying the current project success factors for airports and update current plans and processes in the project manager booklets by organisations such as IPMA, PMI and CIOB, to include the operational readiness as a stage within the product lifecycle of the projects.

7.6 Recommendations for Future Research

This research has suggested an operational readiness framework for airport project operation's stakeholders in the UAE. However, the framework cannot be generalised to all airports around the world as it is within UAE context. Therefore, it is recommended to carry out the same research on different regions of the world. From the framework validation focus group, practitioners suggested additional readiness factors be included for the operational readiness such as risk factor, which can be researched in the future and tested empirically. It is also recommended to have a wider qualitative study to capture

more readiness items and factors from a bigger group of airport stakeholders. Since the framework of operational readiness was developed purposely for the airport stakeholders to use it in the airport projects, it is recommended to study further and investigate the impact of such framework on other industries and products such as oil and gas, mega events and probably Dubai Expo 2020. Finally, we note here that in this research, the timing of the operational readiness activity was not discussed, nor was it investigated in the project timeline. Hence, it is greatly recommended to see when shall the planning and execution of operational readiness start and end and how it might have an effect on the project overall timing.

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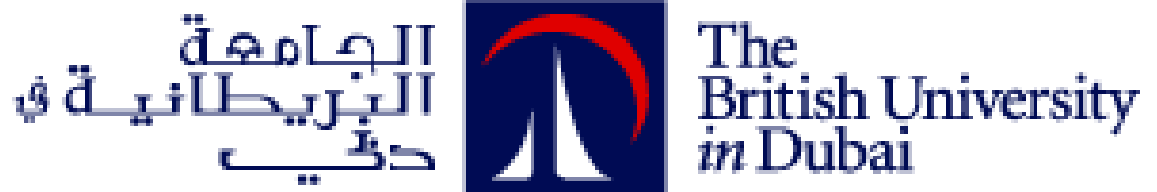
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Appendices

Appendix A: Delphi Session Questions



An Exploration of the Impact of Operational Readiness Factors on the Success of Large Infrastructure Projects in the UAE

دراسة استكشافية لتأثير عوامل الجاهزية التشغيلية على نجاح مشاريع البنية التحتية الكبيرة في
دولة الإمارات العربية المتحدة

Introduction: A Delphi survey on Operational Readiness Factors in Airports Project.

This survey uses a Delphi technique to identify the operational readiness critical factors and related items, which needs to be achieved in every airport construction in order to maximise the success rate (particularly in UAE). The identification of these factors and their related items will be useful to support the quantitative survey for the undertaken PhD study on the “Study of the Impact of Operational Readiness factors on Large Infrastructure Projects (Airports) in the UAE

The Delphi technique is primarily concerned with using selected expert panels which have been chosen from academics and industry practitioners to assist in gathering data and information to achieve research objectives, by designing a consecutive series of questions to which a selected panel of expert responds.

The objective an outcome of the session is to reach a consensus amongst the experts, which will lead to ratification of the current operational readiness critical factors and related items for airport projects. The main factors and its related items crucial to operational readiness success were identified from a literature review and mainly from existing

operational readiness surveys for other industries (Racine and Mitchell 1990; Lyons and Powell 2010; NHS Ayrshire & Arran 2012; Wilson et al. 2004), which have been modified and used in this questionnaire survey, please feel free to provide answers. There will be Four section with multiple items, each on a separate page.

Research Problem

Recent cases of newly completed airport projects suggest that on the first day of operation (after completion and sign off of construction phase), airport services are unlikely to run smoothly. In numerous cases, airport services and operations have failed due to the poor or inadequate 'readiness'.

Research Questions

The Current Study has the following Research Questions:

QR1: Within the context of operational readiness, what is operational readiness?

QR2: How do practitioners perceive operational readiness and it's contributing factors?

QR3: What is the relationship between operational readiness and project success?

Thank you for your willingness to participate in this Delphi study. You are one of 7 individuals with experience in construction and operations of airport projects in UAE or Academics subject matter expert in project and operations management.

Responses from the first questionnaire will be collated to form the basis for the discussion of the second phase, and the third and final phase will be used to collect the perceived answers based on the second phase discussion. Your commitment to this participation

adds greatly to the identification of best practices for the delivery and operations of air-ports projects in UAE. Should you have any questions, please contact me.

Sincerely,

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ROUND # 1

Section 1: Facility Readiness Factor

You are kindly requested to provide us with your opinion on the items required to ensure the operational readiness of newly completed airport facility from the facility perspective.

Kindly tick whether you agree or disagree with each statement, you may also add other statements at the end of the list.

No.	Operational Readiness item	Required/ Agree	Not Required/ Disagree
1. Facility Readiness			
1.1	Ensure that regulatory and compliance requirements for all the new facilities are met		
1.2	Coordinate and support building commissioning activities and integrate it with Operational Trials		
1.3	Ensure the preparedness and schedules of all the Inspection and regulatory licensing for the facility and associated systems.		
1.4	Ensure that all the new small fit out and furniture installation and acceptance are completed.		
1.5	Ensure Pre-occupancy stocking of all maintenance and operational supplies for all stakeholders.		
1.6	Ensure Adequate Building cleaning and security during operational readiness activities and Trials.		
1.7	Ensure the Availability of the Contractor building turnover schedules		
1.8	Availability of the facility operational and maintenance procedures and processes.		
1.9	Availability of all the new airport facilities operating dependencies and move sequences.		
1.10	Availability of supporting department from contractors and consultant for the new facilities during the initial phase of operations.		
1.11	Operational trials and simulation for the new facility with important stakeholders.		

