The influence of project managers' competencies on the delivery of successful innovation in projects

تأثير كفاءات مدراء المشاريع على تقديم الابتكار الناجح في المشاريع

by

AFAF HASSAN

A thesis submitted in fulfilment

of the requirements for the degree of

DOCTOR OF PHILOSOPHY IN PROJECT MANAGEMENT

at

The British University in Dubai

Thesis Supervisor
Professor Halim Boussabaine
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ABSTRACT

This thesis investigates the influence of project manager innovation competencies on the delivery of successful innovation in projects in the United Arab Emirates. The objectives of this thesis are to critically investigate the impact of the project manager innovation competencies on the delivery of successful innovation in projects, and to analytically examine the mediation effect of the project manager innovation personality traits and the project manager innovation environment on the relationship between the project manager innovation competencies and the delivery of successful innovation in projects. The research employs a quantitative method, as data are collected using online questionnaires from employees working in different companies operating in the United Arab Emirates. The data analysis is performed using the Statistical Package for the Social Sciences (SPSS) and structural equation modelling (AMOS) by means of multiple-regression, path and mediation analysis.

The confirmatory factor analysis (CFA) results indicate that there are four clusters for project manager innovation competencies that are impact and influence competencies, cognitive competencies, personal effectiveness competencies, and managerial competencies. There are six clusters for project manager innovation personality traits that are alertness and quickness, self-confidence, decision-making, openness to innovation, honesty and integrity, and energy and toughness traits. There are two clusters to measure the delivery of successful innovation in projects that are control of new scope and response to scope change. Yet, the CFA is not used for the measurements of the project manager innovation environment, as each variable has less than five observations. Thus, the measurements of project manager innovation environment are obtained from the literature review and they include four clusters that are stakeholders, resources, culture, and market.

The findings indicate that all of the studied project manager innovation competencies have a direct positive impact on the delivery of successful innovation in projects. The results also reveal that the project manager innovation personality traits fully mediate the relationship between the project manager innovation competencies and the delivery of successful innovation in projects. Except that the project manager innovation personality traits partially mediate the relationship between project manager personal effectiveness competencies and the response to scope change in projects. At the same time, the project manager innovation environment fully mediates the relationship between the project manager innovation competencies and the delivery of successful innovation in projects. Except that the project manager innovation environment partially mediates the relationship between project manager managerial competencies and the response to scope change in projects. Thus, this research thesis contributes to both the diffusion of innovation theory and the threshold and high performance managerial competencies theory. It is also one of the first empirical studies to establish a relationship between project managers' innovation competencies, innovation personality traits, innovation environment, and the delivery of successful innovation in projects.

ABSTRACT IN ARABIC

هذا البحث يدرس تأثير الكفاءات الإبتكارية لمدير المشروع التي تؤدي إلي تقديم الإبتكار الناجح في المشاريع المقامة في دولة الإمارات العربية المتحدة. تتمثل أهداف هذا البحث في إجراء دراسة نقدية عن تأثير الكفاءات الإبتكارية التي يمتلكها مدير المشروع على تقديم الابتكار الناجح في المشاريع. بالإضافة إلى تحليل سمات الإبتكار الشخصية لمدير المشروع و البيئة المحيطة له كعوامل وسطية مؤثرة على العلاقة بين الكفاءات الابتكارية لمدير المشروع و تقديم الإبتكار الناجح في المشاريع. يستخدم البحث طريقة كمية، حيث جمعت البيانات بإستخدام إستبيان عبر الإنترنت من موظفين يعملون في شركات مختلفة في دولة الإمارات العربية المتحدة. تم تحليل البيانات باستخدام برنامج الحزمة الإحصائية للعلوم الاجتماعية (SPSS) وبرنامج نمذجة المعادلة الهيكلية (AMOS) و ذلك عن طريق دراسة الانحدار المتعدد، و تحليل المسار و الوساطة.

النتائج التي تم الحصول عليها من خلال استخدام طريقة عامل التحليل التأكيدي تشيرإلى أنه يوجد أربعة مجموعات للكفاءات الإبتكارية لمدير المشروع و هي كفاءات الأثر والتأثير و الكفاءات المعرفية و كفاءات الفعالية الشخصية و الكفاءات الادارية. و أيضاً هناك ستة مجموعات لسمات الإبتكار الشخصية لمدير المشروع و هي السرعة و اليقظة، و الثقة بالنفس، و إتخاذ القرارات، والإنفتاح على الإبتكار، و الصدق و النزاهة، و الطاقة و المتانة. بالإضافة إلى وجود مجموعتان لقياس تقديم الابتكار الناجح في المشاريع و هما السيطرة على نطاق العمل الجديد و الإستجابة لأي تغيير يحدث لنطاق العمل. أما بالنسبة للبيئة المحيطة بمدير المشروع فلم يتم استخدام طريقة عامل التحليل التأكيدي لأن العوامل الموجودة في كل قسم عددها أقل من خمسة. لكن تم استخدام المجموعات التي تم الحصول عليها من البحث. وبناءاً عليه فإنه توجد أربعة مجموعات للبيئة المحيطة بمدير المشروع و هي أصحاب المصالح في المشروع، و الموارد، و الثقافة، والسوق.

و أشارت النتائج إلى أن جميع الكفاءات الإبتكارية المدروسة لمدير المشروع لها تأثير مباشر و إيجابي على تقديم الإبتكار الناجح في المشاريع. و تشير النتائج أيضا إلى أن سمات الإبتكار الشخصية لمدير المشروع تتوسط تماماً العلاقة بين الكفاءات الإبتكارية لمدير المشروع و تقديم الإبتكار الناجح في المشاريع. بإستثناء أن سمات الإبتكار الشخصية لمدير المشروع تتوسط جزئياً العلاقة بين كفاءات الفعالية الشخصية لمدير المشروع و الإستجابة لتغيير نطاق المشاريع. و في نفس الوقت فإن البيئة الإبتكارية لمدير المشروع تتوسط تماماً العلاقة بين الكفاءات الإبتكارية لمدير المشروع و تقديم الإبتكار الناجح في المشاريع. بإستثناء أن البيئة الإبتكارية لمدير المشروع تتوسط جزئياً العلاقة بين كفاءات الفعالية الشخصية لمدير المشروع و الإستجابة لتغيير نطاق المشاريع. و بناءاً على ما سبق فإن هذا البحث يساهم في دعم نظرية نشر الابتكار و نظرية مقياس الكفاءات الإدارية و الكفاءات

الإدارية العالية. بالإضافة إلى انه يعتبر واحداً من الدراسات التجريبية الأولى التي تدرس العلاقة بين كفاءات الإبتكار لمدير المشروع، و سمات الابتكار الشخصية، و بيئة الإبتكار، و تقديم الإبتكار الناجح في المشاريع.

DEDICATION

This thesis stands primarily on the support of my family. I wish to highlight my appreciation to my parents, who made me believe that dreams are achievable. I am very grateful to my husband for his continuous; patience, support, and sacrifices during this journey. Also, I am very grateful for my daughters (Joud, Haya, and Raghad) for their smile that boosts me day after day with energy and encourages me to confront challenges.

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First of all I am thankful to Allah who gave me the courage and strength to complete this research. I would like to express my deep and sincere appreciation to the director of this study, Professor Halim Boussabaine, for his inspiration, support, encouragement, and valuable guidance during this research. I am also thankful to the wonderful individuals in the British University in Dubai for their kind help and continued support. I must also acknowledge the University for the opportunities and long-term support it has provided.

I would like to extend my deep thanks to all of my family who have continuously supported, and encouraged me during my studies. Words cannot express the appreciations I have for my parents for their unconditional support and prayers. I owe my gratitude and loving thanks to my husband (Dr. Ahmed Artoli) and my daughters (Joud, Haya and Raghad) who have missed out on many things during my study. Without their constant encouragement and understanding it would have been impossible to complete this work. The achievement of this research is but a small reward for their great efforts and high expectations.

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LIST OF ABBREVIATIONS

AMOS	Analysis of Moments Structures
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
DF	Degree of Freedom
DSI	Delivery of Successful Innovation
EFA	Exploratory factor analysis
EM	Expectation Maximization
GFI	Goodness of Fit Index
HCA	Holistic Competency Approach
HPMC	High Performance Managerial Competencies
HR	Human Resources
IDT	Innovation Diffusion Theory
MC	Managerial Competencies
MCAR	Little's Missing Completely at Random
PM	Project manager
PMIC	Project Manager Innovation Competencies
PMIE	Project Manager Innovation Environment
PMIPT	Project Manager Innovation personality traits
PT	Personality trait
RMSEA	Root Mean Square Error of Approximation
TCQ	Time, Quality & Cost
SEM	Structural Equation Modelling
SRMR	Standardized Root Mean Square Residual
SPSS	Statistical Package for the Social Sciences
TLI	Tucker Lewis Index
UAE	United Arab Emirates

Chapter 1 Introduction

1.1 Introduction

This chapter introduces the current research starting by the study background, which is mainly concerned about project manager competencies and innovation. It also explains the motivation for the study, and lists the research aims, objectives, and questions. This chapter moves further to describe the context of this study, which is mainly performed in the United Arab Emirates (UAE). It also points out the significance of the current research, and provides brief details about the structure of this thesis.

1.2 Background of the study

Innovation is not only a survival necessity in the present highly competitive and rapidly changing world (Sheu & Lee, 2011), but also an important gate for organizations trying to grow in the existing markets (Ernst et al., 2015). Innovation has main benefits that are contributing to economic development, engaging employees, enhancing the ways of thinking, satisfying customers, reducing cost, improving quality, attaining competitive advantages, and improving overall project outcome (Ende, Frederiksen & Prencipe, 2015; Sheu & Lee, 2011; Ozorhon, 2013; Shieh, 2011; Samson & Gloet, 2014; Siguaw, Simpson & Enz, 2006; Slater, Mohr & Sengupta, 2013; Wheatley, 2002). Even though, still innovation has many challenges such as time consumed, diverse and challenging environment, dynamic and unstable market, suitable conditions of success, fear of failure, difficulty of understanding end user needs, lack of facilities, and mainly innovation resistance (Bohlmann, et al., 2013; Chuang, Jason & Morgan, 2011; Dibrov, 2015; Ernst et al., 2015; Jayaram, Oke & Prajogo, 2014; Samson & Gloet, 2014; Song, et al., 2015; Talke & Heidenreich, 2014). However, the chance of a new idea being achieved basically depends on active innovation players (Ling et al., 2007). This indicates that organizations need active innovative individuals, who can work effectively to deliver successful innovation.

Industries can be large, dynamic, complex, multifaceted, and project-based (Behm, 2008; Dulaimi, Ling & Bajracharya, 2003). They may involve internal and external stakeholders who promote the industry's policies, practices, procedures, and culture (Hills et al., 2008). Typically, projects are transitory coalitions of individuals and organizations (Ling et al., 2007). This crates a dynamic nature that includes constantly changing methods, settings, teams, and team members (Leicht, et al., 2010). As a result, in some projects there can be cost escalations, schedule delays, changes in task demands, uncertainty, changes of end user needs and demands, globalization, continuous competition, existence of inexperienced workforce, and occurrence of unexpected events (Çelik, Kamali & Arayici, 2017; Geraldi, Lee-Kelley & Kutsch, 2010; Gharehbaghi & McManus, 2003; Hills et al., 2008; Ling, 2003; Long, Ismail & Amin, 2013; Raiden & Dainty, 2006). But, it is necessary to overcome all of these challenges in order to reduce any wasted time, money, and/or resources (González et al., 2014). Thus, the quest for finding innovative methods to deal with these problems is important, as innovation has the ability to minimize or sometime overcome such challenges through introducing new and effective applications.

Innovation can be very beneficial, but at the same time has many challenges. Some of the benefits that innovation can bring are embracing new strategies, developing new managerial practices, emphasizing strong interest and commitment, becoming influential, increasing organizational effectiveness, realizing competitive advantages, reducing costs, minimizing time, improving quality, encouraging engagement and collaborative work, and satisfying stakeholders (Bossink, 2002; Dulaimi, Nepal & Park, 2005; Halbesleben et al., 2003; Howell, Shea & Higgins, 2005; Jiao & Zhao, 2013; Ling, 2003; Murphy, Perera & Heaney, 2015; O'Connor & Rice, 2013; Ozorhon, 2013; Seaden et al., 2003; Slater, Mohr & Sengupta, 2013). But, these benefits cannot be achieved easily, as innovation is confronted by different challenges such as pressure from clients to meet targets, dealing with diversity, getting adapted to the local market orientation, employees' resistance, high uncertainty, lack of the required mechanisms, characteristics and structure of construction projects, understanding and handling the common goals between innovation and the different industries, and receiving adequate management support for innovation (Chuang, Jason & Morgan, 2011; Dulaimi, Ling & Bajracharya, 2003; Gambatese & Hallowell, 2011; Gann, 2000; Hartmann, 2006; Kelley & Lee, 2010; Murphy, Perera & Heaney, 2015; O'Connor & Rice, 2013; Ozorhon, 2013; Reichstein, Salter & Gann, 2005).

The role of project managers to deliver successful innovation in projects can involve; adopting and carrying innovation in a unique manner, controlling time, cost, quality, safety and environmental matters, promoting innovative ideas openly, making thoughtful strategic decisions, communicating the prominence of innovative solutions systematically, generating a favourable environment for embracing innovation, inspiring others through adhering high ethical standards, and facilitating innovation on site (Dulaimi, Nepal & Park, 2005; Hartmann, 2006; Hills et. al, 2008).

Nevertheless, management competency can influence the management and delivery of innovation (Chatenier et al., 2010; Racela, 2014; Vila, Perez & Coll-Serrano, 2014). In justification, competencies can be used evaluate managers, allow individuals to achieve their targets, develop themselves, and enhance their outcomes, differentiate progressing project managers from their equals, support a range of HR management applications (involving recruitment, training, deployment, succession planning, promotion, and reward management), all of which are essential for to deliver successful innovation in projects (Arditi, Gluch & Holmdahl, 2013; Chong, 2013; Dainty, Mei-I & Moore, 2005; Liikamaa, 2015). In general, the project manager's competence contributes significantly in improving the outcome of project (Jha & Iyer, 2006).

To understand the issues outlined above makes it critical to investigate the relationship between project manager innovation competencies and the delivery of successful innovation. Also, it is important to find out the main aspects that have a mediation effect on such a significant relationship.

1.3 Research Problem Statement

Innovation has many challenges and sometimes it is not being delivered successfully in projects (Gann, 2000; Samson & Gloet, 2014). For example, some of the innovation challenges in projects can be pressures from clients to minimize costs, improve quality, and expedite implementation processes (Gann, 2000). Also, innovation may not be delivered successfully in projects because of failure to create appropriate conditions for a successful adoption, unprofessional selection of project members, or unsuitable project culture (Samson & Gloet, 2014). However, in spite of the conventional role of project managers in managing and controlling projects (Hills et. al, 2008), successful project managers in the longer term can deliver successful innovation in projects (Powl & Skitmore, 2005). The reason is that once project managers are fully convinced about the advantages of innovations; they can adopt and deliver them in a unique manner (Dulaimi, Nepal & Park, 2005).

Accordingly, there is a lack or understanding about the project manager innovation competencies that can influence the delivery of innovation in projects (Howell, Shea & Higgins 2005; Vila, Pérez & Coll-Serrano, 2014). Ahsan, Ho & Khan, (2013) have pointed out that depending on the scope of work and type of a project, the project manager innovation competencies can vary in its depth and breadth. Furthermore, scholars have not reached an agreement about the project manager innovation competencies that are essential to deliver successful innovation in projects (Afsar, Badir & Khan, 2015; Crant, 2000; Montani, Odoardi & Battistelli, 2014; Vila, Pérez & Coll-Serrano, 2014). Thus, in the current study, it is important to find out the project manager innovation competencies, and examine whether a relationship exists between these competencies and the delivery of successful innovation or not.

However, in order increase the understanding about the project manager innovation competencies, it is essential to realize what personality traits they have that compliment or compete with these competencies (Gehring, 2007). Besides, the project manager innovation personality traits can influence the successful completion of innovation (Rothmann & Coetzer, 2003; Stock, von Hippel & Gillert, 2016). In other words, it is found out that the project manager personality traits have an influence on both the project manager competencies (Gehring, 2007), and the delivery of successful innovation in projects (Rothmann & Coetzer, 2003; Stock, von Hippel & Gillert, 2016). Consequently, in this research, it is imperative to assess if the project manager innovation personality traits mediate the relationship between project manager competencies and the delivery of successful innovation in projects.

Nevertheless, the current environment might not encourage the delivery of successful innovation in projects (Cunha, et al. 2014; Lahi & Elenurm, 2015). In this regard, Lahi & Elenurm (2015) have emphasized that the environmental factors can act as a catalyst or barrier to innovation. In justification, a poor environment for the delivery of successful innovation suffers from lack of experienced resources, managers' dissatisfaction about innovation initiatives, and difficulty in dealing with the complexity of any technological solutions (Cunha, et al. 2014). While, an innovation supporting environment can improve the creativity of employees, positively influence the innovation competencies of project managers, advance a successful delivery of innovation in short term, and shape organizational cultures in long term (Dul & Ceylan, 2014). Subsequently, in this study, it is crucial to assess if the project manager innovation environment mediate the relationship between project manager competencies and the delivery of successful innovation in projects.

Overall, in order to overcome the lack of understanding about the association that can exist among the above points, this research will look in more detail at the relationship between the project manager innovation competencies and the delivery of successful innovation in projects. It will also assess if the project manager innovation personality traits and the project manager innovation environment can mediate the relationship between the project manager innovation competencies and the delivery of successful innovation in projects.

1.4 Motivations for the research

This research attempts to identify and test factors that affect the delivery of successful innovation in projects and the impact of the project manager competencies on these factors, in the United Arab Emirates (UAE). This research is academically and practically motivated. Academically, innovation is a multidisciplinary area that covers different perspectives: strategies, design, new-product development, human resources (HR), and organization performance are few examples that overlap to realize the success of innovation. But, current knowledge about innovation is fragmented, and research in this field requires further work (Keupp et al., 2012). The internationalization process of learning has become an attractive field of research, as new opportunities for organizations can exist outside their local markets (De Clercq et al., 2012). Hence, recent research in the field of innovation has captured an enormous attention. Practically, organization will be selective in the process of hiring the right project managers, as they should have the required competencies that will allow them to deliver successful innovation in projects (Cheng, Dainty & Moore, 2005). However, these academic and practical concerns have motivated the researcher to undertake a thorough analysis about the relationship between the project managers' innovation competencies and the delivery of successful innovation.

In particular, the primary rationale for the current study is the lack of studies on the influence of project manager innovation competencies on the delivery of successful innovation in projects, and whether the project manager innovation personality traits and the project manager innovation environment mediate this relationship or not. Since the majority of research into competencies, personality traits, environment and the delivery of innovation in projects have been conducted separately in other contexts that are different from the UAE, and taking into account the rapid globalization of business, there is a great need to broaden the study of the influence of project manager innovation competencies on the delivery of successful innovation in a way that it covers the meditational effects of the project manager innovation personality traits and the project manager innovation environment. Thus, this study intends to help fill the gap in research through finding a link between project manager innovation competencies, project manager innovation personality traits, project manager innovation environment, and the delivery of successful innovation in the UAE context.

Nevertheless, this research is also motivated by the Crawford's model of competence for project management roles (Crawford, 2005), the high performance managerial competency theory (HPMC) (Cockerill, Hunt & Schroder, 1995; Tedstone and McWilliams (2008), and the Rogers' innovation diffusion theory (IDT) (Rogers, 2003). According to Crawford (2000), there are three main classifications of competencies, namely personal competencies, input competencies, and output competencies that can be combined together to evaluate competence. Later, Crawford (2005) has presented an integrated model of competence that consists of knowledge, skills, personality, and performance that has the same categories of competencies. Nijhuis, Vrijhoef and Kessels (2015) have agreed that this model can be considered as taxonomy in itself, as competencies are being classified into different sub-competencies. Yet, the high performance managerial competency theory addresses aspects of competency strategic, personal interactions, inspirational and achievement orientated behaviors. It is longitudinal in nature and has been thoroughly validated (Cockerill, Hunt & Schroder, 1995; Tedstone and McWilliams, 2008). However, regarding Rogers' innovation diffusion theory, Rogers (1995) have clarified that innovation is an idea, application, or object that is seen as new by individuals or any another unit of adoption, while diffusion is the process by which innovation can be communicated through particular channels over time among members of a social system. Hence, combining Crawford's model, the HPMC theory and Rogers' innovation diffusion theory in this research contributes to the gap that this study attempts to fill.

The findings of the current study will probably provide researchers with alternative ways of examination that will help in developing a further understanding about innovation competencies of project managers. Besides, the study findings may aid organization in gaining a clearer picture of the areas in which they may need to develop with regard to innovation competencies of project managers, and move further to deliver successful innovation in all projects.

1.5 Aim, objectives, and research questions

Research aim:

The aim of this study is to critically investigate the relationship between the project manager innovation competencies and the delivery of successful innovation in projects.

Research Questions:

In order to achieve the research aim, the researcher has to identify the project manager competencies that are available in the context of innovation. After identifying these PM competencies, the researcher can then study whether these competencies stimulate the delivery of successful innovation in projects. In particular, the researcher examines the relationship between the project manager innovation competencies and the delivery of successful innovation in projects. Thus, the following research questions are raised:

1. What is the relationship between project manager innovation competencies and the delivery of successful innovation in projects?

2. What is the impact of the project manager innovation personality traits on the relationship

between project manager innovation competencies and the delivery of successful innovation in projects?

3. What is the influence of project manager innovation environment on the relationship between project manager innovation competencies and the delivery of successful innovation in projects?

Research objectives:

In order to encounter the research aim and answer the research questions, a number of objectives are required to be addressed. The objectives enable the researcher to find out factors related to the project manager innovation competencies, incorporate these factors in a model, and then test the model to verify if the selected factors have a significant impact on the delivery of successful innovation in projects. Hence, the following objectives are anticipated:

1. To critically review and extract PM innovation competencies.
2. To critically review and extract the measures for successful innovation in projects
3. To critically investigate the relationship between project manager innovation competencies and the delivery of successful innovation in projects
4. To examine the mediating impact of the project manager innovation personality traits on the relationship between project manager innovation competencies and the delivery of successful innovation in projects.
5. To investigate the mediating effect of the project manager innovation environment on the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

1.6 The context of this study

The study examines the project managers' competencies and their abilities to deliver successful innovation in projects in projects performed in the United Arab Emirates (UAE). This includes the mediation impact of the project manager's personality traits and the project manager's innovation environment on the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

There is an existing gap in the areas of project manager innovation competencies and the delivery of successful innovation in projects. In order to address this gap, the research approach is dominated by the quantitative research method. Furthermore, the quantitative research provides a more rigorous and scientific investigation to identify significant factors that affect the delivery of successful innovation in projects through scanning the innovation competencies of a larger number of participants. The analysis covers a wide range of participants working in different industries and different organization types. This allows for a clearer picture about the relationship between the project manager innovation competencies and the delivery of successful innovation in projects, considering the possible impact of the project managers innovation personality traits and innovation environment on such a relationship.

1.7 Significance of the research

The results of this study will make significant contributions to the United Arab Emirates on the fields of innovation and project manager competencies both theoretically and practically. The ***theoretical contribution*** is generated from this research through providing perceptions into how project manager innovation competencies in UAE organizations have an effect on the successful innovation in projects. Also, it will identify a set of competencies that are necessary for delivering successful innovation in projects. Simultaneously, this study contributes to innovation personality traits and innovation environment literature. This is performed through investigating the mediating effect of project manager innovation competencies and project manager environment on the relationship between project manager innovation competencies and the delivery of successful innovation in projects. Thus, the argument of this study has been examined through two associations between project manager innovation competencies and the delivery of successful innovation in projects.

First, the study contributes to the body of knowledge on innovation and project management competencies. In that respect project managers' innovation competencies have an influence on the delivery of successful innovation in projects. This is in line with the argument of Vila, Perez & Coll-Serrano (2014), who have pointed out that the project managers' innovation competencies allow them to realize opportunities for change, establish creative ideas, distinguish among the potential value of new and previous ideas, and apply novel ideas through reorganizing resources, which in return will improve the delivery of successful innovation. However, the best way to test the abilities of project managers to accomplish the desired goal is through examining and analyzing their competencies. They also have added that competencies that are related to innovation are very significant, mainly when redesigning a particular organization for innovation. Used effectually, the study of competencies can foster key proficiencies, development requirements, and inputs of project managers towards excellence within organizations. Hills et. al (2008) have emphasized this idea through mentioning that somehow there is a relationship between project managers' competencies and what they often do in managing projects. Having the needed competencies enables them not only to control the distinctive requirements of projects, but also inspire others through their active behaviors. However, the thesis findings have suggested that there is a positive direct relationship between project manager innovation competencies and the delivery of successful innovation in projects.

The results of the current study has confirmed that project manager innovation personality traits and the project manager innovation environment have an effect on the relationship between project manager innovation competencies and the delivery of successful innovation in projects. These significant findings add to the body of innovation personality traits and innovation environment literature through providing a more integrative view of the project manager innovation personality traits and the project manager innovation environment as mediator in the relationship between independent and dependent variables. This can also help academics in human resources and organizational behavior studies in understanding project manager innovation competencies and how they impact the delivery of successful innovation in projects, considering the mediation effect of project manager innovation personality traits, and project manager innovation environment.

The ***practical contribution*** is derived from the study findings, and it is recognized that competitive advantage can mainly be achieved through innovation; hence it is essential to build up and develop project managers' innovation competencies (Goswami & Mathew, 2011). In this regards, Konigova and Fejfar (2012) have argued that project manager innovation competencies allow organizations to achieve competitive advantage in different markets, especially in current environments that are characterised by changes and dynamic growth. In addition, competencies can improve project managers' abilities, developments, and contributions (Cheng, Dainty & Moore, 2005). They also help in differentiating between average and outstanding project managers in a workplace (Krajcovicova, Caganova & Cambal, 2012). This helps organization to hire the right project manager, who has the required competencies (Cheng, Dainty & Moore, 2005). In addition, Human Resources professionals can use the outcome of this knowledge for recruitment and future development purposes, as project managers can be evaluated during resume screening, interviews, or reference checking. HR managers can try to determine if the desired competencies are presented in their resumes. When performing interviews, the interviewer can ask behavioral type of questions to verify the nature of competencies owned by a project manager, and if the candidate acquires the competencies required for that particular job position. Speaking with the applicants' references can demonstrate better idea about the competencies they have and whether they can easily use them whenever required (Skulmoski & Hartman, 2010). Further, it is important to prepare guidelines that identify the required competencies. Such guidelines can help HR managers to become more effective in the recruitment process, particularly, when they prepare a job advertisement for a project manager position (Ahsan, Ho & Khan, 2013). Moreover, adopting a competency framework has the potential to enhance the ways in which organizations manage, develop, and maintain their key managerial resources. Project managers can be assessed based on a competency framework to detect their strengths and weaknesses, and to plan for their future effective development and training. Another imperative consideration is that selecting employees based on key competencies is more useful and cost effective option than training them (Cheng, Dainty & Moore, 2005). Thus, in order to deliver innovation successfully in projects, organizations should focus on project managers' competencies, as they are considered to be the basis on which innovation is created and well fortified (Goswami & Mathew, 2011).

Nevertheless, the of the current study has revealed evidence that confirms that the project managers in the UAE have innovation competencies that have lead to delivering successful innovation in projects. The results of this study indicate that there is a positive direct relationship between the project managers' innovation competencies and the delivery of successful innovation in UAE projects. At the same time, the statistical findings of this study show that most of those project managers have favorable innovation personality traits and can work effectively in the innovation environment facilitated by the different organizations.

1.8 Structure of thesis

This thesis has ten chapters plus references and appendices. The structure of this thesis is as follows:

Chapter 1; **Introduction**: has introduced the need for a thorough understanding about the role of project manager innovation competencies in delivering successful innovation in projects. The aims, objectives, and research questions are presented as well as the potential (academic and practical) contributions associated with this study. It concludes with the significance of this research and the structure of this thesis.

Chapter 2; **The Delivery of Successful Innovation in Projects (Literature Review-Part 1)**: provides a review of the literature relevant to the delivery of projects that discusses in details the temporary nature of projects; the main measurements for the delivery of projects; and the role of the project manager in the delivery of projects. It also represents essential background for identifying the antecedents and challenges of innovation in projects, which cover innovation definitions, process, management, benefits, innovation theory relevant to this research, and challenges. Besides, it describes the delivery of successful innovation in projects through identifiying the innovative individuals, innovative environment, the factors influencing the successful delivery of innovation, and project measurements and the delivery of innovation in projects.

Chapter 3; **Project Manager Competencies and Innovation (Literature Review-Part 2)**: provides a review of the literature relevant to project managers' competencies. It starts with a thorough competency background that covers competency definitions, types, competency theory relevant to this research, and the association between personality traits and competencies. It also describes the existing literature about project manager competencies and the delivery of innovation that intails management competency and the delivery of innovation; project manager competencies; project manager competencies and innovation; and project manager competency challenges to deliver innovation. It concludes with the competency models available in literature that can be used as a basis to develop the conceptual framework.

Chapter 4; **Conceptual Framework and Model Development**: presents a conceptual framework and model using a robust theoretical basis. It describes in details the operational definitions and measurements obtained from literature review of this study, which particularly focus on project manager innovation: competencies, personality traits, and environment; the delivery of successful innovation in projects; and the demographics influencing the study. It concludes with the direct and mediation hypothesis developed for this study.

Chapter 5; **Research Methodology**: presents a thorough discussion about the research design and the methodological approach that the researcher has used to test the conceptual framework and the research hypotheses. Further, it entails in detail a description of data coding, reliability, and validity. It is then followed by precise information about the population and sample size used in this study and how the measurements are assessed. It also provides details about the pilot test results, and an explanation about data analysis techniques covering regression, statistical, and structural equation modelling analysis. This Chapter concludes with the ethical consideration followed in this study.

Chapter 6; **Primary Data Analysis**: describes the process of data preparation; survey data and response rate; reversing negatively worded items; checking missing values; replacing missing values; checking outliers; and performing reliability tests using Cronbach Alpha. It also represents descriptive statistics about the current study demographics; project manager innovation: competencies, personality traits, and environment; and the delivery of successful innovation. It concludes with assessments about statistical normality.

Chapter 7; **Factor analysis and confirmatory factor analysis**: provides an exploratory factor analysis followed by a confirmatory factor analysis for the measurements of project manager innovation competencies; project manager innovation personality traits; and the delivery of successful innovation. The project manager innovation environment is excluded from this Chapter, as its measurements include less than five observed variables.

Chapter 8; **Analysis of the Findings**: describes the path analysis between the project manager innovation competencies and the delivery of successful innovation in projects, and verifies the hypotheses associated with this relationship. It also represents a mediation analysis of the project manager innovation personality traits on the relationship between project manager innovation competencies and the delivery of successful innovation in projects, and checks the hypotheses associated with this relationship. At the same time, it demonstrates a mediation analysis of the project manager innovation environment on the relationship between project manager innovation competencies and the delivery of successful innovation in projects, and confirms the hypotheses associated with this relationship.

Chapter 9; **Discussion**: represents comprehensive discussion of the findings and a clear picture about the relationships among the study variables, the degree to which the obtained results agree with or differ from the past empirical outcomes and theoretical arguments. This is achieved through discussing the main concepts of the research including the concepts of delivering successful innovation in projects, and project manager innovation: competencies, personality traits, and environment. It also discusses the results attained from the confirmatory factor analysis for the project manager innovation: competencies, personality traits, and environment; and the delivery successful innovation in projects. It concludes with a discussion about the modelling accomplished for the direct and mediation relationships of this stuy.

Chapter 10; **Conclusion and recommendations**: describes the robustness of the current methodology, and the achievement of the research objectives. It also represents the key academic and practical implications of this research. This Chapter identifies the research key findings, limitations, and future recommendations. It also includes concluding remarks that points out the main findings of this study.

1.9 Summary

This chapter provides a summary view of the existing research, presenting the empirical context of this, research aims, research objectives, research question, the significance of the research, and the structure of the thesis. Furthermore, it highlighted the role of project manager innovation competencies in the delivery of successful innovation in projects. Chapter 2 and Chapter 3 will present the literature review of this study.

Chapter 2 The Delivery of Successful Innovation in Projects

2.1 Introduction

This chapter provides a comprehensive literature review about the delivery of successful innovation in projects. This is approached gradually through studying the successful delivery of projects. This covers an explanation about the temporary nature of projects, the main measures for delivering successful projects, and the role of a project manager in the successful delivery of projects. This followed by studying in detail the antecedents and challenges of innovation, which involves innovation definitions, processes, management, benefits, innovation diffusion theory and innovation challenges. Moreover, this is narrowed down to describe the delivery of successful in innovation in projects. This is attained through pointing out the competencies and traits of the innovative individual, innovation environment, the factors influencing the delivery of successful innovation, and ultimately the project measurements that are important for the delivery of successful innovation in projects.

2.2 The delivery of projects

2.2.1 The temporary nature of projects

Project may be simple or complex; their types can be expanding from the traditional engineering-based projects into Information Technology-projects, change projects and more commonly business projects (Kolltveit, Karlsen & Grønhaug, 2007; Winter, et al. 2006). Though, projects can often be judged against two main parameters, which are how clear are the goals, and how accurate are the methods. This leads to having four types of projects that are (1) goals and methods of completing the project are well defined, (2) the goals are accurately defined but the methods are not, (3) the goals are not precisely defined but the methods are, and (4) neither the goals nor the methods are defined well (Turner & Cochrane, 1993). These four types demonstrate how complicated projects can be.

Although the interest in project management has increased, some projects have maintained their complexity, uncertainty, and failures that continue to grow (Dias et al., 2014). Simultaneously, projects have different natures, and thus require to be managed in different ways (Dias et al., 2014). This indicates that projects are complex in nature and subject for failure, if not managed probably. Yet, the dynamic nature of project occur due to many types of factors such as complexity factors (i.e. project size, execution stage, degree of repetitiveness of the project, and exceptional congestion of project site and its surroundings), uncertainty factors (i.e. incompleteness of planning, frequent changes in planning during implementation, weather influences, and special or unfamiliar technology), speed factors (i.e. special time pressure when getting closer to a project deadline), and other special factors (i.e. management/ supervision system, client constraints, reliability of subcontractors, and poor pricing of project) (Telem, Laufer and Shapira, 2006). In particular, the site-based nature of projects is often characterized by uncertainty, complexity, poor communication, inadequate coordination, and insufficient integration (Tuuli, Rowlinson & Koh, 2010). These factors provide a brief explanation about the dynamic and temporary nature of projects, but still it is important to realize that such a nature may lead to some difficulties. As the dynamic nature of projects can cause many problems such as finding difficulty in planning, having short time frames, producing high levels of interdependence among existing projects, showing strong customization, planning for indefinite results, balancing accountability with flexibility and reliability, balancing decision quality versus decision actual speed, and providing proper timing scope freeze during any quick change (Collyer & Warren, 2009). Besides, temporary project teams may not show reasonable amount of flexibility; and hence, it is not surprising for them to fail (Son & Rojas, 2011). This signifies that accepting or overcoming such problems may not be an easy task. Nevertheless, for this research, it is important to realize the temporary nature of projects, as this makes the delivery of successful innovation limited to time constrains.

2.2.2 Main measurements for successful projects

Time, cost, and quality (TCQ) are three significant competitive objectives of every project, as they are necessary to create a balance throughout optimal resource utilization, which results in a required project performance (Heravi & Faeghi, 2014). They are considered to be the main controlling factors in project management. Balancing them within the project scope is important to judge whether a project is successful or not (Zhang, Du & Zhang, 2014). Additionally, time, cost, and quality are important project indicators that are necessary to make appropriate decisions. Such decisions are meant to pursue the conflicting objectives that can occur simultaneously, which are time minimization, cost minimization, and quality maximization (Heravi & Faeghi, 2014). As the goals of time, cost, and quality are interrelated, it is irrational to pursue one goal and ignore the others. Through integrating all goals, it becomes possible to improve the overall effectiveness and efficiency of project management. (Zhang, Du & Zhang, 2014). Furthermore, the objective of project management is to employ skills and practices to an organization, control all project features, improve the use of resources to create a well designed and thoroughly formed facility that can meet the various client needs of time, cost, function, future operation, and maintenance (Abu Bakar et al., 2011).

Traditional success measures for projects centre on the achievement of cost, program and quality objectives (Dainty, Cheng & Moore, 2003). Recently, the outcome projects can be improved, especially when projects can be accomplished with minimum cost, shorter time, maximum quality, and improved health and safety considerations. But, innovation can be measured considering the initial innovation objectives, without being restricted to typical project management performance standards. Innovation performance can contain measures that are related to environmental drivers such as reduction in energy consumption, decrease in waste and carbon emission, or just like other project objectives such as reduction in cost and duration (Ozorhon, 2013). Achieving innovation effectiveness requires greater commitment of cost, time, energy, and resources than a simple introduction of process innovations (Piening & Salge, 2015). Henceforth, large established organizations usually concentrate on improving their ability to manage their primary businesses, with a focus on incremental innovation, cost reduction, and quality improvements in products and processes. To withstand competitive advantage over a long term, well-established organizations can in parallel advance radical innovations as a base for constructing and controlling basically new markets (O'Connor & Rice, 2013).

In this research, it is imperative to recognize and understand the importance of project time, cost, and quality, and the influence they can have on the delivery of innovation in projects.

2.2.3 The Role of the project manager in projects

Project managers have main significant roles such as:

- *Delivering successful projects*: In most of the cases, a project manager is responsible for the successful completion of a project and is accountable for its planning, directing, assigning, and controlling functions (Bakar, et al., 2011).
- *Meeting project targets*: project managers are accountable for the overall success of a project, which can be reached when delivering the owner's targets within the agreed constraints of schedule, cost, safety, and quality requirements (Edum-Fotwe & McCaffer, 2000).
- *Fostering productivity*: productivity relies on many factors embracing motivation, precise instructions, balance between responsibilities and skills, expectations about technical challenges during activities, obtainability of materials and equipment, collaboration with other businesses, creativity, and focus on safety and quality (Rojas, 2013). This implies that motivating and encouraging productivity is one of the main roles of project managers.

- *Controlling financial and physical resources*: such control can bring projects to a successful completion in terms of time, cost, and stakeholders' satisfaction (Hills et al., 2008). This clarifies that control is a major role of project managers that can allow them to meet the main targets (cost, time, and quality) of a typical project.
- *Leading project team members effectively*: as in a project manager's absence, project team members may not have the skills and abilities to work proficiently with their problems regarding authority nor can they resolve problems relevant to communication and decision-making (Boss, 2000). Project managers also work hard on improving the outcome of their project teams (Arnold, 2013).
- *Addressing the needs of project team members*: Project team members can be satisfied only if their necessities are tackled through making them feel unique and needed, have impact, security, and control (Tanner, 2008).
- *Understanding the potential sources of conflict and realize when such conflicts may occur*: such knowledge will not only help project managers avoid delays in dealing with conflict, but also maximize new opportunities that may take place along with these conflicts (Jiang & Heiser, 2004).
- *Encouraging career development*: this is necessary since there is a demand to create better opportunities, perform better mentoring, support the act of moving up, and offer more hats. (Tanner, 2008).
- *Offering a better project culture*: this can be achieved through constructing a healthy environment, understanding the vision, reducing bureaucracy, communicating efficiently (Tanner, 2008).

In this research, recognizing the role of project managers in projects is essential, as this can be considered as a base to understand the competencies required by them to deliver successful innovation in projects.

2.3 The antecedents and challenges of innovation in projects

2.3.1 What is Innovation?

Duus (1992), in conjunction with Schumpeter (1934), has pointed out that innovativeness is a ‘‘profitable increases in economic efficiency brought about by the putting up of new resource combinations by entrepreneurs’’ (Duus, 1992, p. 5), and it can take place in methodology, organizational, technology, and market development (Duus, 1992; Schumpeter, 1934). But, innovation has been re-defined numerous times after that. Each definition has provided some characteristics about innovation, but the most commonly mentioned component in all definitions is ‘‘newness’’(Tewari, 2011). Innovation can be defined as an efficient application of creative ideas by organizations (Amabile, 2000). It is the creation, improvement, and application of ideas that are novel to an organization and has commercial or practical benefits, covering the adoption and implementing products or processes advanced outside an organization. (Park, Nepal & Dulaimi, 2004; Dulaimi, Nepal & Park, 2005). Innovation is a new idea that a client adopts in a project with the intention of gaining additional benefits, despite of any associated risks or uncertainties that might occur. Given that the new idea can refer to a novel technology, design, material, or technique used in the project (Ling et al., 2007). Innovation stands for an organization's ability to adopt new ideas, products, and processes effectively (Paladino, 2007). It is a new method of doing something, and a positive adjustment to make someone or something better (Tewari, 2011). It signifies something that is necessarily new; creating business value does not essentially have to be new to everyone. It can be new to customers, to an industry, or even a new process or business model that can deliver cost reductions (Samson & Gloet, 2014). Yet, innovation, by virtue of the definitions it has, is considered to be an iterative process that cannot become confined within an organization’s constraints of a chronological project management process (Murphy, Perera & Heaney, 2015). Considering all of these definitions, the current study considers innovation as any new idea, product, process, or service that is implemented and delivered successfully in projects.