1.12	Facilitate accurate budgeting for start-up activities and ongoing operations of the new airport facilities.		
1.13	Manage the impact caused by the new facilities might have on existing facilities operations.		
1.14	New facility's processes and forms shall be created and sign off by the airport operational stakeholders.		

Section 2: People / Human Capital Readiness Factor

You are kindly requested to provide us with your opinion on the items required to ensure the operational readiness of newly completed airport facility from the people/ Human capital perspective. Kindly tick whether you agree or disagree with each statement, you may also add other statements at the end of the list.

No.	Operational Readiness Element	Required/ Agree	Not Required/ Disagree
2. People / Human Capital Readiness			
2.1	Airport's Operational services Training are essential for the operational readiness.		
2.2	Activation and operational readiness team shall be established early in the airport projects		
2.3	Local media shall be involved in the operational readiness program.		
2.4	Airport's Airlines shall be included in the operational readiness program.		
2.5	Airport's public users shall be included in the operational readiness program.		
2.6	Arrange Orientation and familiarisation of staff to new facilities, including new operational plans and practices		

2.7	Airport's government agencies such as police, immigration, customs shall be involved in the operational readiness program.		
2.8	Arrange and ensure staff training on new building systems		
2.9	New airport's system training material should be accessible to the maintenance and operation team.		
2.10	New systems understanding and familiarisation shall be provided to the maintenance and operations team.		
2.11	Availability of all the new airport staff operating dependencies and move sequences.		
2.12	Ensure and maintain staff's safety and security during the initial move and operations.		
2.13	Organise and support stakeholders transfer of existing operational staff and suppliers.		
2.14	Equip operational teams with the necessary knowledge and tools to effectively complete their work.		
2.15	Track accurate budgeting for start-up activities and ongoing operations of the new staff hired and temporary human capital support.		
2.16	Ensure that regulatory and compliance requirements from airport security for all the new hired staff are met.		

Section 3: System / Technology Readiness Factor

You are kindly requested to provide us with your opinion on the items required to ensure the operational readiness of newly completed airport facility from the systems/technology perspective.

Kindly tick whether you agree or disagree with each statement, you may also add other statements at the end of the list.

No.	Operational Readiness Element	Required/	Not Required
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		Agree	Disagree
3. System / Technology Readiness			
3.1	All the system manuals and documentation to be made available during operational readiness and before actual operations.		
3.2	The Maintenance and operational plans for the critical systems to be available.		
3.3	Tracking Adequate recruitment of operations and maintenance staff for all the new systems.		
3.4	Ensure appropriate training and familiarisation is provided for all the new systems maintenance and operational staff.		
3.5	Ensure Full testing and commissioning and integration of the critical systems of the new facility in the airport project.		
3.6	Ensure the completion of the Implementation of the IT/ telecom program.		
3.7	Ensure adequate skills and competencies for all the system's maintenance and operations staff of the new facility.		
3.8	Ensure and test all the systems integration of the new facility to the existing systems.		
3.9	Support and Ensure the relocation of stakeholders existing equipment as planned, with minimal operating disruptions		
3.10	Ensure Pre-occupancy stocking of all Maintenance and operational supplies (Spares) for the critical systems of all stakeholders.		
3.12	Ensure the Validation and communication of the new phone numbers; new computer addresses to all relevant stakeholders and airport users.		
3.14	Ensure Ordering and installing IT/telecom equipment for all the operational stakeholders of the airport.		
3.15	Ensure that regulatory and compliance requirements for all the new and critical systems are met		
3.16	Ensure financial and budget coverage for all the new system operations and maintenance.		
3.17	Availability of all the systems operational and maintenance procedures and processes.		



3.18	Availability of all the new airport's systems operating dependencies and move sequences.		
3.19	A plan for speciality equipment and systems disconnect/ re-connect requirements		
3.20	Availability of supporting department from suppliers and vendors for the systems during the initial phase of operations.		
3.21	Organise and help stakeholders move of existing operational equipment and systems.		
3.22	Operational trials and simulation for the new systems with respective stakeholders.		
3.23	Facilitate accurate budgeting for start-up activities and ongoing operations of the systems.		
3.24	Manage the impact caused by the new systems might have on existing systems operations.		
3.25	Manage the safety and operational risks associated with the activation of the new systems.		

Section 4: Organisation processes / Culture Readiness Factor

You are kindly requested to provide us with your opinion on the items required to ensure the operational readiness of newly completed airport facility from the organisational processes/ culture perspective.

Kindly tick whether you agree or disagree with each statement, you may also add other statements at the end of the list.

No.	Operational Readiness Element	Required/ Agree	Not Required/ Disagree
4. Organisation Process/ Culture readiness			
4.1	Ensure that plans for the operation are developed by the vision and operating stakeholder's priorities.		