2.3.2 Distinguishing among innovation, creativity, and risk

Now that the definitions and main types of innovation have been presented in the previous chapter, it is essential to have a thorough background about innovation. Innovation is a very important aspect that should be part of everyone's mind-set (Samson & Gloet, 2014). It is studied in many disciplines such as business, economics, engineering, science, and sociology (Racela, 2014). At this time of a highly competitive and rapidly changing world, innovation is a survival necessity (Sheu & Lee, 2011). It has great importance for organizations trying to grow in the existing markets (Ernst et al., 2015).

However, some individuals may still confuse the terms innovation, creativity, and risk. Innovation has been thoroughly defined in section 2.3.1. Yet, a wide range of the business literature uses the terms innovation and creativity interchangeably. Creativity and innovation are two distinct but related concepts. A good example of creativity can be idea generation or problem solving, while a good example of innovation can be the implementation of creative idea. While creativity is a significant characteristic for organizations to stay novel, the mere generation of ideas, regardless of practicality or quantity, has no direct influence on an organization's performance. Instead, ideas have to be put into effect for innovation to happen, and ultimately for performance outcomes to be recognized (Racela, 2014). Furthermore, now that the differences between innovation and creativity are understood, it is meaningful to mention that innovation cannot be applied in a haphazard way, but carefully planned and coordinated among relevant participants (Ling, 2003). Hence, risk and innovation are irrelevant concepts, where risk stands for a range of possessions linked to possibility, while innovation refers to a range of possessions linked to new action (Marshall & Ojiako, 2010).

Nevertheless, Samson and Gloet (2014) have clarified that it is essential for organizations to be aware that successful innovation involves an element of risk, although taking risk means an acceptance for some failures along with achieved successes. They also have insisted that innovative organizations should not shy away from any type of risk, in spite of the fact that many of them are risk averse (Samson & Gloet, 2014). This agrees with Seaden et al. (2003), who have argued that innovation can be considered as an added risk rather than being a source of competition.

In this research, in order to develop a clear picture about the delivery of successful innovation in projects, it is critical not to confuse innovation with other concepts such as creativity and risk. Therefore, it is worthwhile to clarify and identify the differences among these concepts.

2.3.3 Innovation process

Innovation process can be an alteration in the ways of performing business or creating products and services; anything that changes the way the job is done, the way the task is designed, or the way the implementation is performed (Smeds, 2001). Yet, a systematic innovation process is a series of phases that start from identifying a work opportunity to technology aspects to the implementation of a newly established technology, tools, and/or products (Sheu & Lee, 2011). Innovation process can have three main dimensions that are idea generation, idea championing, and idea application as shown in Figure 2.1. "Idea generation" takes place when individuals identify problems and opportunities, and create new ideas as solutions (Veenendaal & Bondarouk, 2015). A continuous entry of good ideas and their proper selection and management is thus critical to ignite the process to a new product, process, or services, and hence ideas are the initial point from where innovation starts (Ende, Frederiksen & Prencipe, 2015). ''Idea championing'' is about employees who can provide the required power to move a created idea into practice. These individuals can possibly be managers, members from other departments, or co-workers. ''Idea application'', is about integrating ideas that are generated and endorsed into business, and recognizing any ideas that can probably be realized and experienced. Most likely, the last two dimensions are regularly joined together and labelled implementation (Veenendaal & Bondarouk, 2015).

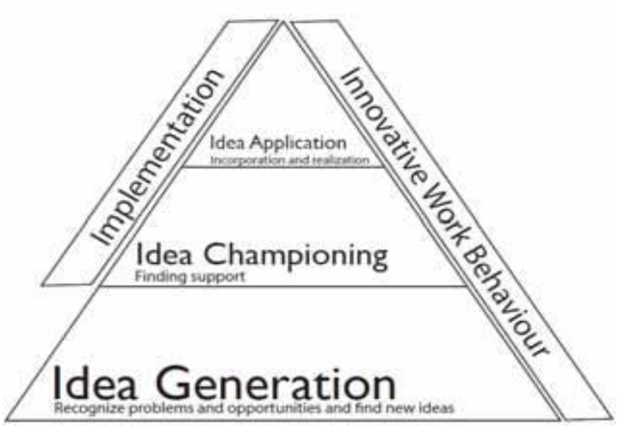

Figure 2.1: Innovation three dimensions process (Veenendaal & Bondarouk 2015, P. 142)

In addition, Figure 2.2 shows the stages that a typical innovator follows to develop innovation. As organizations improve their project management practices, they cycle through four stages process to deploy innovation. These processes are (1) realization of the new idea (2) standardization to increase the proficiency of practice, (3) tailoring the application to satisfy the organizational needs and increase effectiveness, and (4) pruning away any inessential practices through following up with spent efforts to increase the productivity of a tailored application (Thomas, Cicmil & George, 2012).

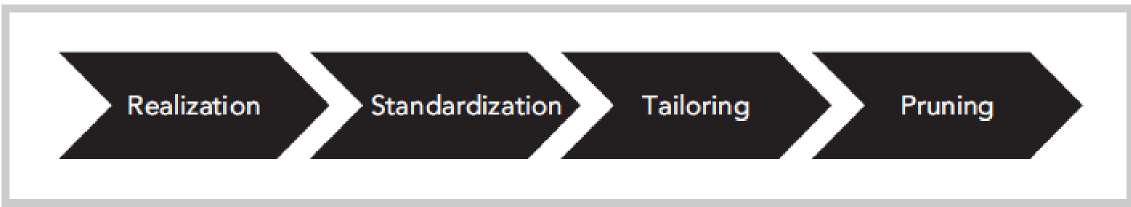

Figure 2.2: Process of project management innovation (Thomas, Cicmil & George, 2012, p. 83)

In this research, it is imperative to clarify the typical process of innovation, in order to have a better understanding about the steps that come before the delivery of successful innovation in projects. Besides, demonstrating the stages that a typical innovator follows to develop innovation helps in recognizing the project managers' competencies that can most probably influence the delivery of successful innovation in projects.

2.3.4 Innovation management

Knowing that innovation management techniques are essential for the final success of innovation process (Song, et al., 2015), it becomes crucial to fully understand how innovation can be managed effectively. Innovation management is about finding a balance among stimulating, supporting, controlling and setting direction. Stimulating and supporting refer to constructing a culture of creativity that offers employees and external users the means to produce, choose, and improve ideas. Here, the quantity and novelty of ideas is being increased. Control and setting direction refer to supporting ideas with the organization's goals through setting criteria, running processes, and ultimately selecting the best ideas. Here, the number of ideas is being reduced, and quality and usefulness for the organization's strategy is being increased. Accomplishing both steps concurrently produces tension. Managing this tension appropriately may lead to more valuable innovation outcomes. The challenge is thus to strike the correct balance between these two types of management activity (Ende, Frederiksen & Prencipe, 2015). Yet, innovation management is often initiated at senior management level (Thomas, Cicmil & George, 2012), and it covers five main processes that are (1) create innovation context, (2) management of innovation processes, (3) initiate innovation processes, (4) produce innovation content, and (5) implementing innovation results (Bossink, 2002).

In addition, innovation management can be considered as a social process due to the collaboration between individuals who have the ability to innovate and those who are influenced by innovation. Thus, there are two methods to effectively manage innovation that are individual innovation and organizational innovation. Individual innovation is about the creativeness of an individual; as the creativity fulfilment level of someone is affected by their natural personality and willingness to risk new ideas. Individuals may be able to use creative thinking strategies to think more creatively and achieve many tasks. Clearly creative individuals often have fresh ideas and are enthusiastic about sharing them. Organizational innovation stands for the creative skill of an entire organization. One way for improving an organization's innovation is through improving the creativity of existing employees within that specific organization (Tewari, 2011). Also, Gann (2000) have stated that innovation can also be managed among several parties, as it is essential for organizations to cooperate, diminish unnecessary boundaries, and for project-based organization to apply new functions and attain new competencies. Furthermore, the study of Holahan, Sullivan and Markham (2013) has advanced the understanding about innovation management, as it explains the varying levels of innovativeness (radical, more innovative, and incremental) as show in Figure 2.3. The uncertainty matrix refers to projects in the upper left or lower right quadrant as "more innovative," projects in the lower left quadrant as "incremental," and projects in the upper right quadrant as "radical." it also explains that innovativeness increases as projects move from low to high market and technological uncertainty (Holahan, Sullivan & Markham, 2013; Moriarty & Kosnik, 1990).

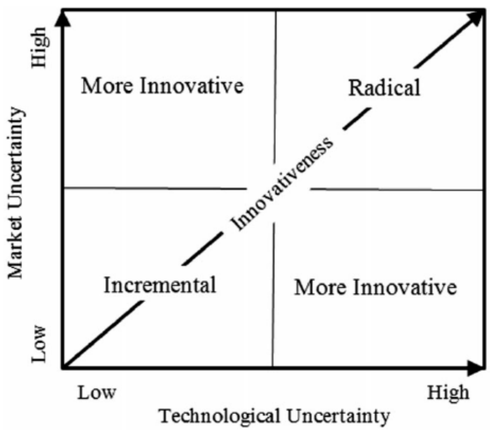

Figure 2.3: The uncertainty matrix (Moriarty& Kosnik, 1990 in Holahan, Sullivan & Markham, 2013, p. 332)

To sum up, two subjects can be pointed out when it comes to managing innovation in organizations. First, developing methods, approaches, and tools that allow for a greater number of ideas to be produced and are consequently aimed at generating variation. Second, emphasizing an appropriate management of the idea-generating phase (Ende, Frederiksen & Prencipe, 2015). Nevertheless, strengthening and enhancing innovation management is necessary for feasible market positioning and success. This can be achieved through three main steps that are (1) embracing advanced methods of management, (2) encouraging reestablishment and alterations of management structure for diversification and flexibility, (3) focusing on positioning of staff and supporting management innovation in Human Resource (HR) management with an emphasis on training, improvement, and continuous renewal of management ideas, (4) constructing a proper organizational culture and improving proficiencies through expressing management beliefs and creating unique management values to incorporate individual beliefs of employees into a distinctive management cultural trend (Shieh, 2011).

In this research, in order to deliver successful innovation in project, it is imperative to understand the concept of innovation management and the difficulties that can take place when dealing with uncertainty. Understanding these points will not only help in realizing the challenges that project mangers confront to deliver successful innovation in project, but also the competencies that they are expected to have in order to achieve such a target.

2.3.5 Benefits of innovation

Innovation can be very beneficial for organizations for several reasons. For example, innovative organizations focus on engaging individuals: ‘‘[i]f we want people to be innovative, we must discover what is important to them, and we must engage them in meaningful issues’’ (Wheatley, 2002, p. 12). This means that one of the benefits is engaging employees effectively in order to deliver successful innovation. Innovation can determine the technology choices of an organization and how such a technology can be leveraged to eventually create high quality innovations, leading to the required organizational outcome (Siguaw, Simpson & Enz, 2006). Here, it is understood that making the right selection of technology (high quality innovation) improves the overall outcome of an organization. Further, another concern is the benefits gained from creating a successful innovation culture, as such a culture by necessity is about moving away from old, occasionally comfortable and apparently active ways of doing business, by thinking thoroughly about innovative process and being committed to its policies (Shieh, 2011). This signifies that an innovative culture can improve the ways of thinking, performing, and reacting towards innovation. Innovation can also address customer needs/problems through producing new product/ process/ service (Sheu & Lee, 2011). Slater, Mohr and Sengupta (2013) have added that innovations offer exceptional customer benefits, extensive cost reductions, or an aptitude to create novel businesses, any of which may lead to better organizational outcome. Samson and Gloet (2014) have also supported this point through pointing out that innovation creates new forms of value for end users, as it decreases internal costs, constructs efficiencies and provides superior outcomes for customers, who may sometimes be part of the innovation process. The previously mentioned points about customers/end users indicate that customer satisfaction is one of the main benefits of innovation. Yet, in today's competitive environment, innovation can contribute to economic development, high living standards and competitive advantages (Ozorhon, 2013). Ende, Frederiksen and Prencipe (2015) have added that idea-generation activities have been gradually essential for organizations' upcoming competitive success. This means that innovation plays an important role in improving the economy, offering a better quality of life, and coping with existing competitions. Going beyond quality, the discipline and commitment that innovation passes to employees can be considered as benefits. This is supported by Samson and Gloet (2014) who have argued that innovations are not only associated with quality improvement, but also brings a robust sense of discipline and a commitment to it. Still, it is important to recognize that innovation benefits can vary depending on project objectives, as it may bring great financial benefits to one project, while it may only improve performance for the other (Ozorhon, 2013). In general, the benefits for organizations reside in the assumption that innovations that aim to shape future opportunities or advance present products, services, or organizational procedures and plans emerge out of novel internal or external ideas (Ende, Frederiksen & Prencipe, 2015).

There are four main factors that can considerably affect the extent to which innovation will be beneficial for project team members as well as that particular project. These factors are: the interest of project team members, work environment, configuration of task groups, and skills of individuals involved in innovation (Ling, 2003). Some other possible factors that can influence the benefits of implementing innovation are goals, capabilities, effective teams, coordination and monitoring techniques, special training opportunities, challenges confronted at project and management level, efforts made at project and management level, constraints, and commitment (Ling et al., 2007). However, innovation has many benefits that it can bring to projects such as:

- **Adopting new strategies:** new strategies such as being aware of clients operating costs, hiring experienced individuals, enhancing skills and knowledge of employees, using professional teams, advancing technological practices and capabilities, developing branded technologies are often shared by the most innovative organizations (Seaden et al., 2003).
- **Developing new managerial practices:** understanding the features of innovation projects and the uncertainty that encompasses them is important to develop proper managerial practices (O'Connor & Rice, 2013).
- **Emphasizing strong interest and commitment:** Innovation cannot be started without a strong management's interest and commitment towards it, and positive steps to motivate relevant players (Ling, 2003).
- **Becoming influential:** individuals who seek to be innovative often learn how to present ideas in a persuasive way, apply multiple influential tactics strategically and proficiently, attain continuous support, and overcome resistance of key stakeholders (Howell, Shea &

Higgins, 2005). Also, innovation benefits can be seen in an enhanced organizational image, recognition and awards, experience, knowledge transfer, sustainability, and future collaborations (Ozorhon, 2013).

- **Increasing organizational effectiveness:** innovative practices can also increase organizational effectiveness and convey long-term benefits to organizations (Dulaimi, Nepal & Park, 2005).
- **Attaining competitive advantages:** various organizations present new methods in information technologies, construction technologies, and business practices to establish a significant competitive advantage (Seaden et al., 2003). Also, the basic purpose of management introduced technological innovation is to enhance and maintain an organization’s competitive advantage (Jiao & Zhao, 2013).
- **Improving quality:** positive impacts of innovation can be seen in an improved quality (Ozorhon, 2013). Besides, tools in strategic quality management can create organizational conditions that develop innovations, initiate and supervise innovation process, present innovation content, and apply innovation in main processes of a specific organization (Bossink, 2002). Here, it is clear that quality tools are used indirectly and sometimes directly to manage innovation processes (Bossink, 2002).
- **Reducing cost:** it is important to note that innovation can bring financial benefits (Ozorhon, 2013), as it can offer substantial cost reductions (Slater, Mohr & Sengupta, 2013). Also, further cost savings in future projects can be feasible based on the acquired experience (Ozorhon, 2013).
- **Encouraging engagement and collaborative work:** project members are expected to encourage early engagement and collaborative work in projects to maintain trust among parties and thus enable innovation (Ozorhon, 2013).

- **Minimizing time:** time is an integral part of the setting of organizations, specifically as the speed of change in models resumes to mirror the rapid evolution of technology. The prominence of time can be magnified in the social background of organizational creativity, as innovation is becoming the main strategic orientation of organizations trying to accomplish a sustained competitive advantage in the present hypercompetitive, knowledge-rich, and global environment (Halbesleben et al., 2003). Yet, teams members may achieve some benefits such as reducing completion time (Ozorhon, 2013).
- **Satisfying stakeholders:** innovation brings substantial benefits to all stakeholders (Murphy, Perera & Heaney, 2015), as innovation can lead to client and end user satisfaction (Ozorhon, 2013).

In this research, recognising innovation benefits emphasizes the importance of delivering successful innovation in projects. The reason is that working hard to deliver successful innovation can maximize the benefits of innovation for a particular project. At the same time, this can encourage project manager to represent their best competencies that will enhance the delivery of successful innovation in projects.

2.3.6 Innovation diffusion theory

Rogers concerns about the diffusion of innovation have started in 1976, when he has mentioned that ‘‘ I believe that research on the diffusion of innovations has played an important role in helping put social structure back in the communication process’’ (Rogers 1976, p. 299). In 1995, Rogers have clarified that innovation is “an idea, practice, or object that is perceived as new by an individual or another unit of adoption” (Rogers, 1995, p. 11), while diffusion is “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995, p. 5). Thus, the Innovation Diffusion Theory (IDT) theory argues that the “potential users make decisions to adopt or reject an innovation based on beliefs that they form about the innovation" (Agarwal, 2000, p. 90).

It is important to be aware about the stages of an innovation-decision process, as this will help in gaining better understanding for the dimensions of IDT. Innovation-decision process is "an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation" (Rogers, 2003, p. 172). This process includes five main stages as shown in Figure 3.1, which are (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation that follow each other in a timely systematic manner (Rogers, 2003).

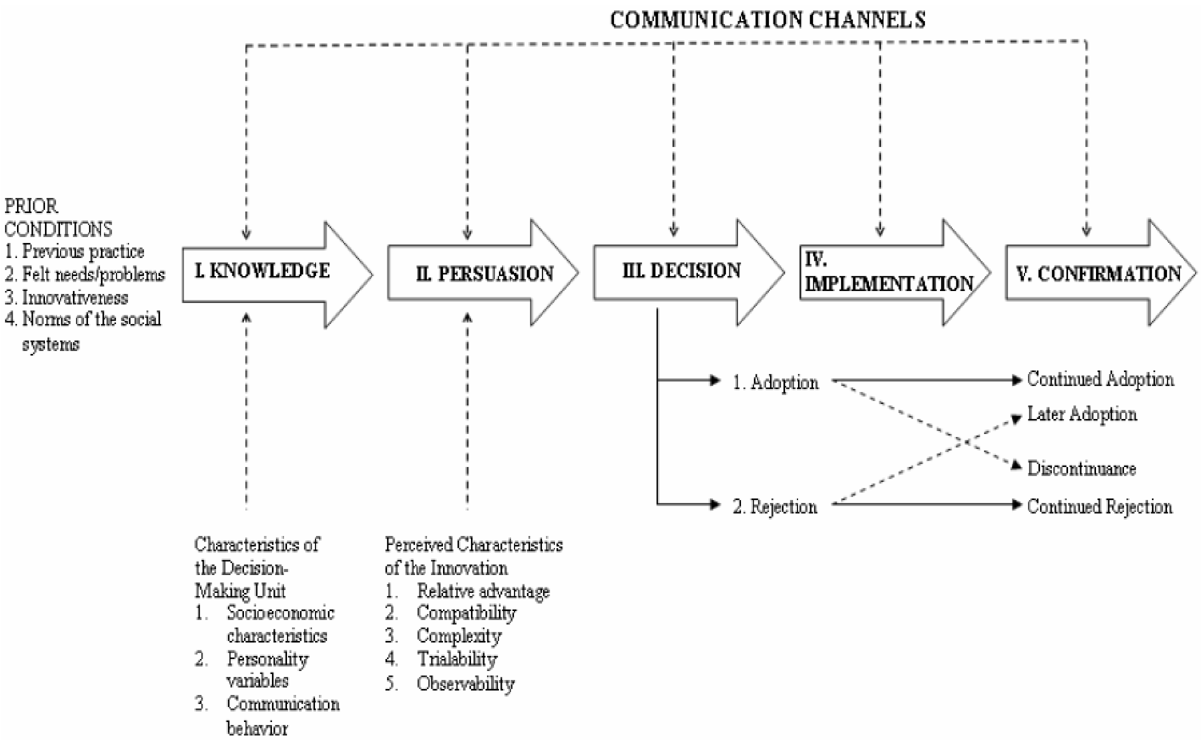

Figure 2.4: Five stages model for innovation-decision process (Rogers 2003 in Sahin, 2006, p. 14)

In particular, acquiring knowledge about innovation is often mediated by personality variables and socioeconomic characteristics (i.e. age or education). Persuasion is the following step at which users, once understand innovation, assess its characteristics (i.e. price, complexity or relative advantages). Based on their evaluation, users may have a positive or negative attitude towards the new product, which eventually can lead to a high or low willingness to pay for an innovation. Then, this subjective assessment of product characteristics leads to making a final decision on whether to accept or refuse an innovation. If convinced, users attempt to use innovation. At the implementation phase, users purchase innovation and evaluate its effectiveness. This evaluation leads to the confirmation phase, at which users choose whether to continue or discontinue using innovation (Franceschinis et al., 2017).

Rogers' theory suggests four key diffusion dimensions for any new technology that are perception of the characteristics of the innovation, communication channels, timing of adoption, and the social system (Rogers, 2003). The first diffusion dimension identified by Rogers is ‘‘Perception of the characteristics of the innovation’’. This dimension can be decomposed into measurable functional constructs that are (Rogers, 2003):

1. Relative advantage: “the degree to which an innovation is perceived as being better than the idea it supersedes” (Rogers, 2003, p. 229).
2. Complexity: “the degree to which an innovation is perceived as relatively difficult to understand and use” (Roger, 2003, p. 15).
3. Compatibility: “the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters” (Roger, 2003, p. 15).
4. Trialability: ‘‘the degree to which an innovation may be experimented with on a limited basis” (Rogers, 2003, p. 16).
5. Observability: “the degree to which the results of an innovation are visible to others” (Rogers, 2003, p. 16).

According to Rogers (2003), the second diffusion dimension is ‘‘communication channels’’. He has looked at communication as a defined process in which the participating members generate and share the information they have with each other to reach a common understanding. Also, he has added that communication has channels that connect sources to receivers, where a source is a person or an organization that initiates a message, and a channel is a means by which a particular message moves from the sender to the receiver. Roger has also stated that diffusion is a specific type of communication, which requires at least the following communication elements; an innovation, two main subjects (sender and receiver) or other units of implementation, and a communication channel between them. Yet, “diffusion is a very social process that involves interpersonal communication relationships” (Rogers, 2003, p. 19). Thus, interpersonal channels are more effective to change or create strong attitudes held by an individual (Rogers, 2003). The third and fourth dimensions for diffusion of innovation are relative ‘‘timing of adoption’’, and the ‘‘social system’’ (Rogers, 2003). He has argued that the adoption time of innovation can mostly be determined by the degree of innovativeness of an individual adopter. This measures how fast a subject embraces new ideas related to other individuals of her/his social system. Where, the social system is referred to as “a set of interrelated units engaged in joint problem solving to accomplish a common goal” (Rogers, 2003, p. 23).

Although it is well known that the IDT has a strong emphasis for customer satisfaction, in the current study, the researcher is adopting the decision making part of this theory. In justification, the ability of the project manager to apply the five stages of innovation-decision process suggested by Rogers (2003) and demonstrated in Figure 2.4, can indicate that the project manager innovation competencies can influence the delivery of successful innovation in projects.

2.3.7 Challenges of innovation

The challenges of successfully producing innovative products have received significant attention from organizational, strategic, and marketing perspectives (Bohlmann, et al., 2013). At the same time, projects may suffer from various barriers and resistance to innovations (Dulaimi, Nepal & Park, 2005). Unfortunately, some industries have historically failed to produce and maintain innovation to achieve the aimed benefits (Murphy, Perera & Heaney, 2015). This can happen due to the notable separation of the design and implementation phases of the improvement process. As new technology embraced during the design phase struggle to survive throughout the implementation phase to fulfil a complete and successful outcome. This in return requires an effective management of the project process in order to mitigate such a potential for failure (Murphy, Perera & Heaney, 2015). Further, innovation is complicated, as innovation activities may range from an introduction of novel products and processes to an introduction of innovative procurement and management strategies (Gray & Davies, 2007). Having a closer look at different projects, it can be realized that a project is a provisional inter-organizational venture that continues only for project duration. Inter-organizational coordination of these diverse organizations is considered to be a challenge in any project. Such characters make the initiation and implementation of innovation difficult and challenging (Dulaimi, Ling & Bajracharya, 2003). However, innovation has many challenges such as:

- **Innovation resistance:** it is a combination of limiting internal (i.e. social, economic, and psychological) and external (i.e. legal, industrial, political, and cultural) factors, preventing individuals as well as organizations from adopting innovation (Dibrov, 2015). This resistance is regularly described as a main challenge for individuals seeking to implement innovations in projects (Chuang, Jason & Morgan, 2011).
- **Innovation rejection:** some end users often reject innovations without bearing in mind their potential, such that the implementation process ends even before it really has started (Talke & Heidenreich, 2014).
- **Stakeholder needs are expressed inaccurately:** most of the end users and other stakeholders cannot accurately express their needs when introducing innovation (Song, et al., 2015).
- **Pressure from clients to meet targets:** innovation challenges may occur due to pressures

from clients to decrease costs, develop quality, and expedite implementation processes (Gann, 2000).

- **The diverse and challenging environment:** It is also clear that when considering diversity, situations can differ from one organization to the other. The reason is that organizations operate in diverse countries or regions, have distinctive histories, offer dissimilar services, present different cultures, etc. (Hartmann, 2006). Also, diversity affects an organization's ability to develop innovative products in the emerging markets (Bohlmann, et al., 2013).
- **The highly dynamic and unstable market:** where customer requirements are regularly changing, organizations struggle to increase their product innovation strategy implementation to seize any opportunities that can be provided in such environments and gain market share (Jayaram, Oke & Prajogo, 2014).
- **Getting adapted to the local market orientation:** more challenges can happen because of the local market orientation of typical implementation processes that can be a main element that separates one industry form the other. The nature of these different markets highly influences the potential for innovation among organizations (Reichstein, Salter & Gann, 2005).
- **High uncertainty:** there are four main types of uncertainty that are organizational, technical, resource, and market uncertainty (O'Connor & Rice, 2013). Each one of these classifications is explained in the context of innovation and differentiated through two further dimensions that are latency and criticality (O'Connor & Rice, 2013).
- **Lack of required mechanisms:** although some industries may lack the mechanisms to successfully implement new ideas, the process of innovation can be captured and conveyed together with project management process in spite of any challenges or complexities that

may occur (Murphy, Perera & Heaney, 2015).

- **Lack of appropriate facilities:** organizations may lack the facilities to use new methods to solve problems or combine existing resources in creative ways (Ernst et al., 2015).
- **Characteristics and structure of projects:** innovation appears less in some industries compared to others due to the characteristics and structure of both the projects and industry (Gambatese & Hallowell, 2011).
- **Innovation implementation time:** as with many complex innovations, the application process demands a substantial time for investment on the part of employees and specifically from managers responsible for scheduling (Chuang, Jason & Morgan, 2011).
- **Lack of proper conditions for the success of innovation:** problems in implementing innovation can occur due to failure to establish proper conditions for successful adoption, lack of an effective way of gaining, using and transferring their knowledge resources to suit the organizational context, unprofessional assessment of people (starting from managers to other stakeholders), or unsuitable organizational culture (Samson & Gloet, 2014).
- **Understanding and handling the common goals between innovation and industries:** it is necessary for professionals to be able to understand and handle the common goals of their industry and innovation. According to Dulaimi, Ling and Bajracharya, (2003), these goals often involve enhancing work quality within one's own organization, strengthening own organization's stake or influence in a project, improving performance of a whole project, and securing virtuous reputation. About the same issue, O'Connor and Rice (2013) have mentioned that well-established organizations usually concentrate on improving their aptitude to manage their primary businesses, with a focus on innovation, cost reduction, and quality enhancements in products and processes. While, Ozorhon (2013) have stated that projects can be improved, especially when projects can be accomplished with minimum

cost, shorter time, maximum quality, and improved health and safety considerations. He also added that innovation could be measured considering the initial innovation objectives, without being restricted to typical project management standards. Yet, time and financial constraints frequently reduce the potential to develop an idea that is ready for implementation (Hartmann, 2006).

- **Receiving adequate management support for innovation:** a main challenge for organizations pursuing to advance innovation management lies in figuring out when to provide managerial support, and realize how much support is needed to accomplish an innovative project (Kelley & Lee, 2010).
- **Other possible sources of challenge:** Sometimes project members may be reluctant to accept new ideas due to some challenges such as inexperienced employees, additional costs, unavailability of materials, and resistance to change. This can discourage the concerned individuals and can make them more reluctant to invest in new techniques (Gambatese & Hallowell, 2011). In addition, challenges typical for working in an innovation context involve high uncertainty, cognitive distances and high diversity, lower social cohesion and risky learning climate, low reciprocal commitment, low availability of resource, power differences, and absence of traditional hierarchical lines (Chatenier et al., 2010).

In this research, being aware about innovation challenges is imperative. The reason is that such an awareness will not only help in understanding the difficulties confronted by project manager toward innovation, but also the competencies that these project managers need to deliver successful innovation in spite of these challenges.

2.4 The delivery of successful innovation in projects

2.4.1 Innovative individuals

One of the main indicators used to evaluate the success of innovation is the availability of an active innovation champion (Gambatese & Hallowell, 2011), thus this section provides details about innovation champions and their main characteristics.

Innovation champion is any individual who develops innovative ideas and puts them into practice (Bossink, 2002). Also, an 'innovation champion' refers to any individual who practices to be a champion, knows how to present ideas in a persuasive way to use multiple influential tactics proficiently and strategically, works hard to attain support, and overcomes resistance of key stakeholders. They push vigorously for innovation and continue in spite of any obstacles that may occur (Howell, Shea & Higgins, 2005). These definitions indicate that an innovation champion can be anyone who does those actions (i.e. project manager or any team member), and thus there is an actual need for an energetic innovation champion, who can work effectively and faithfully to meet targets (Howell, Shea & Higgins, 2005), reduce cycle time, and provide new products to the existing market (Gambatese & Hallowell, 2011).
Keeping in mind that the chance of a new idea being realized largely depends on innovation players (Ling et al., 2007), other scholars have looked at a narrower picture of critical innovative individuals and referred to them as innovation leaders and/or innovation managers who are highly inspired and inflamed by innovation champions (Bossink, 2002; Klaukien, Shepherd & Patzelt, 2013). In explanation, it is very important to point out that innovation champions can base their innovative contributions to the process on the back-up they get from innovation leaders/ managers (Bossink, 2002; Klaukien, Shepherd & Patzelt, 2013), on the skills, abilities and flexibility to find out innovative solutions, the enthusiasm and interest for producing something novel, and the feeling of accountability for a sustainable improvement of the society (Bossink, 2002). Another

clarification that is concluded from this section is that an innovation champion can be anyone who delivers successful innovation effectively from the beginning to the end, including innovation leader, innovation manager, or any other innovative project team member. In particular, a brief description about an innovation leader and innovation manager is as follows:

a) Innovation leader

In line with the insights of Mumford and his colleagues (Mumford, 2000; Mumford et al., 2000; Mumford et al., 2002), leader abilities and skills can enable creativity as well as innovation in organizations. Such abilities and skills allow a leader to assist in developing strategic compensations, as organizations become more dependent on innovation to cope with product competition and market demands (Alldredge & Nilan, 2000). Likewise, ''*[t]his leader must support and encourage innovation, individual initiative, through the construction of competences centered on learning, on open communications that minimalize the costs of internal change and on the creation of cohesion in teamwork*'' (Montes, Moreno & Morales, 2005, p.1160). Leaders spend excessive energies and resources to develop the necessary social and technical skills of selected team members, devote noteworthy energies to communicate outside the assigned team, and generate an effective atmosphere in which team members can deal independently with others (Jassawalla & Sashittal, 2001). Further, the main responsibility of innovation leaders is to manage innovation processes in projects, as they frequently act as facilitators and stimulators of innovation processes. The leadership skills of innovation leaders is based on their knowledge, their responsibility for the degree to which innovations can be advanced, on passion and interest, or on accountability for an enhancement of the society. Most of the innovation leaders base their leadership skills on a combination of these insights (Bossink, 2002). Besides, an effective leader is often expected to acquire the essential competencies (i.e. work with people, lead change), skills (i.e. leadership, communication, conflict management,) and knowledge (i.e. project management) to construct an effective team (Tabassi, et al., 2014).

b) Innovation manager

Innovation managers can utilize new opportunities, recognize their own decision policies, and decrease faulty or premature innovation decisions. Their passion for work inspires their decisions to produce new opportunities. It is important for innovation managers to understand their own decision strategies and how their emotional experiences influence main decisions to exploit new opportunities. The work motivation of innovation managers does not arise from organizational targets to attain a definite innovation output, from social pressures to work long hours, from a changing pay compensation scheme, or from the need to receive a living for their family or retain a good lifestyle; rather, their motivation comes from their desire and willingness to work (Klaukien, Shepherd & Patzelt, 2013).

In this study, identifying the innovative individuals in projects is essential. The reason is that such individuals have specific competencies and personality traits that can help them deliver successful innovation in projects. Accordingly, the characteristics of innovative individuals can be narrowed down to perform a specific analysis about the project manager competencies and personality traits that are associated with delivering successful innovation in projects.

2.4.2 Innovation and Project Managers

Once project managers are fully persuaded about the advantages of innovations, they can adopt and carry them in a unique manner (Dulaimi, Nepal & Park, 2005). This indicates that convinced project managers act better towards innovation. In spite of the conventional role of PMs in controlling important factors such as time, cost, quality, safety, and environmental matters (Hills et. al, 2008), successful project managers in the longer term can bring active creativity and innovation benefits (Powl & Skitmore, 2005). Here, it is recognized that meeting the required cost, schedule, and quality has always been important for project managers, but currently delivering successful innovation is becoming a necessity as well. However, in order to deliver successful innovation, project managers have many responsibilities. For instance, project managers can promote innovative ideas openly, make thoughtful strategic decisions about the direction of an organization's innovation activity and offer hierarchical and systematic support during innovation process (Hartmann, 2006). They can also communicate the prominence of innovative solutions systematically, offer individuals freedom to become innovative and support innovative employees vigorously with their hierarchal potential (Hartmann, 2006). Project managers can provide enough resources and a continuous support to innovation and generate a favourable environment or organizational culture that cultivates and facilitates the project manager's role in embracing innovation in projects (Dulaimi, Nepal & Park, 2005). They can inspire others through following high ethical standards of behaviours, and avoid any dishonest practices that can weaken confidence and trust of the involved members (Hills et. al, 2008). Bearing in mind that projects embrace a large number of dissimilar specialists, project managers can play a distinctive and main role in collaboration among them so as to assure rational actions and realistic solutions to problems (Hills et. al, 2008). Further, the role of the project manager is basically to facilitate innovation on site and advance project outcome (Dulaimi, Nepal & Park, 2005). This emphasizes the main responsibility of project managers towards innovation, which working as facilitators for innovation.

In this study, understanding the role of project managers towards innovation is critical. Being aware about the main responsibilities that a PM has to facilitate, adopt, and accomplish innovation is considered to a main step in this study. The reason is that these roles and responsibilities are a good start to gain better understanding about the competencies and personality traits that can help project managers to deliver successful innovation on projects.

2.4.3 Innovation and Project Team

In general, a team can be described as a small or large number of individuals, who share commitment to a set of objectives and approaches for which they are equally accountable (Katzenbach & Smith, 1993). Project teams can contribute positively to the success of projects (Chen, 2002). They can also be looked at as diverse groups of individuals having different styles and skills, focusing on similar goals, and working together effectively (Tanner, 2008). This shows that in spite of the diversity of project team members, they still share the same goals. Project teams have special characteristics such as their ability to respect skills of all other team members, share common project goals, manage projects through behavioral principles, focus on results with responsibility, use goal-setting and problem-solving techniques to build ownership, apply team concepts genuinely, and communicate openly (Chen, 2002). Such characteristics can help in enhancing their outcome and achieving the required project targets. Hewage, Gannoruwa and Ruwanpura (2011) have argued that hard and fast work alone cannot enhance productivity, and that one of the most significant elements that can influence and improve the productivity of projects is the social skills and motivation of project teams. This clarifies that hard and quick work, combined with an appropriate set of social skills and motivation, can help in improving the outcome of projects. Abu Bakar et al. (2011) have added that the productivity and site attendance of project teams are primary for project success. This implies that field experience is also important for the success of project teams. Recently, project teams can attain better outcome when team compensation approaches are adapted and team development practices are encouraged (Tabassi, et al., 2014). This points out that it is imperative to motivate the good work of project team members through providing reasonable rewards and recognition. Eventually, it is critical to have an active project team that is skilful, knowledgeable, and have the capacity to realize the broader picture (Arnold, 2013).

In particular, considering innovation, a proficient workplace invests in its human resources and encourages their innovation and technical skills through team development (Tabassi, et al., 2014).

Hence, projects are temporary in nature, and similarly project team members are brought together temporary (Ozorhon, 2013; Wei et al., 2013). Teams are expected to be familiar and well attuned to the project's aims and missions, and the organization's system toward innovation (Wei et al., 2013). This helps in creating a strong project team. Simultaneously, the challenges confronted by management at the project level can be minimized through the existence of robust team spirit (Ling, 2003). Moreover, innovation can only be successful if project team members are greatly interested in it, during initiation and implementation phases, while practitioners are expected to control and manage the significant factors affecting the implementation of innovation (Ling, 2003). This implies that the interest of project team members in innovation can make it take place successfully. Innovation can also be effectively implemented when a project team's efforts and energies are put into carrying innovation through, considering expected goals, favourable outcomes and great commitment (Dulaimi, Ling & Bajracharya, 2003). Here, it is emphasized that project team efforts and energies are essential for delivering successful innovation. Yet, understanding individuals' reactions towards technological innovation from managerial viewpoint may be incomplete because while managers may argue how to make team members cope with or be committed to change, employees may be thinking whether that change is fair or justified. If project team members' cannot convince themselves that a particular change is fair, it is doubtful they will adopt the change, consider it reasonable, or make effort to guarantee its success (Jiao & Zhao, 2013). This argument points out that when project team members are persuaded about innovation, they will show full commitment towards it. Later, Weiss, Hoegl and Gibbert (2014) have argued that innovation project team members' insights can be influenced by two factors, which are the belief of the team being able to achieve a task and the task's workload. This means that in order to realize successful innovation, project team members need to have self-confidence that they can reach the required goals, and be aware about the load of tasks they are assigned to complete. Ultimately, it is significant to mention that there is a strong linkage between the team members' perception of the environment and their use of innovative practices (Seaden et al., 2003). This indicates that more innovative practices in environments can be subject to hasty technological change for all organizations (Seaden et al., 2003).

In this research, it is essential to realize and understand that the role of project teams is not only to achieve successful projects, but also to deliver successful innovation in projects. At the same time, this section indicates that project team members can provide a valuable feedback about the project managers' innovation competencies, personality traits, environment, and their ability to deliver a successful innovation in projects.

2.4.4 Innovation and the environment

In the recent dynamic environments, organizations are urged to regularly renovate themselves and become adapted to any environmental changes through introducing new products, processes or services (Song & Chen, 2014). But, this dynamic is not the only concern, as the competition also plays an important role. Jayaram, Oke and Prajogo (2014) have stated that in highly competitive environments, organizations may find it rather challenging to compete through providing superior products alone due to the high level of competition existing within the market. Yet, the complexity of environment is another main point. Hence, it is argued that ''[b]ecause firms today operate in increasingly turbulent and complex environments, they need to be more proactive and innovative'' (Rese & Baier, 2011, p. 138). However, innovation often takes place in a multiparty environment (Ozorhon, 2013), which can be external or internal (Lloyd-walker, Mills & Walker, 2014) as discussed in this section.

Innovation environment can be affected by external factors. Khang and Moe (2008) have mentioned that a project environment typically stands for the relationship to existing external conditions and concerned stakeholders. External factors can be economical, political, geographical, social, cultural, technical, or competition (Belassi & Tukel, 1996; Shenhar & Dvir, 1996). This indicates that there are various sources of external conditions. On the other side, during the phases of projects, starting from initiation to handover, many interests can be influenced, in a favorable or unfavorable manner. The representatives of these interests are referred to as project's stakeholders. In general, the stakeholders present and clarify their requirements and expectations about the project. This generates a challenge for project team members to evaluate and fulfill their requirements and expectations (Olander, 2007). Hence, stockholders can be clients, contractors, designers, business associations, consultancy firms, research institutions, suppliers, customers (target end users), competitors, funding agencies, agencies of recipient governments, and implementing agencies (Bossink, 2002; Khang & Moe, 2008; Pellicer, Yepes & Rojas, 2010; West & Bogers, 2014). Here, it is clear that stakeholders can be many parties with different interests, which can somehow affect the environment positively or negatively. But, thinking about innovation, the main focus can be given to customers, as their needs and requirements interact in a dynamic way. In order for any organizations to adopt innovation, it should first learn about customer needs. Organizations are even advised to go beyond the immediate customers' requirements and learn about the needs of the customers' customers and competitors (Bohlmann, et al., 2013). This helps organizations to focus resources that can more likely be accepted by customers, and deliver better innovative efforts (Bohlmann, et al., 2013). Yet, other factors can also affect the environment such as the need for novel kinds of infrastructures, market globalization, competitive pressure, communication, standards for environment sustainable processes and professional safety, superiority of suppliers of goods and services, innovation rules and taxes, ability to get loans, availability of skilled workers, and business culture (Pellicer, Yepes & Rojas, 2010). Ultimately, innovations can be acquired from external sources following two steps that are finding external sources of innovation, and then bringing those innovations into an organization. Using external sources can be cooperating with external stakeholders, gaining innovation that is “pushed” by external stakeholders, identifying particular sources of external knowledge (West & Bogers, 2014).