4.2	Documentation of the escalation process and communicating it to all relevant stakeholders of the new facility.		
4.3	Confirmation of an escalation process to higher management during operational readiness.		
4.4	Ensure all roles and responsibilities (operator, maintainer and user) documentation are signed off by relevant airport's stakeholders.		
4.5	Confirmation of all roles and responsibilities (operator, maintainer and user) are fully documented and communicated to all the airport stakeholders.		
4.6	All the new standard operating procedure (SOP) and irregular operating procedure (IOP) shall be documented and communicated to all operational stakeholders.		
4.7	All the new airport operational process should be documented and communicated to all operational stakeholders.		
4.8	New facility objectives and performance outcomes shall be documented and signed off by the operations team.		
4.9	Airport's project should have phased (soft) opening as part of its operational readiness plan.		
4.10	Airport's project should have fixed date for an opening as part of operational readiness plan.		
4.11	Activation and operational readiness plan shall be established early in airport's projects.		
4.12	Operational readiness program should be led by the operations team of the airport.		
4.13	Operational readiness program should be led by Project team of the airport.		
4.14	A Checklist/Reporting mechanism is necessary to be used for the operational readiness program.		
4.15	Progress update on operational readiness plan shall be managed and communicated to all airport stakeholders.		
4.16	Operational readiness plan should be part of the project overall planning schedule		<input type="checkbox"/> <input type="checkbox"/>
4.17	A clear protocol for, issue identification/resolution during the operational readiness program is required		

4.18	A clear protocol for communication during the operational readiness program is required.		
4.19	A formal Charter or mission statement for the operational readiness program/Team is required		
4.20	A formally dedicated activation and operational readiness team are required.		
4.22	Minimising of the time from construction completion to the start-up of operations.		
4.23	Ensure that regulatory and compliance requirements for all the processes and procedures are met		
4.24	Manage the impact caused by the new activation might have on existing operations.		
4.25	Use multidisciplinary teams to drive the activation planning process and Ensure that cross-functional processes, as well as enabling elements (e.g., information technology, human resources), are clearly integrated within process and activation plans.		
4.26	Equip airport activation teams with the necessary knowledge and tools to effectively complete their work. This may include training in meeting facilitation as well as specific orientation to project objectives, macro schedules, and guiding principles.		
4.27	Provide consistent, real-time communication of project schedules and plans to all relevant Airport stakeholders including constituencies, including planning teams, medical staff, employees, and the community		
4.28	Develop a database of airport activation issues, questions, and answers that are accessible to all relevant stakeholders.		
4.29	Assign stakeholders to project single point of contact (SPOC) to coordinate, facilitate, and drive all aspects of activation planning and implementation, and ensure that this individual has adequate time allocated to fulfil this role.		

4.30	Timely manner decisions making shall be taken by the activation team and communicate the decisions across the planning organisation.		
4.31	Establishing Joint control room with all the stakeholders for the move sequence and new operations		
4.32	Ensure and maintain passenger safety and security during the initial move and operations.		
4.33	Define and communicate the supporting department responsibilities during the initial phase of operations that includes the contractor and consultant as part of the stakeholders.		
4.34	Maintain lines of communication with all the stakeholders during initial start-up and operations.		
4.35	Prepare and communicate the grand opening activities		
4.36	Adequate arrangement for the public and speciality tours and events to the new airport facilities.		
4.37	Arrangement and agreement on the public communications, including service-scheduling impact.		
4.38	Availability of new business and administration operational procedures and processes for all stakeholders.		
4.39	Prepare and communicate all the new policies and procedure to stakeholders of the new facility.		
4.40	A formal activation and operational readiness program required.		

ROUND # 2

In this Round, Discussion of the results generated from Round 1 and agreeing with the final results to be used for Round 3 in scoring the important items for each factor.

ROUND # 3

You are kindly requested to provide us with your opinion on the rating of importance of each item from the four major factors of operational readiness for newly completed airport facility from the people/ Human capital perspective.

1.0 Facility Readiness						
1	Ensure that regulatory and compliance requirements for all the new facilities are met	1	2	3	4	5
2	Ensure that all the new small fit out and furniture installation and acceptance are completed.	1	2	3	4	5
3	Ensure Pre-occupancy stocking of all Maintenance and operational supplies for all stakeholders.	1	2	3	4	5
4	Ensure Adequate Building cleaning and security during operational readiness activities and Trials.	1	2	3	4	5
5	Availability of the facility operational and maintenance procedures and processes.	1	2	3	4	5
6	Availability of all the new airport facilities operating dependencies and move sequences.	1	2	3	4	5
7	Availability of supporting department from contractors and consultant for the new facilities during the initial phase of operations.	1	2	3	4	5
8	Operational trials and simulation for the new facility with respected stakeholders.	1	2	3	4	5
9	New facility's processes and forms shall be created and sign off by the airport operational stakeholders.	1	2	3	4	5
2.0 People / Human Capital Readiness						