Innovation environment can be affected by internal factors. Gambatese and Hallowell (2011) have clarified that inter-organization environmental factors stand for the ability of an organization to implement efficient innovation, encourage value engineering, attain mutual targets, assign resources, share knowledge, improve technical capability, and obtain required competencies. Likewise, ‘‘organizational climate for innovation’’ term is often used to analyse environmental impacts. It stands for two main classifications that are ‘‘psychological climate’’ and ‘‘supportive organizational climate’’. Psychological climate is regularly determined at individual level. It indicates organizational expectations for implementing innovation and accomplishing potential outcomes. While, supportive organizational climate involves resource commitment (i.e. time, manpower, and money), failures and errors, creativity acknowledgement, innovative culture, strategic vision and risk tolerance (Dulaimi, Nepal & Park, 2005). Now, that the idea of internal environment is understood, more focus can be given to the innovative culture. The reason is that establishing an innovative culture is essential for innovative organizations, as it generates positive outcomes at the individual employee level. It demonstrates the role of employees’ attitudes, perceptions, and cognitions. Innovative culture enhances employees’ inputs in terms of organizational performance and competitive advantages. Employees working in an innovative culture can convert their job satisfaction into a better organizational performance (Wei et al., 2013).

However, it is significant to encourage innovation-supporting environments, as ‘poor’ environments can affect innovation negatively. For example, in a poor-resource environment, problems come form the lack of resources that can potentially lead to unfavourable results, the dissatisfaction of managers who prefer their organization to have more control on innovation initiatives, and the low-cost that may not be acceptable by professionals whose authority is partially articulated by the amount of resources they command and the complexity of the technological solutions they provide (Cunha, et al. 2014). This reveals that poor environments can suppress innovation. Therefore, Dul and Ceylan (2014) have pointed out that a creativity-supporting environment helps organizations become more advanced in terms of innovation development. The reason is that such an environment can support the creativity of employees who are directly or indirectly involved in innovation process, improve innovation in short term, and shape organizational cultures in long term (Dul & Ceylan, 2014). It is easy to observe supporting environments, as the workplace often focuses on physical elements (e.g., furniture, colours, plants) and social elements (e.g., individuals, groups) (Dul & Ceylan, 2014). Similarly, Khang and Moe (2008) have added that a favorable environment offers sufficient support from main stakeholders, provides suitable resources, produces positive conditions, attains management support, and presents adequate policies and regulations. Moreover, a favourable environment does not only positively influences product and process innovation (Jayaram, Oke & Prajogo, 2014), but also maximizes collaborations and decisions making abilities (Lloyd-walker, Mills & Walker, 2014).

In general, environmental factors that can act as catalysts or barriers to innovation are illustrated in Figure 2.4 (Lahi & Elenurm, 2015). In particular, innovation commonly is created in a multiparty environment and designed by project requirements, and this justifies why the environmental analysis is often done at project level (Ozorhon, 2013). Simultaneously, a project environment can be affected by internal factors (i.e. financial strength, knowledge strength, time needs, cooperative conduct, and service offer), or external factors (i.e. innovation acceptance of the client, procurement form, regulation degree, and dependency on client and location) (Hartmann, 2006). Now, in order to gain better understanding about the internal and external environment, it is essential to mention the main drivers of innovation. Such derivers can occur due to ‘demand-pull’ of user requirements that incorporates the regulatory environment, fiscal policy, trade and education policies, environmental policy, and competition policy. It can also take place as a result of 'technology-push' that can come from contractors, manufacturers, and suppliers within a particular industry, but more frequently includes the implementation of new technologies from other industries (Murphy, Perera & Heaney, 2015).

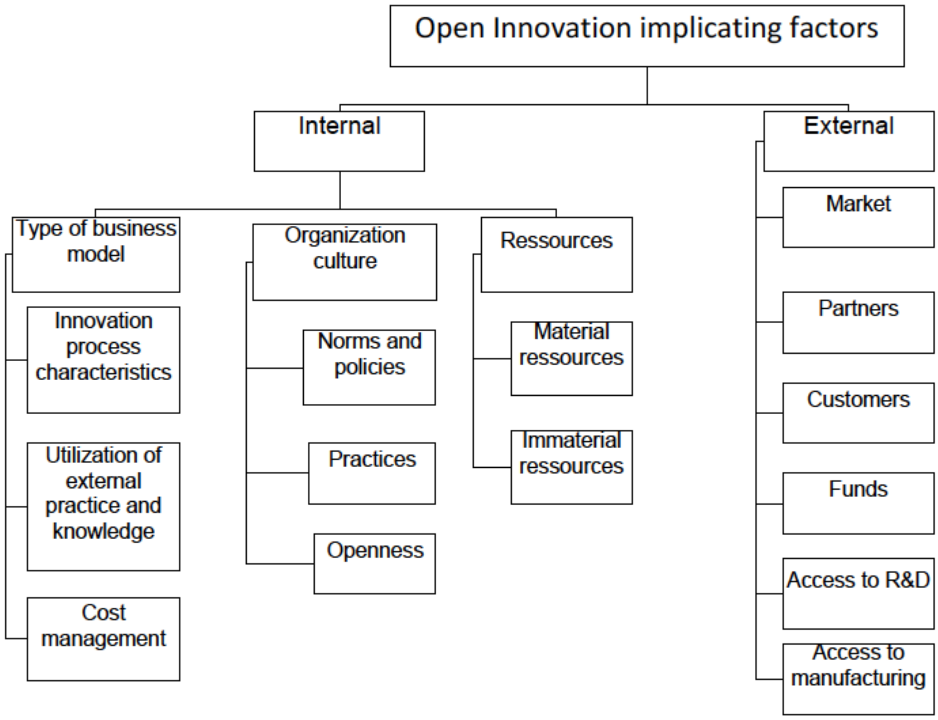

Figure 2.5: Environmental factors associated with innovation (Lahi & Elenurm 2015, p. 36)

Furthermore, project and industry stakeholders are usually strongly involved in innovation activities, as this in return can lead to better growth and development of projects as well as industries (Powl & Skitmore, 2005). Hence, the best way to design innovation is not only through drawing upstream and downstream parties together, but also through looking after their interests in a particular project (Dulaimi, Ling & Bajracharya, 2003). This agrees with Ozorhon (2013), who have argued that organizations do not often innovate by themselves, clients play a principal role in forming the project settings in which innovation can improved, and in realizing and communicating end user requirements to project team members. This points out the strong effect that clients and end users have on environment. Yet, the more clients are creative and innovative in their own business, the more likely that they will also be open minded about innovation (Hartmann, 2006). Also, recently, organizations are gradually concerned about establishing closer connections with customers and users that have traditionally been weak (Bygballe & Ingemansson, 2014).

Nevertheless, organizations can promote innovation on projects through creating appropriate organizational climate that encourages innovation and facilitates resource supply (Dulaimi, Nepal & Park, 2005). A positive organizational climate is very effective, as it inspires the creation of new ideas, a vigorous organizational structure that encourages efforts to determine and adopt new ideas, and a well-arranged core strategies and values to help in overcoming innovation challenges (Gambatese & Hallowell, 2011). This presents the importance of such a climate for the success of innovation. A supportive organizational climate in projects can involve acknowledging and rewarding creativity; showing commitment of required resources such as time, money, manpower, and information; producing an innovative culture that values innovation, change, and the organization strategic vision, among others; and presenting tolerance of risk, mistakes, and failure (Dulaimi, Nepal & Park, 2005). Such acts signify the existence of a positive and supportive environment for innovation in projects.

In this research, it is imperative to understand the internal and external environment that can influence the ability of project managers to deliver innovation. It is also important to recognize the difference between innovation supportive environment, and other environments that have many barriers for innovation. At the same time, this section demonstrates that the main environmental factors that can influence the delivery of successful innovation in projects are stakeholders, resources, culture, and market.

2.4.5 Factors influencing the successful delivery of innovation

In general, the business environment is a driving factor for innovation (Jayaram, Oke & Prajogo, 2014). In particular, this indicates that many factors within the business environment can influence the delivery of innovation. For example:

- Management competency can influence the management and delivery of innovation (Chatenier et al., 2010; Racela, 2014; Vila, Perez & Coll-Serrano, 2014). Project manager's competence contributes significantly in improving the outcome of project (Jha & Iyer, 2006). A detailed and extended explanation about this factor is provided in Section 3.3.1.
- Management practices factor is essential to achieve a successful management and delivery of innovation (Büschgens, Bausch & Balkin, 2013; Hosseini, Azar, and Rostamy, 2003; Samson & Gloet, 2014; Thamhain and Kamm, 1993). Top management in an innovation-oriented organization does not only motivate employees' interaction and innovation, but also value their ideas at all levels (Hosseini, Azar & Rostamy, 2003; Thamhain & Kamm, 1993). In addition, to inspire innovation, management needs to establish, clarify, and communicate organizational goals to organizational members (Song & Chen, 2014). This indicated the importance of management effective communication to attain the required targets. Besides, managerial practices require a fundamental structure to decide the culture required to adopt innovation, and to evaluate if a particular culture can be an effective cooperation instrument (Büschgens, Bausch & Balkin, 2013). This explains that an appropriate culture can improve management practices towards innovation. In details, management practices involving balanced autonomy, marked recognition, cohesive socio-technical systems and flexibility are crucial to innovation (Samson & Gloet, 2014). Such a balance can enhance the management and delivery of innovation.
- Management support is a significant factor (Ernst et al., 2015; Evanschitzky, et al. 2012;

Siguaw, Simpson & Enz, 2006; Wei et al., 2013). One of the most effective ways to foster employees' innovation is through management, as they understand, inspire, enhance, and direct the readiness of employees to apply their energy and multiplicity of ideas in the service of a particular set of collective beliefs and understandings, to help in orienting or guiding an entire innovation community (Siguaw, Simpson & Enz, 2006). However, management support that can (positively or negatively) influence the management and delivery of innovation appears in many forms. For example, management makes sure that team members are familiar to the project's mission, aims, and systems of the organization toward innovation. They also communicate the usefulness of innovation to the involved employees and generate strong employee awareness towards innovation (Wei et al., 2013). This means that management can successfully support innovation through effective communication. Besides, management support can appear in different ways, as management can develop products for emerging markets by creating a separate and more flexible processes, producing a separate team or business unit, staffing teams with members from present markets, or even relocate important business tasks (Ernst et al., 2015).

- Organizational culture can be a main factor (Büschgens, Bausch & Balkin 2013; Evanschitzky, et al. 2012; West and Bogers 2014). Evanschitzky, et al. (2012) have stated that culture has a moderating effect on innovation, as working in diverse cultures will result in having different backgrounds that can influence the success of innovation. This clarifies the influence of a diverse culture. Then, Büschgens, Bausch and Balkin (2013) have mentioned that organizations that are well known for their ability to produce and commercialize new technologies regularly emphasize a unique culture. In order to clarify their point of view they have added that there is no good or bad about cultures, as in some cases it may decrease an organization's willingness to innovate, and still it may be positive regarding achieving other organizational goals. Here, it is understood that although cultures may be unique in nature, their influence (positive or negative) on the management or delivery of innovation will remain unpredictable. Recently, West and Bogers (2014) have confirmed that organizational culture plays an important role in the ability and willingness of an organization to effectively gain benefit from various sources of innovation.

- Market orientation has direct influence on the management and delivery of innovation (Evanschitzky, et al. 2012; Paladino, 2007). The reason is that it enhances the ability of management to encourage the effectiveness of an innovation activity (Paladino, 2007). However, market orientation is often associated with other terms that can play a significant role in the management and delivery of innovation such as market potential (Evanschitzky, et al. 2012; Rese & Baier, 2011), marketing synergy (Evanschitzky, et al. 2012; Rese & Baier, 2011), Marketplace characteristics (Evanschitzky, et al. 2012), proficiency of marketing activities (Rese & Baier, 2011) and marketing task proficiency (Evanschitzky, et al. 2012).
- Degree of formalization is another principal factor (Evanschitzky et al. 2012; Song & Chen, 2014), as organizations can succeed in launching innovation using effective formal rules and procedures (Song & Chen, 2014). Formalization helps in identifying roles and responsibilities within an organization; facilitates the management of collective action; and stores previous knowledge and experience to enable better performance of current action (Song & Chen, 2014). This indicates the benefits of formalization that can increase when the degree of formalization increases. Yet, the significance of formalization for product innovativeness differs according to market growth rate. In case of a low growth market, it has an effect on product innovativeness because the preceding best-practice frameworks are applicable under existing market conditions. While, in case of a high growth market, the

effect of formalization is negligible most likely because former policies and procedures are neither appropriate nor harmful to product innovation in present market environments (Song & Chen, 2014).

- Risk taking can be considered as one of the factors that affect the management and delivery of innovation (Marshall & Ojiako 2010; Samson & Gloet 2014; Seaden et al., 2003; Song & Chen, 2014). Seaden et al. (2003) have mentioned that innovation can be considered as an additional risk, Samson and Gloet (2014) have explained that successful innovation involves an element of risk, while Song and Chen (2014) have pointed out that risk taking is important especially when allocating resources to innovative projects in emergent way. Besides, Marshall and Ojiako (2010) have clarified that although innovation and risk are different concepts, innovative actions may have complicated effects upon actors' overall risk experiences, create new risks, increase or mitigate old risks, and modify overall risk exposures in ways that are not easily expected. This argument can confirm that risk taking is part of innovation. In explanation, although taking risk enables organizations to accept the risk of adopting new ideas, it may decrease innovators' motivation to succeed (Song & Chen, 2014). Innovation does not rely on taking extreme amount of risk, as those who create ‘‘true innovation’’ must practice judgments through performing strategic planning, facilitating cautious direction through formal policies and procedure, and allowing for emergent coordination (Song & Chen, 2014). Another way could be risk shifting, as it boosts risk-taking behaviors, and it is a way to inspire people to work on new ideas to produce innovative products. The problem is that it has its disadvantages, because the benefits of risk shifting may outweigh spent costs (Song & Chen, 2014).
- Organizational design is another critical factor (Evanschitzky, et al. 2012; Song & Chen, 2014). An organization design has three main attributes. First, the attributes of a control-

oriented organization; introduce order, create direction, maintain best practice structure, support rule following behaviors, and exploit organizational knowledge (Song & Chen, 2014). These attributes affect innovation, as it tends to decline with market growth. Second, the attributes of flexibility oriented organization; tolerate risk taking, endorse investigations, support flexibility, allow for adjustments, and exploit on local knowledge (Song & Chen, 2014). These attributes affect innovation, as it rises with market growth. Third, strategic planning is also a significant attribute that has a positive effect on product innovativeness. It is imperative to form strategic direction, and obtain resource commitment for nnovation (Song & Chen, 2014). This attributes positively affects innovation, irrespective of the market growth.

- Organizational redundancy is another factor, as it is contributory in determining practical consistency and enabling functional cooperation in the initiation of innovative products (Song & Chen, 2014). The impact it has on innovation differs with market growth. In high growth markets, it has important impact on innovation, as the benefits of outweigh costs. The reason is that organizational redundancy escalates reliability and enables common modification in dynamic environments. While, in low growth markets, its effect on innovation is negligible, as the cost of organizational redundancy can be approximately equal to its benefit (Song & Chen, 2014). This indicates that organizational redundancy can directly influence the management and delivery of innovation.
- Capabilities can play a substantial role, as organizations can successfully innovate when they improve, clarify, integrate and use an appropriate set of capabilities (Reichert et al., 2016; Zawislak et al., 2012). There are four main capabilities required to enhance innovation, which are development, operations, management and transaction (Reichert et al., 2016). Individual capabilities, by themselves, cannot lead to innovation success (Reichert et

al., 2016). In other words, development and transaction capabilities are not enough for achieving successful innovation, unless they are combined with either a management or an operations capability. This signifies that in order achieve a successful management and delivery of innovation; it is preferred to combine development and transaction capabilities along with management and operations capabilities in an effective way. Hence, managers may reveal potential techniques to support, train, develop, and combine such capabilities to attain effective and successful innovation (Reichert et al., 2016).

- Resources can be a factor that influences the management and delivery of innovation (Cunha, et al. 2014; Evanschitzky, et al. 2012; Paladino, 2007; Weiss, Hoegl & Gibbert, 2014). Managers looking for innovation and the success of new products should focus on developing resources within their organizations (Paladino, 2007). The reason is that resources have a critical relationship with innovation success, as an effective control of resources can expand an organization's tendency to innovate (Paladino, 2007). Besides, the capacity to be innovative in a resource-poor environment has some advantages. It allows organizations to respond more rapidly, to use resources ignored by others, target new markets creatively, encourage creativity, and inspire innovation (Cunha, et al. 2014). However, being more specific, material resources are important (Weiss, Hoegl & Gibbert, 2014), but dedicated human resources are more powerful to achieve innovation success (Evanschitzky, et al. 2012). The reason is that human resources involve teams or specific individuals, who are essential for the delivery and management of innovation (Weiss, Hoegl & Gibbert, 2014). This indicates that the effect of human resources can be more influential than other types of resources.

In this research, the main focus is about management (more specifically project managers') competencies and their relationship with the delivery of successful innovation in projects. Still, it is significant to realize the other factors that can influence the delivery of successful innovation in projects. The reason is that some of them can be used as moderators. For example, in section 4.3.3, stakeholders, resources, culture, and market are broken down to more specific criteria that are used to measure the project manager innovation environment, which is a main moderator for this study.

2.4.6 Project measurements and the delivery of innovation in projects

The main measures of projects that are time, cost, and quality can be influenced by innovation (Bossink, 2002; Chuang, Jason & Morgan, 2011; Halbesleben et al., 2003; Hartmann, 2006; Jayaram, Oke & Prajogo, 2014; Kelley & Lee, 2010; Ozorhon, 2013; Slater, Mohr & Sengupta, 2013). In explanation, tools of tactical quality management are valuable in forming the organizational settings in which innovations can be advanced, managing and introducing a suitable innovation process, creating appropriate innovation content, and applying innovations in the main processes of a particular organization. `Quality management of innovation' is considered to be a subset of `innovation management' that sometimes participates directly, and in most of the cases indirectly, to the progress of innovations. Quality management can support deliberately the management of innovation. As tools in strategic quality management can create organizational conditions that initiate, apply, and develop innovation. In short, quality tools are used indirectly and sometimes directly to manage innovation processes (Bossink, 2002). Regulations can play a significant role in projects, as they can stop legal disputes by defining the quality of services to be provided (Hartmann, 2006). Although it is commonly believed that new products are likely to be of high quality, high performing and quality products do not necessarily have to be very innovative or new to positively affect business performance (Jayaram, Oke & Prajogo, 2014). Furthermore, time is an integral part of the context of organizations, specifically as the speed of change in models continues to mirror the quick evolution of technology. The prominence of time is magnified in the social setting of organizational creativity, as innovation has become a strategic orientation of organizations trying to accomplish a continued competitive advantage in today's environment (Halbesleben et al., 2003). As with many complex innovations, the application process demands a substantial time investment on the part of employees and specifically from managers responsible for scheduling (Chuang, Jason & Morgan, 2011). Time and financial constraints frequently reduce the potential to develop an idea that is ready for implementation (Hartmann, 2006). Thus, it is important to note that innovation may bring remarkable financial benefits in one case, while it may only develop environmental performance in other cases (Ozorhon, 2013). Innovation can also offer substantial cost reductions (Slater, Mohr & Sengupta, 2013).

In this research, it is fundamental to understand the main project measurement that can identify successful projects. In this section, it is obvious that time, cost, and quality are key measurements for successful projects, and thus they can be used to study the successful delivery of innovation in projects. The successful innovation: time outcome, cost outcome, and quality outcome will be studied to measure the delivery of successful innovation in projects. In section 4.3.4, these factors are broken down into more specific criteria to obtain accurate results.

2.5 Summary

This chapter provides a thorough literature review about the delivery of successful innovation in projects. The temporary nature of projects, and the role of a project manager in the successful delivery of projects are important to deliver successful projects. The details about innovation background and challenges provide a clear picture about innovation: definitions, management, processes, benefits, and innovation challenges.