1	Activation and operational readiness team shall be established early in the airport projects	1	2	3	4	5
2	Airport's Airlines shall be involved in the operational readiness program.	1	2	3	4	5
3	Arrange Orientation of staff to new facilities, including new operational plans and practices	1	2	3	4	5
4	Airport's government agencies such as police, immigration, customs shall be involved in the operational readiness program.	1	2	3	4	5
5	Arrange and ensure staff training on new building systems	1	2	3	4	5
6	New airport's system training material should be accessible to the maintenance and operation team.	1	2	3	4	5
7	New systems understanding and familiarisation shall be provided to the maintenance and operations team.	1	2	3	4	5
8	Availability of all the new airport staff operating dependencies and move sequences.	1	2	3	4	5
9	Ensure and maintain staff's safety and security during the initial move and operations.	1	2	3	4	5
10	Organise and support stakeholders move of existing operational staff and suppliers.	1	2	3	4	5
3.0 System / Technology Readiness						
1	All the system manuals and documentation to be made available during operational readiness and before actual operations.	1	2	3	4	5
2	Ensure adequate training and familiarisation is provided for all the new systems maintenance and operational staff.	1	2	3	4	5
3	Ensure Full testing and commissioning and integration of the critical systems of the new facility in the airport project.	1	2	3	4	5
4	Ensure adequate skills and competencies for all the system's maintenance and operations staff of the new facility.	1	2	3	4	5
5	Ensure and test all the systems integration of the new facility to the existing systems.	1	2	3	4	5
6	Support and Ensure the relocation of stakeholders existing equipment as planned, with minimal operating disruptions	1	2	3	4	5
7	Ensure Pre-occupancy stocking of all Maintenance and operational supplies (Spares) for the critical systems of all stakeholders.	1	2	3	4	5
8	Ensure system integration of the new facility to existing systems in the airport.	1	2	3	4	5
9	Ensure the Validation and communication of the new phone numbers; new computer addresses to all relevant stakeholders and airport users.	1	2	3	4	5
10	Availability of all the new airport's systems operating dependencies and move sequences.	1	2	3	4	5
11	A plan for specialty equipment and systems disconnect/ reconnect requirements	1	2	3	4	5
12	Availability of supporting department from suppliers and vendors for the systems during the initial phase of operations.	1	2	3	4	5

13	Operational trials and simulation for the new systems with respected stakeholders.	1	2	3	4	5
14	Manage the impact caused by the new systems might have on existing systems operations.	1	2	3	4	5
15	Manage the safety and operational risks associated with the activation of the new systems.	1	2	3	4	5
4.0 Organization Process/ Culture readiness						
1	Documentation of the escalation process and communicating it to all relevant stakeholders of the new facility.	1	2	3	4	5
2	Confirmation of an escalation process to higher management during operational readiness.	1	2	3	4	5
3	Ensure all roles and responsibilities (operator, maintainer and user) documentation are signed off by relevant airport's stakeholders.	1	2	3	4	5
4	Confirmation of all roles and responsibilities (operator, maintainer and user) are fully documented and communicated to all the airport stakeholders.	1	2	3	4	5
5	All the new standard operating procedure (SOP) and irregular operating procedure (IOP) shall be documented and communicated to all operational stakeholders.	1	2	3	4	5
6	All the new airport operational process should be documented and communicated to all operational stakeholders.	1	2	3	4	5
7	New facility objectives and performance outcomes shall be documented and signed off by the operations team.	1	2	3	4	5
8	Airport's project should have phased (soft) opening as part of its operational readiness plan.	1	2	3	4	5
9	Activation and operational readiness plan shall be established early in airport's projects.	1	2	3	4	5
10	A Checklist/Reporting mechanism is important to be used for the operational readiness program.	1	2	3	4	5
11	Progress update on operational readiness plan shall be managed and communicated to all airport stakeholders.	1	2	3	4	5
12	Operational readiness plan should be part of the project overall planning schedule	1	2	3	4	5
13	A clear protocol for, issue identification/resolution during the operational readiness program is required	1	2	3	4	5
14	A clear protocol for communication during the operational readiness program is required.	1	2	3	4	5
15	A formally dedicated activation and operational readiness team are required.	1	2	3	4	5
16	Ensure that regulatory and compliance requirements for all the processes and procedures are met	1	2	3	4	5
17	Use multidisciplinary teams to drive the activation planning process and Ensure that cross-functional processes, as well as enabling elements (e.g., information technology, human resources), are clearly integrated within the process and activation plans.	1	2	3	4	5

18	Equip airport activation teams with the necessary knowledge and tools to effectively complete their work. This may include training in meeting facilitation as well as specific orientation to project objectives, macro schedules, and guiding principles.	1	2	3	4	5
19	Provide consistent, real-time communication of project schedules and plans to all relevant Airport stakeholders including constituencies, including planning teams, medical staff, employees, and the community	1	2	3	4	5
20	Develop a database of airport activation issues, questions, and answers that are accessible to all relevant stakeholders.	1	2	3	4	5
21	Assign stakeholders to project single point of contact (SPOC) to coordinate, facilitate, and drive all aspects of activation planning and implementation, and ensure that this individual has adequate time allocated to fulfil this role.	1	2	3	4	5
22	Timely manner decisions making shall be taken by the activation team and communicate the decisions across the planning organisation.	1	2	3	4	5
23	Establishing Joint control room with all the stakeholders for the move sequence and new operations	1	2	3	4	5
24	Ensure and maintain passenger safety and security during the initial move and operations.	1	2	3	4	5
25	Define and communicate the supporting department responsibilities during the initial phase of operations that includes the contractor and consultant as part of the stakeholders.	1	2	3	4	5
26	Maintain lines of communication with all the stakeholders during initial start-up and operations.	1	2	3	4	5
27	Prepare and communicate the grand opening activities	1	2	3	4	5
28	Adequate arrangement for the public and speciality tours and events to the new airport facilities.	1	2	3	4	5
29	Arrangement and agreement on the public communications, including service-scheduling impact.	1	2	3	4	5
30	Availability of new business and administration operational procedures and processes for all stakeholders.	1	2	3	4	5
31	Prepare and communicate all the new policies and procedure to stakeholders of the new facility.	1	2	3	4	5
32	A formal activation and operational readiness program.	1	2	3	4	5

Appendix B: Operational Readiness Questionnaire

Operational Readiness Impact on Airport's Project Success
1. introduction

Dear Sir/Madam,

This questionnaire gives you the opportunity to express your views on operational readiness plans in the large infrastructure project (airport) that you have worked on and the impact these operational factors have on project success. Please note that there is no right or wrong answer.