Chapter 3 Project Manager Competencies and Innovation

3.1 Introduction

This chapter provides a thorough literature review about the project manager competencies that are associated with innovation. It presents a robust background about competencies that involves competency definitions, types, relevant theory, and the relationship between personality traits and competencies. It also describes in detail the link between project manager innovation competencies and the delivery of innovation, covering explanations about project management competencies and the delivery of innovation; project manager competencies; project manager competencies and innovation; and project manager competency challenges to deliver successful innovation. This is followed by a demonstration of the existing competency models, and giving more focus to the project manager competency model. This Chapter clarified that there is a gap in literature about the relationship between the project manager innovation competencies and the delivery of successful innovation in project. As the research moves forward, the project manager innovation personality traits and the project manager innovation environment possibly have an impact on the main concern of this research, which is the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

3.2 Competencies background

3.2.1 Competency definitions

The perception of competency has its origins in the sociological analysis conducted by Selznick (1957), in which he has referred to what makes one organization better than other organizations (Eriksen and Mikkelsen, 1996). The definition of ‘‘competence’’ can vary with user needs and competency utilization (Hoffmann, 1999). This is inline with other authors, who have argued that there are no commonly agreed definitions or theories of a competency within the context of project management (Cheng et al., 2005). Indiscriminately, the term ‘competency’ is regularly used in research as a synonym to ‘competence’ and vice versa (Trivellas & Drimoussis, 2013). Boyatzis (1982) has defined competence as an underlying characteristic that could be a trait, skill, motive, an aspect of individuals’ social role or self-image, or knowledge that individuals use. Competency is also defined as the ability to encourage the existing business, while giving special concentration on the processes leading from changing work settings to realizing viable competitive advantage (Ulrich et al., 1995). This indicates that competencies can be adapted to cope with the changing conditions and work demands. Competence can be considered as how well an organization achieves its required activities that can be classified into organizational levels, such as an organization’s corporate core competencies, and business unit competencies (Mills, Platts & Bourne, 2003; Mills et al., 2002). A competency conception can be extended to inferior levels in a particular organization, such as individual and team levels (Eraut, 1994; Mills, Platts & Bourne, 2003; Mills et al., 2002). Drejer (2001) has combined these levels and mentioned that competency is the ability of individuals, groups, or organizations to combine and utilize resources such as knowledge, skills, and behaviours to accomplish the required activities. This definition points out a competency is not only concerned with individuals, but also with teams and organizations. Other authors have described competencies as a job-related personal attributes, considering knowledge, skills, and values as the main aspects that individuals draw upon to achieve their work effectively (Selmer &Chiu 2004). In line with this definition, Mashhoodi (2010) have argued that competence is one of those personal characteristics that enable individuals to successfully complete the tasks they are allocated for, where each competency is a unique combination of abilities, behaviours, knowledge, and skills. Skulmoski and Hartman (2010) have added that competencies involve behaviours, knowledge, personal characteristics, and skills that can be enhanced with experience and/or training. These definitions highlight the main attributes of a competence that are behaviours, knowledge, and skills. At a later stage, Long and Ismail (2011) have defined competency as a personnel related perception signifying a set of behavioral dimensions of an individual's efficient performance at workplace. This implies that competent professionals have personal credibility coupled with knowledge and behaviours in a way that makes work practices align with and achieve industry goals (Long & Ismail, 2011). This is followed by the argument of Liikamaa (2015), who have mentioned that a competency is an individual's essential characteristic, which is causally connected to efficient outcome in a situation or job; competency can expect behavior in many situations and job tasks; Individuals need competencies, which are abilities to use knowledge effectively and to make things take place; competencies disclose what individuals are capable of doing and why they act in a particular way (Liikamaa, 2015). In addition, an individual's ability to accomplish a job can be named competency, but through time and further research competence is recently referred to other conceptions. Competency is a term broadly used, but can have different implications for different individuals. Competencies incorporate the skills, knowledge, practices and behaviours that are often linked with improved work performance (Anvari, Soltani & Rafiee, 2016). This indicates that with merely project management knowledge, an individual may not be competent. They may also recognize how to apply that knowledge and how to interact with human resources, behavioural and social matters. Most definitions of competencies cover all of these dimensions (Anvari, Soltani & Rafiee, 2016). ‘‘A competency focus is a modern version of the great person theory-generalizable competencies simply raise the question of how great the person’’ (Hollenbeck, McCall and Silzer, 2006, p. 408). A competency can be treated as a mediator that acts between job's requirements and individuals' capacity (Shet, Patil & Chandawarkar 2017). Nevertheless, knowing that ambiguity can exist in how "competency" is defined, Shet, Patil and Chandawarkar (2017) have provided different definitions from various perspectives to minimize confusions as demonstrated in Table 3.1.

Table 3.1: Definitions on competency/competencies (Shet, Patil & Chandawarkar, 2017, p. 3)

Author/Year	Definition
Boyatzis (1982)	As an essential characteristic of a person in that it may be a motive, trait, skill, aspect of one's self-image or social role, or body of knowledge which he or she uses
Spencer and Spencer (1993)	An underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation
Dubois (1993)	A competency is the capability of applying or using knowledge, skills, abilities, behaviours, and personal characteristics to successfully perform critical work tasks, specific functions, or operate in a given role or position
Quinn, Faerman, Thompson, and McGrath (1996)	Competency that recognizes the importance of skills, knowledge and personal characteristics and the linkages between possessing these competencies and performing certain tasks or roles
Wynne and Stringer (1997	As the things people have to be, know and do, to achieve the outputs required in their job
Tas (1988)	Competence as performance of duties based on one's ability to accomplish specific job related tasks and assume the role connected to the position
Lucia and Lepsinger (1999	Competencies, or individual characteristics, were recognized as significant predictors of employee performance and success, equally as important as an individual's academic aptitude and knowledge content as indicated by tests scores or results
Hoffmann (1999)	Summarized three key points in defining a competency: (a) underlying qualification and attributes of a person, (b) observable behaviours, and (c) standard of individual performance outcomes
Van der Klink and Boon (2002)	Defined competencies in terms of three distinct perspectives: competencies as individual characteristics; competencies as characteristics of organisations; and the notion of competencies as a tool to structure and facilitate communication between education and the labour market
Bartram (2005)	As sets of behaviours that are instrumental in the delivery of desired results or outcomes

3.2.2 Types of competencies

There are many types of competencies that have been prepared by different scholars. The commonly types of competencies are:

- *Core competencies* are those abilities that strategically differentiate an organization. They are a set of harmonized, integrated abilities that discriminate an organization in the marketplace (Prahalad and Hamel, 1990). A core competency involves all needed abilities to deliver an internal advantage (i.e. a new technology) to the market resulting in competitive advantage (Wind & Mahajan, 1988).
- *Professional competencies* are a combination of knowledge obtained, and skills attained by experience and the implementation of the acquired knowledge (Edum-Fotwe & McCaffer,

2000; Isidro-Filho et. al, 2013). Professional competencies offer a wide overview about behavioral competencies, as they include job, technology, and service oriented behavioral competencies as provided in Table 3.2. They are described by the way in which people reflect, apply, and alter their knowledge, skills, and attitudes in the workplace. The professional competencies are mainly designed to encourage professional growth and to overcome obstacles, hence assuring better performance at work (Isidro-Filho et. al, 2013).

Table 3.2: Professional competencies (Isidro-Filho, et. al 2013, p. 127).

Sl. No.	Professional Competencies
1	Work-Oriented Behavioral Competencies
a.	Show due attention when using the systems and equipment in my daily work.
b.	Ability to communicate clearly & objectively with my colleagues at work.
c.	Contribute to the quality of the hospital services by performing my activities at work to the best of my abilities.
d.	Willingness to learn new skills & knowledge needed to carry out my activities at work.
e.	Show ability to work in a team.
2	Service-Oriented Behavioral Competencies
a.	Describe the characteristics of the products, & services offered by the hospital.
b.	Identify the contribution made by the implantation of new technologies to improve the hospital's quality of service.
c.	Correctly describe the functionality of the systems, equipment, & technological resources used in my daily life at the hospital.
d.	Describe the contributions of the work carried out in my sector to improve the hospital's quality of service.
3	Technology-Oriented Behavioral Competencies
a.	Identify solutions for problems caused by the inadequate use of the systems and equipment used in the workplace.
b.	Handle systems, equipment, & technological resources correctly at work on a daily basis.
c.	Insert data into the systems correctly and fully in accordance with the standards required by the hospital
d.	Maintain and duly update the systems I use at work.
e.	Ability to quickly locate information in the systems or technological resources that I use at work.

- *Job-task competencies* or *work-related competencies* are a range of functional measures (specific to the industry) in which project managers are assessed (Ahsan, Ho & Khan, 2013; Cheng, Dainty & Moore, 2005). *Job-task competencies* are very specific to the industry in which project managers work as shown in Table 3.3. They can be used to inspire improvement of project management activities and professional standards. These competencies indicate a clear set of practical performance measures for a specific project management role (Ahsan, Ho & Khan, 2013; Cheng, Dainty & Moore, 2005). Through embracing this perception, it becomes easy to realize that this type of competencies is an attribute of both job itself and the jobholder. Hence, job-task competencies are context sensitive: they define managers' actions in organizations, not what management theories or psychology say should be essential for a project's success (Cheng, Dainty & Moore, 2005).

Table 3.3: Job-task competencies (Cheng, Dainty & Moore 2005, p. 30)

Sl. No.	Job-task competencies
1	Ensure work is properly considered prior to work starting
2	Deliver the job to client satisfaction and maintain long-term relationships
3	Maintain budgetary control and maximize the company's profits
4	Ensure that the project is completed within the original program requirements
5	Ensure that the quality of the end product meets all stakeholder expectations
6	Adhere to health and safety and environmental standards
7	Ensure all staff and supervisors are aware of their roles and responsibilities
8	Ensure that design and other production information is appropriately and effectively communicated to members of the project team
9	Promote continuous improvement through team learning and development
10	Promote and share knowledge
11	Champion company standards and approaches
12	Input into tendered work and submissions
13	Chair meetings and coordinate activities
14	Employ, coordinate and ensure the co-operation of supply chain partners

- *Behavioral competencies* are typically generic in nature (Ahsan & Khan, 2013; Cheng, Dainty & Moore, 2005; Park, Nepal & Dulaimi, 2004). Hence, innovation methods can be clarified in terms of behavioral dimension, in spite of the fact that some other individuals or situational factors may impact innovation (Park, Nepal & Dulaimi, 2004). However, although Brophy and Kiely (2002) have mentioned that it is still uncertain whether the elaboration of generic competency profiles is achievable, other scholars have argued that innovation relies on true associations that are indivisibly related to behavioral drivers (Lloyd-walker, Mills & Walker, 2014). Table 3.4 provides a list of 12 core behavioral competencies of project managers (Cheng, Dainty & Moore 2005; Dainty, Cheng & Moore, 2004; Dainty, Mei-I & Moore, 2005). Later, these competencies have been re-categorized into five more specific clusters using a different study done by Dainty, Mei-I & Moore (2005) that is keen about comparing behavioral competencies of client-focused and production- focused project managers. The new categories are (1) achievement and action oriented competencies, (2) impact and influence based competencies, (3) managerial competencies, (4) cognitive competencies, and (5) personal effectiveness competencies.

Table 3.4: Behavioural competencies (Cheng, Dainty & Moore 2005, p. 30; Dainty, Cheng & Moore, 2004, p. 881; Dainty, Mei-I & Moore, 2005, p.6)

Sl. No.	Behavioural Competencies	Sl. No.	Behavioural Competencies
1	Achievement orientation	7	Team work and cooperation
2	Initiative	8	Team leadership
3	Information seeking	9	Analytical thinking
4	Focus on client's needs	10	Conceptual thinking
5	Impact and influence	11	Self-control
6	Directiveness	12	Flexibility

- *Managerial competencies* emphasize an explicit description about behavioral competencies. They express behaviors that lead to the anticipated level of a project manager's performance (Konigova & Fejfar, 2012). They also indicate the skills that proficiently escalate the characteristic behavior of a particular PM, to achieve a superior performance for a particular manager position. Managerial competencies can be categorized into three types: key, specific, and general. Key MCs are those that are central for a manager and that improve performance of workers. Specific MCs are essential to achieve required performance for a particular management position. General MCs are the capacity to provide quality job performance in any selected management position (Krajcovicova, Caganova & Cambal, 2012). Managerial competencies are related in a complicated way to managers' performance, being the core requirements for reliable performance throughout time (Bucur, 2013). MCs reveal behaviors that are linked with innate human beliefs that are rooted within cultural extents (Chong, 2013). In order to identify the managerial competencies that professionals need to enhance their performance and that of their organizations, they compel a better grasp of occupational competencies and organizational competencies (i.e. construction and project management, comprising advanced construction technology management, supervision of works and site management, and resource management), which some professionals may not fully gain from their formal education and training (Long, Ismail & Amin, 2013). Hence, in some cases the lack of managerial competencies among specialists can be a major influential factor in the lack of competitiveness of organizations in their efforts to secure projects (Long, Ismail & Amin, 2013). Examples of managerial competencies arranged by different scholars are provided in Table 3.5, Table 3.6, and Table 3.7 (Arditi, Gluch & Holmdahl, 2013; Chong, 2013; Konigova & Fejfar 2012).

Table 3.5: Managerial competencies (Konigova & Fejfar 2012, p. 74)

Sl. No.	Managerial Competencies	Sl. No.	Managerial Competencies
1	Leadership	6	Organizational Skills
2	Communicativeness	7	Proactivity
3	Flexibility	8	Decisiveness
4	Comportment	9	Loyalty
5	Responsibility	10	Self Confidence

Table 3.6: Managerial competencies (Chong, 2013, p. 349)

Managerial competencies	
Organizational and strategic awareness	Oral communication
Analysis and judgment	Energy and initiative
Planning and organizing	Interpersonal sensitivity
Managing staff	Adaptability and resilience
Persuasiveness	Distinct competencies business sense
Assertiveness and decisiveness	Achievement-motivation

Table 3.7: Managerial Competencies (Arditi, Gluch & Holmdahl, 2013, p. 986)

Managerial competencies		
Initiative	Quality focus	Business awareness
Risk taking	Oral communication	Learning orientation
Innovation	Sensitivity	Authority/Presence
Flexibility/Adaptability	Relationships	Motivating others
Analytical thinking	Teamwork	Developing people
Decision making	Achievement	Resilience
Planning	Customer focus	

- *Entrepreneurial competencies* are experience based, and are not closely tied to certain projects. They can enhance the ability to size complex situations and properly judge which opportunities are worthy, which are not (Lampel, 2001). Entrepreneurial competencies include technical, evaluative, and relational competencies (Lampel, 2001). The key characteristics of entrepreneurial competencies in Engineering Procurement Construction are demonstrated in Table 3.8.

Table 3.8: Entrepreneurial competencies (adapted from Lampel, 2001, p. 475)

Entrepreneurial competencies
Based on a mixture of market experience and intuitive understanding of clients' needs it gives firms the ability to: Detect and develop opportunities Assess complex and fluid situations Sell project ideas to clients
Technical competencies Based on analysis, but reinforced by tacit technical knowledge, it gives firms the ability to: Use technological assets and know-how Move knowledge quickly from one task to another Absorb knowledge from external sources
Evaluative competencies Based on an interaction of human judgement and information systems it gives firms the ability to: Estimate cost and returns on projects Estimate schedules Estimate partner and subcontractor risk
Relational competencies Based on social, psychological, and cross-cultural skills it gives firms the ability to: Manage relationships with clients, suppliers, and partners Avoid and resolve disputes Adjust team dynamics in the face of unforeseen contingencies

- *Management competencies* have different levels and types. For example, Loufrani-Fedida and Missonier (2015) have categorized competencies into three main levels that are individual (i.e. project manager), collective (i.e. project team), and organizational (i.e. integration and coordination of skills and technologies). At this organizational level, there are two types of competencies particularly for innovative projects, which are *functional competencies* (i.e. meeting clients' needs and adapting to changing contexts) and *integrative* *competencies* (i.e. effectively combine and coordinate the different functional competencies employed in a project). In the same year, Liikamaa (2015) has classified three clusters of competencies that are required to distinguish outstanding from average project managers, which are (1) cognitive competencies (i.e. pattern recognition and system thinking), (2) emotional intelligence competencies (i.e. emotional self-control and self-awareness), and (3) social intelligence competencies (i.e. relationship management competencies and social awareness).

Yet, as one main outcome of their literature review, Shet, Patil and Chandawarkar (2017) have summarized the main classifications and categorizations of competencies as shown in Table 3.9.

Table 3.9: Classification/categorisation of competencies (Shet, Patil & Chandawarkar 2017, p. 6)

Author/Year	Classification and categorisation of competencies
Spencer and Spencer (1993)	Threshold competencies and differentiating competencies
Kuijpers, Schyns, and Scheerens (2006)	Functional. Learning and career competencies
Abraham et al. (2001)	Problem skills, result focused, leadership, customer oriented, flexible, team worker, quality oriented, dependable, communication and interpersonal skills
Rothwell (2002)	Foundational and intermediate competencies
Jacobs (1989)	Hard and soft competencies
Prahlad and Hamel (1990)	Core competencies
Thomas and Sireno (1980)	Control, leadership and communication competencies
Raven and Stephenson (2001)	Meaning, relation, learning and change competence
Hunt and Wallace (1997)	Leadership, strategic management, administrative. Problem solving, decision-making, networking and political skills
Boyatzis (1982)	Leadership, HRM and goal and action management
Le Deist and Winterton (2005)	Functional competencies with underpinning behavioural competencies

3.2.3 Distinguishing among competencies, capabilities, and skills

There is a need to distinguish competencies from two main terms that are capabilities and skills, as follows:

First, capabilities can be defined as a subset of abilities that helps in creating new products and processes, and responding to changing market circumstances (Teece, Pisano, & Shuen, 1997). Capabilities refer to an organization's capacity to utilize resources, regularly in combination, employing organizational processes to achieve a desired end. Different from resources, capabilities are based on carrying, exchanging, and developing information within the organization's human capital (Saá-Pérez & GarcÍa-FalcÓn, 2002). A capability is an organization's ability to proficiently combine resources (i.e. human resources information, and technologies) to achieve a particular objective (Amit and Schoemaker 1993; Becker, Huselid and Beatty 2009). A capability does not only refer to a single resource, but also to a distinctive and superior way of allocating, utilizing, and integrating resources in specific business processes such as customer relationship, supply chain management, and product development (Schreyögg & Kliesch-eberl 2007). Moreover, Wang, Lu and Chen (2008) have argued that innovation capability is an indefinable, complex, and uncertainty concept that is very difficult to determine, whereas Zawislak et al. (2012) have defined it as the ability to understand, adapt and transform a specific technology into certain managerial, operational, and transactional practices that can lead an organization to improve its innovation outcomes. Zawislak et al. (2012) have clarified that the term capability may appear within different labels that have the same meaning such as specific skills, distinctive competencies, core competencies, human resources, invisible assets, repertoire of routines, absorptive capacity, organizational capabilities, technological capabilities, and marketing capability. Yet, Samson and Gloet (2014) have defined innovation capability as a set of factors that enable an innovative organizational climate and culture that leads to innovation performance and overall business success. It also involves knowledge, persistence, determination, resources and energy, and it demands a strategy reinforced by resources, measures, recognition and rewords (Samson & Gloet, 2014). Samson and Gloet (2014) have added that another critical concept is the ''sustained innovation capability''. Sustained Innovation Capability is composed of an integrated approach to innovation that covers innovation strategies, processes, behaviour/culture, rewards/recognition, and measures/payoffs.

Furthermore, capabilities also have different types. Zawislak et al. (2012) has mentioned four types of capabilities that are technology advancement capability, operations experience, management proficiency, and transaction capacity. In order to gain better understanding about these types pf capabilities, Table 3.10 provides definitions for each type. Zawislak et al. (2012) have added that organizations create specific capabilities and use them strategically in order to identify existing market gaps to be filled effectively with new offerings of value.

Table 3.10: Definitions of capabilities (Zawislak et al., 2012, p.17)

Capability	Definition
Technology Development capability	The ability that any firm has to interpret the current state of the art, absorb and eventually transform a given technology to create or change its operations capacity and any other capability aiming at reaching higher levels of technical economic efficiency.
Operations capability	The ability to perform the given productive capacity through the collection of daily routines that are embedded in knowledge, skills and technical systems at a given time.
Management Capability	The ability to transform the technology development outcome into coherent operations and transaction arrangements.
Transaction Capability	The ability to reduce its marketing, outsourcing, bargaining, logistics, and delivering costs; in other words, transaction costs

Second, some other studies clarify the differences between competencies and skills (Anvari, Soltani & Rafiee, 2016; Mashhoodi, 2010; Selmer & Chiu 2004; Skulmoski and Hartman, 2010). Changes in the current workplaces and the nature of work created new prospects for employees. Skills that have been considered crucial a decade ago can be less important. The reason is that new position titles and job types have occurred around new demands (Morris & Massie, 1999). The changing nature of work made it hard for academics and practitioners to identify skill sets that can be associated with the wide variety of jobs (Dench 1997). At the beginning skills have been described in terms of proficiency and/or knowledge required to accomplish tasks, but recently some personal attributes such as leadership and communication abilities are often considered as fundamental skills in job advertisements and position specifications (Wikle & Fagin, 2014). Fortunately, most people quickly understand the differences between the main two types of skills, which are hard skills (i.e.

working with data, equipment, and software) and soft-skills (i.e. interpersonal or intrapersonal focused) (Williams, 2001). This gives brief idea about skill types, as the following section discusses these types thoroughly. In addition, there are two main types of skills that are ‘‘hard skills’’ and ‘‘soft skills’’. Hard skills (technical) are particular abilities or competencies required to complete a certain job or series of various activities. They include expertise developed through education, experience, and/or training (Laker & Powell, 2011; Wikle & Fagin, 2014). On the other hand, “soft skills” (intrapersonal and interpersonal) are generic competencies such as efficient communication or an ability to work successfully within a positive environment (Laker & Powell, 2011; Wikle & Fagin, 2014). Soft skills are also intrapersonal skills such as an individual’s ability to manage oneself, and interpersonal skills such as how an individual handles his/her interactions with others (Laker & Powell, 2011). In comparison, hard skills are context specific, while most of the soft skills are transferable across employment levels and job types (Wikle & Fagin, 2014). Employees consider soft skills to be significant in making alterations to the changing work demands and environment (Broscow & Kleiner 1991). Also, employees with well-built soft skills are able to compete effectively for promotions and pay increases (Wikle & Fagin, 2014).

Nevertheless, it is principal to differentiate among the concepts of competency, capability, and skills. Using The Online Oxford English Dictionary (2017), basic definition state that capability is described as the ability or power to perform something, competency is the ability to perform something successfully or proficiently, while skills is the ability to perform something well; proficiency. From the first glance these definitions may appear to be similar. But, when conducting a closer examination, it becomes easier to realize the differences among them. At the beginning, capabilities are compared with competencies. Here, it is possible to recognize that some scholars have argued that a competency can be defined as a ability and capacity of a specific organization to generate continuous innovation (Goswami & Mathew, 2011; Liikamaa, 2015). Capabilities can involve abilities, knowledge and skills that can lead managers to undertake different strategic actions, which in return produce different outcomes for organizations (Thompson & Heron, 2005). Whereas, a competency is defined as "a capability or ability… a set of related but different sets of behaviour organized around an underlying construct" (Boyatzis, 2008, p. 6). This is in line with other authors who have argued that a competency can be considered as the ability of using and structuring resources for any productive purposes in some way that possibly brings a competitive advantage (Christensen, 1996; Grant, 2005). Yet, others have disagreed with them and pointed out that a ''[c]ompetence to perform a task is far beyond the capability of doing it'' (Anvari, Soltani & Rafiee, 2016, p. 191). Another argument has pointed out that in order ''to tackle the changes existing in the environment, organizations also need to develop a series of specific capabilities and to regenerate their essential competences'' (Montes, Moreno & Morales, 2005, p.1160). This indicates that Montes, Moreno and Morales (2005) consider capabilities and competencies to be different terms. Then, competencies are compared with skills. Here, some authors have considered skills and competencies to be similar terms (Schulze et al. 2013; Wikle & Fagin, 2014). For example, Schulze et al. (2013) have outlined a set of competencies and skills such as problem solving, teamwork, spatial analysis, communication skills, and critical thinking. Wikle and Fagin (2014) have argued that hard skills are specific abilities or competencies required to complete tasks, while soft skills are generic competencies. It is important to be aware that a skill can be called competency (Schulze et al. 2013;Wikle & Fagin, 2014), but a competency is more that just a skill as it covers behaviours, knowledge, and skills at the same time (Anvari, Soltani & Rafiee, 2016; Mashhoodi, 2010; Selmer & Chiu 2004; Skulmoski and Hartman, 2010). Now, it becomes clear that skills can be linked to competencies, as ''[t]here is an assumption that project manager skills can traverse different projects leading to prescriptions of project manager competencies'' (Ahsan, Ho & Khan, 2013, p.38). Liikamaa (2015) have mentioned that the perception of competency is not new, but it is valuable when investigating how the various project managers' skills can fit the daily work challenges. Good examples of project manager skills can be leadership, human, technical, cognitive, social, or even language skills (Liikamaa, 2015).

Accordingly, in this research, the focus will be mainly on competencies, and the term capabilities and skills will not be used, as they are different and may result in having some confusion.

3.2.4 Threshold and high performance managerial competencies theory

Cockerill, Hunt and Schroder (1995) have argued that there are two levels of managerial competencies that are ''threshold competency'' and ''high performance competency''. At the beginning, Boyatzis (1982) have identified ''Concern with Close Relationship''. He has described it as the behaviour of employing some time speaking with team members when there is no specific job requirement and of making successful relationships with others. This can be considered as a good example of a threshold competency (Cockerill, Hunt & Schroder, 1995), which is defined as ''a cluster of related behaviours, which is used by job holders but has not been found empirically to be associated with superior job performance'' (Cockerill, Hunt & Schroder, 1995, p. 2). On the other hand, Schroder (1989) has identified ''Concept Formation''. He has defined it as behaviour of establishing frameworks and models or creating conceptions, ideas, or hypotheses on the basis of knowledge to become conscious about trends, patterns, and any possible structural cause/effect relations. This can be consider as an example of a high performance managerial competency (HPMC) (Cockerill, Hunt & Schroder, 1995), which is defined as ''a cluster of related behaviours that has been found empirically to distinguish high-performing from average-performing job holders in terms of relevant work output criteria''(Cockerill, Hunt & Schroder, 1995, p. 2). However, most of the job analyses identify behaviors that are applied by managers, without considering the relationship that could exist between these behaviors and a job performance (Cockerill, Hunt & Schroder, 1995).

In this theory, Cockerill, Hunt and Schroder (1995) have categorized three groups of researcher and practitioners, who use competencies to select and develop managers. These classifications include competencies that are (1) related to rapid career development, (2) effective in future organizations, and (3) associated with superior team, unit, or organization's performance. These groups are named respectively as traditionalists, inventors, and scientists. In particular, traditionalists realize that competencies are basically insignificant unless they are linked to some impartial criterion and base their work on behaviors that can discriminate superior managers from less successful ones. Inventors are mainly interested in introducing a language into an organization to reinforce the selection and progress of future managers. Whereas, Scientists identify, assess, develop, and validate competencies that are linked to objective performance criteria such as sustained development in sales, profitability, or customer satisfaction (Cockerill, Hunt & Schroder, 1995). The approach of this theory is selected considering the following statement. Unlike Traditionalist, Scientists use indices to study an organizational performance, rather than a job development, to classify and authenticate behaviors that distinguish managers whose teams and units reliably outperform others. Accordingly, this argument has been used to identify eleven high performance managerial competencies as demonstrated in Table 3.11. These are observable dimensions of a managerial behavior that can be determined reliably and that relate positively and considerably with an organizational performance (Cockerill, Hunt & Schroder, 1995).

Table 3.11: The high performance managerial competencies (Cockerill, Hunt & Schroder, 1995, p. 5)

HPMC	Behavioural Definition
Information Search	Gathers many different kinds of information and uses a wide variety of sources to build a rich informational environment in preparation for decision-making in the organisation.
Concept Formation	Builds frameworks or models or forms concepts, hypotheses or ideas on the basis of information; becomes aware of patterns, trends and cause/effect relations by linking disparate information.
Conceptual Flexibility	Identifies feasible alternatives or multiple options in planning and decision-making; holds different options in focus simultaneously and evaluates their pros and cons.
Interpersonal Search	Uses open and probing questions, summaries, paraphrasing etc. to understand the ideas, concepts and feelings of another; can comprehend events, issues, problems, opportunities from the viewpoint of others.
Managing Interaction	Involves others and is able to build co-operative teams in which group members feel valued and empowered and have shared goals.
Developmental Orientation	Creates a positive climate in which staff increase the accuracy of their awareness of their own strengths and limitations; provides coaching, training and developmental resources to improve performance.
Impact	Uses a variety of methods (e.g. persuasive arguments, modelling behaviour, inventing symbols, forming alliances and appealing to the interest of others) to gain support for ideas and strategies and values.
Self-Confidence	States own "stand" or position on issues; unhesitatingly takes decisions when required and commits self and others accordingly; expresses confidence in the future success of the actions to be taken.
Presentation	Presents ideas clearly, with ease and interest so that the other person (or audience) understands what is being communicated; uses technical, symbolic, non-verbal and visual aids effectively.
Proactive Orientation	Structures the task for the team; implements plans and ideas; takes responsibility for all aspects of the situation even beyond ordinary boundaries – and for the success and failure of the group.
Achievement Orientation	Possesses high internal work standards and sets ambitious, risky and yet attainable goals; wants to do things better, to improve, to be more effective and efficient; measures progress against targets.

Using the theory of HPMC, there are seven steps in order to achieve reliable measures of managerial competencies (Cockerill, Hunt and Schroder 1995), as follow:

1. After managerial behaviors that empirically differentiate high from average performing project managers are identified, it is essential to analyze them to check their differences and similarities so they can be grouped into small number of discrete competency dimensions. This process is known as ‘‘Content Analysis’’.
2. A rating scale is created for each competency to allow the project manager’s level of usage of each to be possibly determined. In order to achieve this, a general model of a rating scale and guidelines to design a definite rating scale for each HPMC are provided Appendix A.
3. Observers assigned for this task are then coached to apply the rating scales to a high level of consistency.
4. Competency evaluations of project managers are performed by coached observes using the rating scales.
5. The analytical structure done for the competency dimensions is then examined through using sound statistical procedures (i.e. Lisrel) to the evaluation ratings made by coached observers to reveal whether or not the dimensions that have been identified initially, by the applied content analysis, are truly being measured.
6. Revisions to the rating scales are made based on the findings of the statistical analyses and then the present observers should be retrained.
7. The complete cycle of competency evaluation, statistical analysis, and observer retraining should be repeated, preferably for seven times, so that the existing structure of the studied competency dimensions and the consistency of their measurement can reach stability.

Recently, Tedstone and McWilliams (2008) have pointed out that the HPMC theory can mainly be selected for the following reasons:

- It is a holistic approach that addresses aspects of competency in general; covering strategic personal interactions, and inspirational and achievement orientated behaviors.
- This theory is longitudinal in nature and has been thoroughly validated. It particular, it is validated in a dynamic and complex environment that relates to the enduring challenges.

Considering the argument of Tedstone and McWilliams (2008), the researcher has decided to adopt the High Performance Managerial Competencies theory for the current study.

3.2.5 Personality traits and competencies

Personality is a unique organization of behaviour, feelings, and thoughts joint distinctly in each individual that determines and defines the individual's pattern of interaction with the environment, which involves both human and nonhuman elements (i.e. organizational demands, physical environment, and work conditions) (Atalah, 2014). Yet, personality consists of "broad dimensions of individual differences between people, accounting for inter individual consistency and continuity in behavior, thought, and feeling across situations and over time" (McAdams & Pals, 2006, p. 207). Hence, now it is time to define traits, which is considered to be a continuous dimension on which a person's differences may be quantitatively measured through the number of attributes an individual exhibits (Gatewood & Field 2001). In psychology, a personality trait is described as the fairly stable patterns of feelings, thoughts, and behaviors that distinguish individuals from one another and that reveal the tendency to respond in definite ways under particular circumstances (Roberts, 2009). ''Personality traits are considered as stable characteristics of individuals that can be used for selection, measured in percentages, and expect to be normally distributed in a population'' (Yilmaz, et al., 2017, P. 101). The interesting part about personality traits that they are assumed to have a high level of stability over time (Golsteyn & Schildberg-Hörisch, 2017). This indicates that the personality traits of individuals are less likely to change as time passes.

The most popular model is known as the ‘‘Big Five personality traits model’. This model displays minimal overlap and provides important measurements for analyzing individual differences (McCrae and Costa, 1997). The main personality traits of this model are: *Openness to Experience* stands for “someone who is intellectually curious and tends to seek new experiences and explore novel ideas” (Zhao & Seibert, 2006, p. 261). A high level of openness to experience indicates that an individual is creative, curious, imaginative, and unconventional (George & Zhou, 2001; McCrae & Costa, 1985). While, a low openness to experience implies that an individual is limited in interests, unadventurous, unanalytical, and traditional (McCrae & Costa, 1987). *Extraversion* explains “the extent to which people are assertive, dominant, energetic, active, talkative, and enthusiastic” (Zhao & Seibert, 2006, p. 260). An extravert individual prefers being with others and enjoys social activities, while introvert individuals show low social engagement (LePine & Van Dyne, 2001; Lucas et al., 2000). *Conscientiousness* represents “an individual’s degree of organization, persistence, hard work, and motivation in the pursuit of goal accomplishment” (Zhao and Seibert, 2006, p. 261). Individuals with high conscientiousness show motivation to achieve goals, dependability, self-discipline, and preference for planned and systematic behaviours (Barrick, Mount, Judge, 2001). *Agreeableness* represents a person’s interpersonal orientation, including the tendency to prefer cooperation and positive interpersonal relationships (Zhao & Seibert, 2006). Agreeable individuals are compliant, forgiving, trusting, modest, softhearted, tolerant, and have higher quality interpersonal interactions (Barrick & Mount, 1991). Ultimately, *Neuroticism* describes “the tendency to exhibit poor emotional adjustment and experience negative affects, such as anxiety, insecurity, and hostility” (Judge et al., 2002, p. 767). Individuals with high neuroticism seem to be anxious and regularly show undesirable attitudes, and interact less with others in the same social situations (LePine & Van Dyne, 2001). While, individuals with emotional stability (The opposite of neuroticism) tend to be adjusted, calm, patient, and secure (Feist, 1998; McCrae & Costa, 1987).

Aside from the ‘‘Big Five’’ personality traits, scholars have mentioned different types of personality traits. Sadeh, Dvir and Malach-Pines (2006) have described project manager personality trait as shown in Table 3.12.

Table 3.12: Project manager personality traits (adapted from Sadeh, Dvir & Malach-Pines, 2006, p. 43)

Sl. No.	PM Personality Trait	Sl. No.	PM Personality Trait
1	Intuition	9	Anxious-Ambivalent
2	Perceiving	10	Open to Experiences
3	Introversion	11	Entrepreneurial Risk
4	Investigative	12	Investment Risk
5	Enterprising	13	Organizational Risk
6	Type A	14	Entrepreneur
7	Secure	15	Manager
8	Avoidant	16	Rebellious Dreamer

Besides, Creasy and Anantatmula (2013) have mentioned some key personality traits for project managers such as communication apprehension defined as defined as “an individual’s level of fear or anxiety associated with either real or anticipated communication with another person or persons” (McCroskey, 1977, p. 78); innovativeness known as the willingness and openness to embrace new ideas in order to develop new products (Hurley & Hult, 1998); Conflict Management is a necessity when there are contrary emotions, goals, or opinions between individuals that can lead to disagreements (Villax & Anantatmula, 2010); Self-Monitoring takes place when individuals control their self presentations and expressive behaviors to enrich desired public appearances (Scott, Barnes, & Wagner, 2012). Further, Horverak et al. (2013) have mentioned five main multicultural personality traits that can be used for managers’ selection that are cultural empathy, open-mindedness, social initiative, emotional stability, and flexibility. In addition, Miulescu (2013) have mentioned achievement through conformism, intangible fluency, insightfulness, and job orientation as key personality traits for managers. Whereas, Bakker-Pieper and de Vries (2013) have represented a subset of personality traits that are specifically significant for leaders/ project managers as demonstrated in Table 3.13.

Table 3.13: Project manager personality traits (adapted from Bakker-Pieper & de Vries 2013, P. 8)

Sl. No.	PM Personality Trait	Sl. No.	PM Personality Trait
1	Extraversion	10	Questioningness
2	Conscientiousness	11	Emotionality
3	Agreeableness	12	Impression manipulativeness
4	Openness	13	Leader performance
5	Emotionality	14	Satisfaction with leader
6	Honesty-Humility	15	Intention to leave
7	Expressiveness	16	Leader–Member Exchange relations
8	Preciseness	17	Trust in the leader
9	Verbal aggressiveness		

Still, in their study, Nichols and Cottrell (2014) have mentioned critical leader/ manager personality traits as listed in Table 3.14.

Table 3.14: Project manager personality traits (adapted from Nichols & Cottrell, 2014, p. 717)

Sl. No.	PM Personality Trait	Sl. No.	PM Personality Trait
1	Agreeableness	9	Emotional stability
2	Ambition	10	Extraversion
3	Assertiveness	11	Intelligence
4	Compassion	12	Open-mindedness
5	Confidence	13	Supportiveness
6	Conscientiousness	14	Trustingness
7	Cooperativeness	15	Trustworthiness
8	Courage		

At the same time, Atalah (2014) have pointed out 47 personality traits of PMs as shown in Table 3.15. Nevertheless, in their study, Espíritu-Olmos and Sastre-Castillo (2015) have considered seven main personality traits in the analysis model that they have developed, which are kindness, need for achievement, risk, extroversion, inner control, neuroticism, and tolerance for ambiguity. Eventually, Montequin et al. (2015) have adopted some personality traits, which are focus of attention, seeking of information, decision-making, and relationships with the world.

Table 3.15: Interpretation of project manager personality traits: Factors (Atalah 2014, 175)

Instrument	Factor description
Achievement striving	Aspiration levels
Activity	Rapid tempo and vigorous movement
Agreeableness	Altruism
Altruism	Active concern for others
Angry hostility	Tendency to experience anger and frustration
Art	Interest in activities that make beauty
Assertiveness	Dominance, forcefulness, and social ascendancy
Communications	Interest in using language, either writing or speaking it
Competence	The sense that one is capable, sensible, prudent, and effective
Compliance	Deference to others in reaction to interpersonal conflict
Computations	Interest in activities that use numbers
Conceptual ability	Ability to learn job requirements within a reasonable time
Conscientiousness	Planning, organizing, and carrying out tasks
Consideration	Ability to develop job relationships with subordinates characterized by mutual trust, respect, consideration, and warmth
Deliberation	The tendency to think carefully before acting
Dutifulness	Adherence to ethical principles and moral obligations
Employees	Attitude toward the subordinates; knowing of their motivations and needs
Excitement-seeking	Craving for excitement and stimulation
Extraversion	Outgoingness
Fantasy	Openness to fantasy
Feelings	Openness to one's own inner feelings and emotions
Gregariousness	Preference for other people's company
How supervise	Supervisor's knowledge and insight concerning human relations in industry
Human relations	Supervisor's techniques to handle problems, lateness, apathy, arguments
Human services	Interest in helping other people
Ideas	Intellectual curiosity
Impulsiveness	Inability to control cravings and urges
Management	Feeling toward top management, pay, company policy, benefits, plant regulations, and other aspects over which the supervisor has little control
Mechanical	Interest in knowing how things work and using tools to make or repair things
Nature	Interest in outdoor activities, such as growing or caring for plants or animals
Office detail	Interest in keeping track of things, people, or information
Openness	Willingness to try different activities
Order	Characteristics of organization
Positive emotions	Tendency to experience positive emotions
Sales and management	Interest in dealing with people, such as leading a team of workers or selling ideas
Science and technical	Interest in discovering or understanding the natural or physical world
Self-discipline	The ability to begin tasks and carry them through to completion
Straightforwardness	Frankness, sincerity, and ingenuousness
Structure	Ability to define a person's own role and those of subordinates to achieve goal
Supervision	Attitude toward the duties and responsibilities of a supervisor; a person's annoyances, desires, and needs; and feelings toward other supervisors
Teamwork knowledge, skills, and abilities (KSA)	Knowledge, skills, and abilities (KSAs) that predict ability to work in teams
Tender-mindedness	Attitudes of sympathy and concern for others
Total score	Individual's attitude about being a supervisor
Trust	Disposition to believe that others are honest and well intentioned
Values	Readiness to reexamine values
Vulnerability	Vulnerability to stress
Warmth	Issues of interpersonal intimacy

In this research, one of the main concerns is to find out through performing a comprehensive literature review if there is an association between PM personality traits and PM competencies.

Fortunately, the literature review indicates that there can be an association between the project manager personality traits and the project manager competencies.

3.3 Project manager competencies and the delivery of innovation

3.3.1 Management competency and the delivery of innovation

Although some scholars have disagreed that competencies could have strong influence on the delivery of innovation, and people may look for other factors, as they have mentioned that ‘‘*[w]ith the commitment to competencies of so many in our profession today, we risk being seen as the enemy of competence. Nothing could be further from the truth. The heresy we propose is that the enchanting song of the competency sirens has lured us into dangerous rocks. It is time to put wax in our ears and seek a better route*’’ (Hollenbeck, McCall and Silzer, 2006, p. 399). However, nowadays, managers are evaluated on set of tasks with distinctly described industry standards labelled as “competencies” (Chong, 2013). Competencies necessary for innovation are those that permit project team members to create effective ideas and apply them to enhance productivity, these competencies can be considered as individuals’ capacities to realize opportunities for change, establish creative ideas to the work environment, discriminate among the potential value of present and previous ideas, and apply novel ideas through reorganizing resources (Vila, Perez & Coll-Serrano, 2014). Competencies can be fundamental elements that allow individuals to accomplish their targets, advance themselves, and improve their outcomes (Arditi, Gluch & Holmdahl, 2013). It can also assist in identifying competencies that differentiate progressing PMs from their equals (Chong, 2013). Yet, establishing a competence profile can add a new perception to innovation management through concentrating on how individuals involved in innovation teams have the opportunity to enhance innovation success (Chatenier et al., 2010). Besides, the study of competencies support a range of HR management applications, involving recruitment, training, deployment, succession planning, promotion, and reward management, all of which are essential for to deliver successful innovation in projects (Arditi, Gluch & Holmdahl, 2013; Dainty, Mei-I & Moore, 2005; Liikamaa, 2015). Nevertheless, typically, each project manager is assigned in one project and each project manager has a sufficient opportunity to use his/ her skills to resolve any outstanding project concerns (Gransberg, 2002). Then, Turner and Muller (2006) have pointed out that a project manager's success at managing projects dependents on his/her competence. However, competencies help organizations in determining which manager actions are significant, helping to differentiate the outcome of team members, linking project manager actions to the strategic goals and directions of business, and offering an integrative model of management that is applicable across various management positions and situations (Hollenbeck, McCall & Silzer, 2006). All of these points explain that management competencies have influence on the delivery of innovation.