The questionnaire will be used to collect the primary data needed for a research study to identify the operational readiness critical factors and related items, which needs to be achieved in every airport construction to maximise the success rate (particularly in UAE). The identification of these factors and their related items will be useful to support the quantitative survey for the undertaken PhD study on the “Study of the Impact of Operational Readiness factors on Large Infrastructure Projects (Airports) in the UAE. Therefore, we seek your assistance to be as open. Fair and honest as possible as you can in your responses.

The researcher assures you that no individuals will be identified from their responses and there are no requests for confidential information included in the questionnaire. The results of the analysis will be used by the researchers strictly for study purposes only.

The questionnaire comprises Three

parts: General information

Operational readiness

factors Project success

Operational Readiness Impact on Airport's Project Success

2. Part One: General Information

This section record the general and job-related information.

* 1. What is your gender?

- Female
 Male

* 2. Kindly select which airport you are working in:

- Abu Dhabi International
Airport Dubai International
Airport
 Al-Maktoum International
Airport Sharjah International
Airport

* 3. What is your job role?

- Office/Clerical
 Field Services
 Mid-Level Manag-
ers Senior Level
Manager Other
(please specify)

* 4. How many years of experience do you have?

- 1
 2-7
 8-13
 14-19
 20 or more

* 5. what is the type of organisation you are working in?

- Airlines
- Airport Operators/Maintainers
- Government Entity (Police, Customs, Immigration.)
- Airport Ground handlers
- Project Management Organization
- Contractors
- Consultants
- Other (please specify)

* 6. How many Airport projects you have worked in?

- 1
- 2
- 3
- 4
- 5
- More than 5

This part is about operational preparations and readiness before starting up any newly completed project. For each statement, please tick one box that best describes your opinion.

* 7. Kindly Rate the items on the Facility Readiness Factor

Strongly Disagree Disagree Undecided Agree Strongly Agree

Ensure operational trials and simulation for the new facility with important stakeholders.

Ensure Pre-occupancy stocking of all Maintenance and operational supplies for all stakeholders.

New facility's processes and forms shall be created and sign off by the airport operational stakeholders.

Availability of supporting department from contractors and consultant for the new facilities during the initial phase of operations.

Ensure that all the new small fit out and furniture installation and acceptance are completed.

Availability of the facility operational and maintenance procedures and processes.

Availability of all the new airport facilities operating dependencies and move sequences.

This part is about operational preparations and readiness before starting up any newly completed project. For each statement, please tick one box that best describes your opinion.

* 8. Kindly Rate People / Human Capital Readiness Items

Strongly Disagree Disagree Undecided Agree Strongly Agree

Airport's government agencies such as police, immigration, customs shall be involved in the operational readiness program.

Activation and operational readiness team shall be established early in the airport projects.

Ensure and maintain staff's safety and security during the initial move and operations.

Arrange and ensure staff training on new building systems.

New systems understanding and familiarisation shall be provided to the maintenance and operations team.

Availability of all the new airport staff operating dependencies and move sequences.

New airport's system training material should be accessible to the maintenance and operation team.

Airport's Airlines shall be involved in the operational readiness program.

	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

This part is about operational preparations and readiness before starting up any newly completed project. For each statement, please tick one box that best describes your opinion.

* 9. Kindly rate the items of Information / Technology Readiness

Strongly Disagree Disagree Undecided Agree Strongly Agree

Manage the safety and operational risks associated with the activation of the new systems.

All the system manuals and documentation to be made available during operational readiness and before actual operations.

Manage the impact caused by the new systems might have on existing systems operations.

Availability of supporting department from suppliers and vendors for the systems during the initial phase of operations.

Ensure Full testing and commissioning and integration of the critical systems of the new facility in the airport project.

Ensure the Validation and communication of the new phone numbers; new computer addresses to all relevant stakeholders and airport users.

Ensure system integration of the new facility to existing systems in the airport.

A plan for speciality equipment and systems disconnect/ reconnect requirements

Ensure adequate training and familiarisation is provided for all the new systems maintenance and operational staff.

Operational trials and simulation for the new systems with important stakeholders.

Ensure Pre-occupancy stocking of all Maintenance and operational supplies (Spares) for the critical systems of all stakeholders.

Support and Ensure the relocation of stakeholders existing equipment as planned, with minimal operating disruptions

Ensure and test all the systems integration of the new facility to the existing systems.

Availability of all the new airport's systems operating dependencies and move sequences.

Ensure adequate skills and competencies for all the system's maintenance and operations staff of the new facility.

This part is about operational preparations and readiness before starting up any newly completed project. For each statement, please tick one box that best describes your opinion.

* 10. Kindly rate the items of Organization process/ culture readiness

Strongly Disagree Disagree Undecided Agree Strongly Agree

Operational readiness plan should be part of the project overall planning schedule.

Documentation of the escalation process and communicating it to all relevant stakeholders of the new facility.

Establishing Joint control room with all the stakeholders for the move sequence and new operations

Ensure and maintain passenger safety and security during the initial move and operations.

A Checklist/Reporting mechanism is necessary to be used for the operational readiness program.

Activation and operational readiness plan shall be established early in airport's projects.

Ensure all roles and responsibilities (operator, maintainer and user) documentation are signed off by relevant airport's stakeholders.

Timely manner decisions making shall be taken by the activation team and communicate the decisions across the planning organisation.

Confirmation of all roles and responsibilities (operator, maintainer and user) are fully documented and communicated to all the airport stakeholders.

A clear protocol for communication during the operational readiness program is required.

Maintain lines of communication with all the stakeholders during initial start-up and operations.

A formally dedicated activation and operational readiness team are required.

Ensure that regulatory and compliance requirements for all the processes and procedures are met.

Confirmation of an escalation process to higher management during operational readiness.

New facility objectives and performance outcomes shall be documented and signed off by the operations team.

Progress update on operational readiness plan shall be managed and communicated to all airport stakeholders.

Airport's project should have phased (soft) opening as part of its operational readiness plan.

Strongly Disagree Disagree Undecided Agree Strongly Agree

Define and communicate the supporting department responsibilities during the initial phase of operations that includes the contractor and consultant as part of the stakeholders.

Prepare and communicate the grand opening activities.

Adequate arrangement for the public and speciality tours and events to the new airport facilities.

Arrangement and agreement on the public communications, including service-scheduling impact.

Availability of new business and administration operational procedures and processes for all stakeholders.

Prepare and communicate all the new policies and procedure to stakeholders of the new facility.

A formal activation and operational readiness program.

	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. Part Three: Project Success Factors

This section is to evaluate the criteria for your project success; Kindly tick one box that best describes your opinion

* 11. Kindly rate the Factor of the project success

Strongly

Strongly

Disagree Disagree Undecided

Agree

Agree

We are usually good at delivering projects within budget.

Generally, our projects meet their time objectives.

Project specifications are usually met by the time of handover.

We usually employ an efficient and safe project management process.

Our projects usually result in tangible benefits for the organisation. (Technical Performance)

Generally, customers of our projects are satisfied with the outcome.

Our project stakeholders are usually happy with the way our projects are managed.

Project team members are usually happy working on projects.

There are often clearly identified intangible benefits from the projects we carry out

Generally, the project will result in substantial revenues and profit for the project owners.

The project will increase the market share of the project owners.

Generally, the project will enhance the reputation of the project's stakeholders.

Generally, the project will enhance the competitive advantages of the project's stakeholders.

Overall, we are very successful at projects

Appendix C: Focus Group Validation Document

Operational Readiness framework

Validation Focus Group

Validator # _____

Validator Details

Job Title (Project Manager, ORAT Manager, etc.)	
Organization Type (Airlines, Airport operator, Project Management, etc.)	
Trade (MEP, Operations, ...etc.)	
Experience (Years)	
Airport projects completed	

Abstract

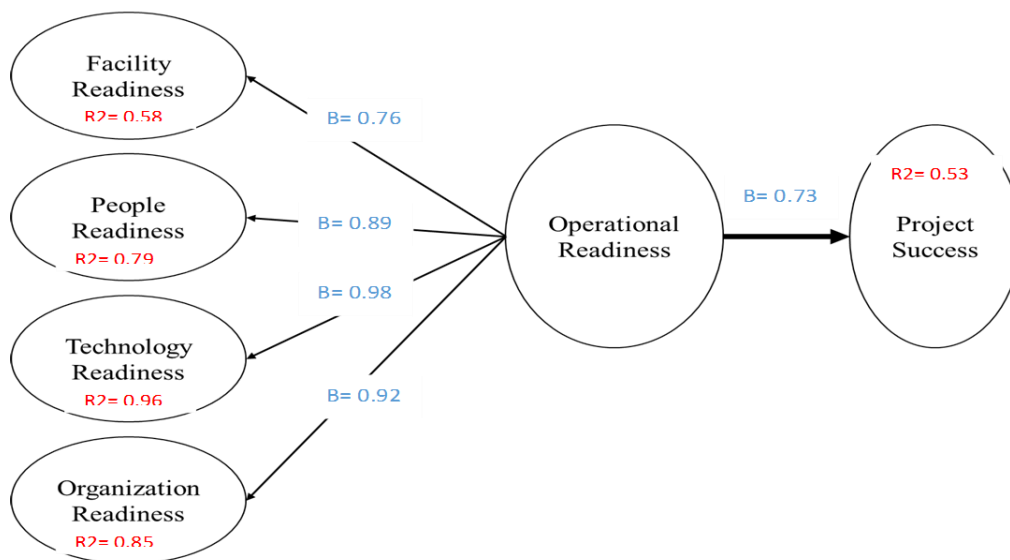
The study explores the factors that impact upon the operational readiness success of complex multi-stakeholder airport projects. The study is undertaken to conform to mixed-methods (triangulation) research approaches, comprising firstly a focus group categorisation assessment of operational readiness factors drawn from literature that was conducted (enabling the design of a survey instrument). Emergent from this process were four readiness factors, 13 project success items and 68 operations readiness items. The second step of the methodology was to undertake a survey of 900 operations readiness practitioners and project managers working across four international airports based in the United Arab Emirates (Dubai International Airport, Al-Maktoum International Airport-Dubai, Abu Dhabi International Airport and Sharjah International Airport). Multiple exploratory interviews were then undertaken with some key stakeholders involved in operations readiness across these airports. To support the study, I employed a Delphi method for categorisation assessment of operational readiness while we employed SPSS/AMOS to analyse the quantitative data. In particular, correlation and regression analysis were undertaken. The study finds a significant correlation between *operational readiness* and *project success*. Four of the operational readiness factors correlated significantly with *project success*. They were *facilities readiness*, *people readiness*, *systems and technology readiness*, and *Organisational readiness*. A stepwise regression analysis demonstrated that the factors of *operational readiness* are predictive of the level of *project success in airport projects*. Emergent from the study will be the development of a conceptual framework that

can assist operations readiness practitioners to enhance the success of the transition of completed projects to fully operational endeavours, in particular on the first day of operation. The main contribution of the study is that studies explicitly contextualised within complex multi-stakeholder infrastructure projects (such as in the case of airports) remain sparse. Thus, the candidate argues that this doctoral study serves as the basis of much wider empirical studies on the notion of ‘operations readiness’ within the context of operations and more specifically, project management.

Research Map

	Research Problem	Research Aim	Research Objectives	Research Questions	Research rationale	Underlying theory
1	Recent cases of newly completed airports projects suggest that on first day of operation (after completion and signoff of construction phase), airport service are unlikely to run smoothly, in effect. In numerous cases, airport services and operations have failed due to poor or inadequate ‘readiness’.	Critically examine, discern and synthesize the notion of operational readiness within the context of operations and project management.	Explore , define and review relevant literature related to operational readiness with focus on large infrastructure projects (Airports)	Within the context of project management, What is operational readiness ?	There seems to be sparse literature on operations readiness and specifically in the context of operations and project management.	Readiness (Organization) Theory (Weiner 2009)
2		To support organizations ensure that on first day of operation (after completion and signoff of construction phase), airport service run smoothly, in effect. In effect, the study seeks to ensure that airport services and operations do not fail due to poor or inadequate ‘readiness’. Therefore, the development of an operational readiness framework for airport services is proposed for the UAE consultants. By having such a readiness framework, the operations managers are able to analyze, evaluate and develop an awareness of their readiness in term of the implementation of airport services.	Identify and categorize factors from existing literature that constitute the major theory behind operations readiness. Identify and characterize key elements of operational readiness in the context of large infrastructure projects (Airports)	How do practitioners perceived operational readiness and contributing factors?	There are needs to identify and group operational readiness factors for future use in projects.	Transactional theory (Lazarus & Folkman, 1987)
3		Develop a conceptual framework that can improve project success in large infrastructure projects (Airports).	What is the relationship between operational readiness and project success?	Investigating the impact of operational readiness factors on project success. To be able to create a framework that can be used in the future for large infrastructure projects.		

Research Framework



Purpose of the Focus Group (Validations)

The purpose of the framework validation was mainly to determine the applicability, appropriateness and practical usability. It is important for the researcher to validate with the airport's projects stakeholders who are might be the future users of this model/framework.

Specifically, the validation will:

- Evaluate the application and effectiveness of the operational readiness framework/model to be used by airport projects stakeholders.
- Evaluate the facilitation and support project success elements and criteria for airport projects.
- Evaluate framework's help in achieving operational readiness state of operating agencies in airport projects.
- Evaluate the extent to which the framework can assist governments decision makers and airport project owners in operating newly constructed airport projects.
- Gather relevant suggestion and improvements recommendations from validators of the framework which are expected to be expert in the project management and

operations of airport projects including the obstacles in using such framework in real cases of airport projects.

Review of operational readiness framework factors and items

Facility Readiness

Item	Description
1	Conduct Trials and Simulation.
2	Pre-occupancy stocking
3	Creating of facility's processes and forms
4	Contractor and suppliers support
5	Completion of fit out and furniture
6	Facility's Procedural manuals
7	Facilities dependencies and move sequences.
Kindly list any additional items that you recommend to include it in this Factor	

People Readiness

Item	Description
1	Airport's government agencies involvements
2	Early establishment of operational readiness team.
3	Staff Safety and Security During transition.
4	Training of staff on new building and systems
5	Familiarisation to new building and systems is required.
6	Availability of staff operating dependencies and move sequences.
7	Accessibility of airport's system training material.
8	Active Involvement of the Airport's Airlines
Kindly list any additional items that you recommend to include it in this Factor	

Technology Readiness

Item	Description
1	Manage operational and safety of newly activated systems.
2	Availability of critical system manuals and documentation.
3	New to Existing system interface Management.
4	Availability of suppliers and vendors during initial start-up.
5	Assurance of commissioning and integration of the critical systems.

6	Availability of Emergency Telephone contact numbers during start up.
7	Assurance of New to Existing systems integration.
8	Plan for Disconnect/Connect Special Systems.
9	Availability and implementation of Training of all the systems.
10	Ensure operational Trials and simulation to all systems.
11	Pre-occupancy stocking of all Maintenance and operational supplies.
12	Support the plan of Stakeholders systems relocations.
13	Ensure skills and competencies for all the system's maintenance.
14	Availability of all the new airport's systems operating dependencies.
Kindly list any additional items that you recommend to include in this Factor	

Organization readiness

Item	Description
1	Operational readiness plan.
2	Escalation process and communicating plan.
3	Establishing common control room with all the stakeholders.
4	Assurance of passenger safety and security during the initial move.
5	Readiness program Checklist/Reporting mechanism.
6	Early Activation and operational readiness plan with all the stakeholders.
7	Documentation of the roles and responsibilities (operator, maintainer and user) Matrix.
8	Availability of stakeholder's decisions maker.
9	Protocol for communication during the operational readiness program.
10	Lines of communication during Start-up phase.
11	Dedicated activation and operational readiness team.

12	Regulatory and compliance requirements.
13	Escalation process to higher management.
14	Full documentation of the readiness performance outcomes.
15	Tracking update on operational readiness plan.
16	Phased (soft) opening plan.
17	Roles and Responsibilities of the supporting department during initial start-up.
18	Communicate the grand opening activities.
19	Public and special visit arrangement.
20	Public message and communications plan.
21	Availability of the completed SOP/IOP for all stakeholders.
22	New policies and procedure communications.
23	Formal activation and operational readiness program.
Kindly list any additional items that you recommend to include in this Factor	

Framework Rating

Model scoring

Kindly answer the following questions by ticking the appropriate number (1 = Poor and 5 = Excellent)

	Question	Poor (1)	Fair (2)	Satisfac- tory (3)	Good (4)	Excellent (5)
Q1	How useful would you rate the overall Operational readiness framework for airport projects?					
Q2	How easy would it be to follow the process of the framework (clarity of the framework)?					

Q3	To what extent can following the framework help in carrying out operational readiness to open new airport?					
Q4	How effectively can the framework facilitate the overall success of Airport projects?					
Q5	How effectively does the framework focus on readiness management issues relevant to airport projects?					
Q6	How well does the framework establish links between the factors of airport projects?					
Q7	How would you rate the applicability of the framework in airport projects?					
Q8	How would you evaluate the comprehensiveness of the framework?					
Q9	How would you rate the logical structure of the framework?					
Q10	How useful would you consider the framework in decision making?					

General Comments

1. What do you consider the main benefits from using the operational readiness framework?

Research Project Title: _____

1. I have read the research project information sheet for this study and have had details of the study explained to me by the researcher.
2. My questions about the study and its impacts have been answered to my satisfaction, and I understand that I may ask further questions at any time.
3. I also understand that I am free to withdraw from the study at any time, or to decline to answer any particular questions in the study.
4. I agree to provide information to the researchers under the conditions of confidentiality set out in the research project information sheet.
5. I wish to participate in this study under the conditions set out in the research project information sheet.
6. I consent to the information collected for the purposes of this research study being used for any other research purposes.

Participant's Name: _____
Participant's Signature: _____
Contact details: _____

Researcher's Name: _____
Researcher's Signature: _____
Contact details: _____

Date: / /

* Participants will be given a photocopy of this consent form after it has been signed.

Appendix F: Operational Readiness Items

1	Facility Readiness	4	Organization Readiness
1.1	Conduct trials and simulation.	4.1	Operational readiness plan.
1.2	Pre-occupancy stocking.	4.2	Escalation process and communicating plan.
1.3	Creating of facility's processes and forms.	4.3	Establishing Joint control room with all the stakeholders.
1.4	Contractor and suppliers support.	4.4	Assurance of passenger safety and security during the initial move.
1.5	Completion of fit out and furniture.	4.5	Readiness program Checklist/Reporting mechanism.
1.6	Facility's procedural manuals.	4.6	Early Activation and operational readiness plan with all the stakeholders.
1.7	Facilities dependencies and move sequences.	4.7	Documentation of the roles and responsibilities (operator, maintainer and user) Matrix.
2	People Readiness	4.8	Availability of stakeholder's decisions maker.
2.1	Airport's government agencies involvements.	4.9	Protocol for communication during the operational readiness program.
2.2	Early establishment of operational readiness team.	4.10	Lines of communication during Start-up phase.
2.3	Staff safety and security during transition.	4.11	Dedicated activation and operational readiness team.
2.4	Training of staff on new building and systems.	4.12	Regulatory and compliance requirements.
2.5	Familiarisation to new building and systems.	4.13	Escalation process to higher management.
2.6	Availability of staff operating dependencies and move sequences.	4.14	Documentation of the readiness performance outcomes.
2.7	Accessibility of airport's system training material.	4.15	Tracking update on operational readiness plan.
2.8	Active Involvement of the Airport's Airlines.	4.16	Phased (soft) opening plan.
3	Technology Readiness	4.17	Roles and Responsibilities of the supporting department during initial start-up.
3.1	Manage operational and safety of newly activated systems.	4.18	Communicate the grand opening activities.
3.2	Availability of critical system manuals and documentation.	4.19	Public and special visit arrangement.
3.3	New to existing system interface management.	4.20	public message and communications plan.
3.4	Availability of suppliers and vendors during initial start-up.	4.21	Availability of SOP/IOP for all stakeholders.
3.5	Assurance of commissioning and integration of the critical systems.	4.22	New policies and procedure communications.
3.6	Availability of emergency telephone contact numbers during start up.	4.23	formal activation and operational readiness program
3.7	Assurance of new to existing systems integration.		
3.8	Plan for disconnect/connect special systems.		
3.9	Availability and implementation of training of all the systems.		
3.10	Ensure operational trials and simulation to all systems.		
3.11	Pre-occupancy stocking of all maintenance and operational supplies.		
3.12	Support the plan of stakeholders systems relocations.		
3.13	Ensure skills and competencies for all the system's maintenance.		

3.14	Availability of all the new airport's systems operating dependencies.		
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