There can be a relationship between management competency and the delivery of innovation. In justification, ‘‘*Firms possessing strong innovation orientations encourage the acquisition of competencies that facilitate innovation. The deliberate managerial actions, processes, procedures, and practices are honed to a set of innovation competencies because of the overarching innovation orientation that unifies and guides action*’’ (Siguaw, Simpson and Enz, 2006, p. 563). Here, there is an indication that there can be a link between competencies and the delivery of innovation. In justification, the evidence for this has been provided by Hurley and Hult (1998), who have linked innovativeness that is defined as ‘‘the organization's overall approach to innovation’’ (Hurley & Hult, 1998, p. 44) to competency or the capacity to innovate that can be defined as ‘‘the ability of the organization to adopt or implement new ideas, processes, or products successfully’’ (Hurley & Hult, 1998, p. 44). Further, ‘‘*[p]ast experiences of failure, thus, seem to lead to a higher readiness of firms to look for outside help and competence for new innovation projects in order to reduce the risk of such projects*’’.(Tödtling, Lehner and Kaufmann, 2009, p.68). Senge et al. (1994) have also supported this, as they have mentioned that organizational learning aims to create a path for professional development to develop competencies that provide sustainable advantages through innovation. Other scholars have also added that organizations have an opportunity to decrease the ambiguities that innovation project teams may confront through acquiring effective project management competencies (Leifer, O'Connor, and Rice, 2001; O'Connor et al., 2008). Yet, Siguaw, Simpson and Enz (2006) have found that an innovation oriented knowledge structure is considered to be a group of organization widely shared understandings and beliefs about learning, the future conception of an organization and its target strategies, and the integration of its diverse functions that identify an organization and lead to competencies supportive for innovation. In short, all of the previously mentioned arguments indicate that there is a relationship between management competencies and the delivery of successful innovation in projects.

3.3.2 Project manager competencies

In order to highlight the competencies of project managers, a good start is to be aware about the building blocks of PM competencies that are knowledge, skills, and abilities (KSA) (Ahsan, Ho & Khan, 2013). Table 3.16 shows the building blocks of PM competencies and the top-five KSAs that are attained from job advertisements.

Table 3.16: Building blocks and top five KSAs from job advertisements (Ahsan, Ho & Khan, 2013, p. 46)

Sl. No.	Knowledge	Skill	Ability
1	Educational background	Communication	Result oriented
2	Certification	Technical Skills	Problem solver
3	Health and Safety	Stakeholder management	Commercial acumen
4	MS project	Cost management	Agility
5	Compliance to Regulations	Time management	Work under pressure

In deed, project management practices demand management knowledge, coupled with professional skills. Knowledge areas of project managers are shown in Figure 3.1. While, the project management skills that are crucial for project managers basically incorporate leading others, communicating effectively, negotiating existing issues, and solving problem (Edum-Fotwe & McCaffer, 2000).

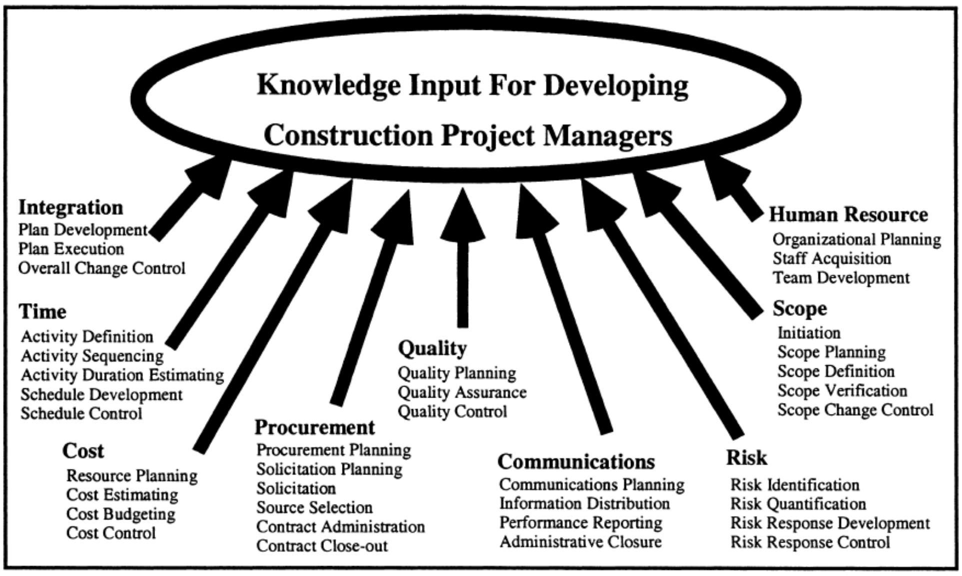

Figure 3.1: Project management knowledge areas (PMBOK in Edum-Fotwe & McCaffer, 2000, P. 113)

However, in order to meet the aims of new projects that are progressively complex in nature, it is crucial for project managers to be able to use their competencies effectively (Ogunlana, et al., 2002). However, scholars have presented different views about project manager competencies. For example, Anderson (1992) has established a list of key attributes describing the key competencies of a project manager as shown in Table 3.17.

Table 3.17: Key attributes of project managers (Anderson, 1992, P.140)

Human relation skills	Leadership skills	Technical skills	Administrative skills
- Capability to motivate people (understand elements of human behavior and their relationship to motivate) - Team building - Integrating team members - Communications - Conflict resolution	- Clear leadership and director with authority - Capability to plan and elicit commitment - Problem identification and solving (director and facilitator) - Balance technical, economics, and human factors - Decisive decision making (individual/group) - Communication - Conflict resolution	- Understand technology - Knowledge of tools and techniques used in the engineering/ construction process - Applications and methods - Technology trends and evolution	- Planning - Organizational skills - Knowledge and understanding of estimating systems, cost control, scheduling control, quality and safety - Procedure development and implementation

Frame (1999) have mentioned that project management literature is rich in competency studies that have been undertaken at three main levels, which are individual, team, and organizational. Edum-Fotwe and McCaffer (2000) have stated that, from professionals' point of view, in order to develop project management competencies, the most significant considerations are work experience, academic courses, and formal training, with a more emphasis on work experience. Abraham et al. (2001) has mentioned that competencies demonstrate an array of various behaviours, characteristics and traits that are necessary to achieve work. Some scholars have stated that an effective project manager is expected to acquire nine main competencies that are (1) Team building; the project manager is responsible for forming and gelling an effective team to ensure the availability of a stable project environment. (2) Leadership; the project manager uses leadership skills for assigning tasks and providing direction. (3) Decision-making; the project manager has an important role in taking the lead on main management choices that needs to be made throughout project's progress. (4) Mutuality and approachability; the project manager ensures that good internal trust relations exist within teams. (5) Honesty and integrity; Honesty and integrity can be linked to self-portrayal of the project manager to other project team members. (6) Communication; the project manager needs to encourage an effective internal and external communication with other project stakeholders. (7) Learning, understanding and application; the project managers can integrate information and use it to formulate proper actions. (8) Self-efficacy; self-efficacy can be related to aspects of self-management that can somehow impact their work performance. (9) External relations; the project manager should also focus on external relations with those outside of the project team (Dainty, Cheng and Moore 2003; Dainty, Cheng & Moore, 2005). Also these PM competencies have been divided into two categories, which are superior and average managers (Dainty, Cheng & Moore, 2005). Suikki, Tromstedt and Haapasalo (2006) have emphasized that project management competence requires a sufficient understanding for the business environment, leadership skills, and project management knowledge areas. Rose et al. (2007) has identified seven project management competencies for project managers, which are time, technical, personal, business, process, client, and uncertainty management. The PMI (2007) model has specified different methods for competency development: coaching, mentoring, role-playing, group training, peer-to-peer, on-the-job training, in-house training, computer based training, formal conferences and training. Chen et al. (2008) have identified criteria for a competent project manager. They have used two approaches that are behaviour oriented and work oriented, to differentiate project management competencies. The earlier highlights individuals' elements, such as abilities, skills, personal traits, and knowledge, whereas the later considers work as present independently, and definable in terms of technical needs of any work missions (Holmes & Joyce, 1993). Yet, Skulmoski & Hartman (2010) have pointed out key competencies for project managers as demonstrated in Table 3.18.

Table 3.18: Competence of project managers (Skulmoski & Hartman 2010, p. 73)

PM Key Competencies	
Effective questioning/generating feedback	Ability to get along/ team player
Persuasiveness/ marketing/ selling	Result-oriented
Listening skills	Truthful/ honest
Vision oriented/ articulate the business problem	Writing skills
Consensus building	Share – information and credit
Project management skills and knowledge	Pride in workmanship/ quality
Technical skills/ theoretical knowledge	

Abu Bakar et al. (2011), have provided a more detailed list of attributes for the competencies/ roles of project managers as demonstrated in Table 3.19.

Table 3.19: Attributes for the competencies of project managers (Abu Bakar et al., 2011, pp. 167-167)

Management Knowledge and skills		
Time management	Negotiation	Motivation
Decision making	Strategic Planning	Promotion
Technical Knowledge and skills		
Basic knowledge (in their own field)	Technical writing	Productivity and cost control
Material procurement	Planning and scheduling	Quality control
Business Knowledge and skills		
Marketing and sales	Understanding of organization	Ability of market demand
Public relations	Understanding of low	
Management Knowledge and skills		
Social/ moral sensitivity	Maturity	Intuitive
Integrity	Open minded	Diplomatic
Team player	Specific	Creative
Dynamic		

PMI (2013b) has classified project management competencies into ten elementary project management knowledge areas that are time, cost, scope, quality, communication, risk, stakeholders, HR, procurement, and integration. Ahsan, Ho and Khan (2013) have focused on three core competencies for a project manager that are *knowledge competence*, it reflects knowledge or body of information (i.e. the tools, techniques and processes for project works) necessary to conduct project tasks; *performance competence*, it explains project manager's actions and how their knowledge can be used to meet the required project outcomes; *personal Competence* (soft skills), it reflects how they behave when performing activities, this category embraces elements of the project manager's attitudes and personality characters. Rojas (2013) have mentioned that a successful project manager can acquire twelve main competencies that are (1) *Humility*; if project managers are to reflect team members as their customers, humility turns out to be vigorous to counteract the sense of power that an increase to a certain managerial position may inadvertently express. Humility reveals in several ways and can be articulated in a multiplicity of contexts. (2) *Character*; managers with character can promote optimal performance. Hence, character stands for admirable traits that differentiate individual's personality. A good example of those traits is being reflective, where reflective managers gather all related facts before acting, and their responses correspond effectively to circumstances. An individual who exaggerates to existing problems, and unavoidably worsens a situation. (3) *Leadership*; leadership skills are vital for project managers. Effective project managers understand how to assign through showing control and permitting others to make reasonable decisions by their own. (4) *Consistency*; project managers can show consistency through applying the same set of standards to everyone, in any circumstances. They recognize that being impartial with employees is crucial to instil confidence. (5) *Commitment*; project managers can be entirely committed to their jobs through being careful about what they accomplish. They are ambitious individuals who work because it satisfies them, not because they want to make money. Every time they disclose themselves as team members dedicated to their work and the organization's goals, in a way that the attentiveness of their project comes first all time. They also appear to be self-starters, overachievers, and self-motivated members. (6) Curiosity; PMs have inquisitive minds. The available knowledge economy of the twenty first century awards curiosity; hence PMs can retain a thirst for both knowledge and personal development. As they pursue to understand the environment where they function, they find techniques of refining it, enhancing their project members' skills, boosting their leadership skills, and renewing their practical knowledge. (7) *Communication Skills*; communication skills supplement the tasks of PMs as they can express ideas in a simple, clear, brief, and logical way to increase individuals' effectiveness. Project managers are urged to acquire both excellent verbal and written communication abilities. Those who communicate effectively know how to analyze a complex job into simple tasks that team members can clearly recognize. Project managers are expected to be good listeners. Only by listening PMs can learn about the different complications and challenges of project team members. Effective communicators practice all stages of listening to amplify their understanding of different situations. (8) *People Skills*; people skills stand for an individual's nature and attitude when dealing with others and are crucial for existing project managers. Project managers with suitable people skills practice fundamental politeness when interacting with others, such as welcoming others and providing a helping hand to those who are in need. They show an approachable and friendly approach that welcomes effective communication and conveys willingness to engage. Those with sufficient people skills are likable as they show respect to others and appreciate the good work of team member. They do not threaten, speak loudly, or otherwise provoke people and stay calm even under the most unfavourable circumstances. They realize that they do not have the ability to control others but that they own full control over themselves and thus practice self-control to diminish conflict. (9) *Effectiveness*; project managers are expected to achieve the anticipated results. In clarification, effective PMs can perform multiple tasks, as they acquire the necessary organizational skills and have the ability to handle stressful situations. They make sure that project team members have all appropriate instructions, space, equipment, technical tools, and materials to excel at their work. These PMs are outstanding planners who have an observable sense of urgency and have the ability to schedule well-timed inspections to indorse completion of work. (10) *Knowledge*; in the knowledge economy, project managers can epitomize knowledge through interpreting existing information and making sense of obtained data. They also can categorize problems, study possible options, show proficiency with information technologies, and select the most suitable and timely solution. (11) *Experience*; no amount of theoretical knowledge has the capability to balance an obvious lack of experience. Project managers can direct other team members; understand the most efficient workflow; and complete different installations. Experience alone is not enough to breed such understanding. (12) Willingness; willingness stands for the inclination or disposition of a certain individual to achieve the activities and responsibilities of a PM. Unfortunately, sometimes, job candidates may not be aware of their clear aversion toward the responsibilities and tasks of a project manager, as they do not know about what these positions entail. In addition, Guillén and Saris (2013) have studied the competencies of managers that are shown in Table 3.20.

Table 3.20: Project manager competencies (adapted from Guillén & Saris 2013, p. 79)

Sl. No.	Competency	Sl. No.	Competency
1	Adaptability	9	Conflict management
2	Initiative	10	Influence
3	Optimism	11	Inspirational leadership
4	Achievement oriented	12	Teamwork
5	Transparency	13	Achievement
6	Service oriented	14	Power
7	Change catalyst	15	Affiliation
8	Developing others		

Ríos-Carmenado, Rahoveanu and Gallegos (2014) have presented main competence elements (technical, behavioral and contextual) for PMs as shown in Table 3.21 There are 22 main competencies. Four of them are behavioural competencies; leadership, negotiation, communication, and teamwork. Two are contextual competencies; finance and program, and projects implementation. The remaining ones are technical (Ríos-Carmenado, Rahoveanu & Gallegos, 2014).

Table 3.21: Competence elements for project managers (Ríos-Carmenado, Rahoveanu & Gallegos, 2014, p. 617)

Core competencies		
Teamwork	Ethics	Legal
Negotiation	Reliability	Program orientation
Leadership	Openness	Permanent organization
Communication	Efficacy	Systems, products and technologies
Efficiency	Engagement and motivation	Information and documentation
Creativity	Finance	Resources
Values appreciations	Program, projects implementation	Interested parties
Consultation		

Loufrani-Fedida and Missonier (2015) have found out that project management competencies provide organizations with the ability to serve projects (i.e. means to manage the constraints of time, costs, and quality; to assess the project's risks; to allocate and control available resources). Nevertheless, in order to provide a general idea about project management competencies, a comprehensive list is shown in Table 3.22.

Table 3.22: Project management competencies (adapted from Takey & Carvalho, 2015, p. 786)

Category	Competences
Project management processes	Integration management; scope management; time management; costs management; quality management; human resource management; communication management; risk management; contract management; environmental management; safety and health management
Personal	Leadership; communication; opening; relationships; teambuilding; teamwork; development of others; conflict resolution; holistic view; systemic view; assertiveness; problem-solving; ethics and integrity; commitment; self-control/work under pressure; relaxation; uncertainty; creativity; negotiation; emotional intelligence; commitment to the organisation; reliability; attention to detail; delegation; search for information; analytical thinking; conceptual thinking; flexibility
Technical	General technical overview; technical vocabulary; technical challenges; search for innovative technical solutions; technical solution assessment; technical risk assessment; technical trade-off decisions; relationship between technologies; design (project); technical drawing
Context and business	Organisation's profitability; strategic alignment; customer relationships; customer satisfaction; forces of industry (organisation, customer and suppliers); legislation; finance; continuous management improvement

Nevertheless, Liikamaa (2015) has established a list of competencies that can be used to evaluate project managers. These competencies and their definitions are demonstrated in Table 3.23.

Table 3.23: Project manager competencies and their definitions (Liikamaa, 2015, pp.683-684)

No.	Competencies	Definition of competencies
1	Emotional awareness	Ability to recognize, realize and specify one's feelings
2	Self-confidence	A strong belief in one's capability, competency and self-esteem
3	Self-assessment	Knowing one's limits and strengths
4	Trustworthiness	Behaving honestly and ethically
5	Maintaining order	Concern for order, quality and accuracy
6	Flexibility	Ability to adapt to changes
7	Innovation	Being comfortable and open with new ideas, approaches and data
8	Responsibility	Being conscientious and responsible for one's own personal performance
9	Seeking information	Satisfying one's curiosity and desire for knowledge
10	Production efficiency	Performing work quickly and with a high quality
11	Decision quality	Making decisions based on principles, purposes and values
12	Stress management	The ability to handle adverse, tiring and stressful issues and situations
13	Analytical thinking	Breaking down problems into sub-problems and their systematical diagnosing by rational principles
14	Conceptual thinking	Identifying, applying and defining concepts
15	Language proficiency	Ability and courage to use foreign languages
16	Achievement drive	Willingness to aim at more effective performances
17	Commitment	Adopting the goals of the group or organization
18	Initiative	Recognizing and acting on opportunities and possessing an ability to create opportunities
19	Optimism	Pursuing goals in spite of obstacles and setbacks
20	Understanding others	Perceiving, considering and understanding the feelings and viewpoints of others
21	Developing other people	Perceiving the development needs of others and reinforcing their abilities
22	Leveraging diversity	Creating opportunities for cooperation with different kinds of people
23	Organizational savvy	Understanding and utilizing organizational dynamics in order to achieve objectives
24	Communications	Listening openly and conveying clearly
25	Conflict management	Arbitrating and resolving differences
26	Management	Concentrating on things
27	Leadership	Concentrating on people
28	Relationship building	Building, cultivating and developing useful relationships and informal networks
29	Collaboration	Working with others toward common goals

Recently, Dziekoński (2017) has found out critical operational measures to assess the competencies of project managers as shown in Table 3.24.

Table 3.24: Operational measures of project manager's competency (Dziekoński, 2017, p. 176)

Attitude Management skills Knowledge	Management skills	Knowledge
Intellectual	Ability to make decisions	Experience in managing projects
Creative	Ability to assess the impact of actions taken	Ability to use appropriate project management methodology
Expressing confidence	Ability to formulate goals	Competence in the area in which project is implemented
Assertiveness	Ability to organize work to subordinates	Ability to use project management software
Self-confidence	Ability to communicate	Ability to manage the scope, time and cost of the project
Authority	Ability to motivate team members	
Integrity and honesty	Help in solving problems	
Empathy	Focus on the goals	
Aspiration	Ability to resolve conflicts	
Ability to deal with stress	Ability to negotiate	
Ease of establishing contacts	Flexible management style	
Ability to work in a team		

3.3.3 Project manager competencies and innovation

Depending on the scope of work and type of a project, the competencies of a project manager can vary in its depth and breadth (Ahsan, Ho & Khan, 2013). Starting with Muller and Turner (2007) who have identified the relationships between PM leadership competencies (emotional, intellectual, and managerial) with project success. Then, Muller and Turner (2010) have argued that a project manager's leadership competency profiles can differ in accordance with projects' type. As simple projects entails more transactional leadership style, while composite projects demand transformational leadership style. Yet, Hölzle (2010) have stated that the fundamental PM competencies incorporate leadership, problem solving, project-based expertise, and social competence. In the same year, Stevenson and Starkweather (2010) have mentioned that most important and valued PM competencies are experience and education, although simultaneously the main soft competencies for PMs involve leadership, communication, professionalism, negotiations, personal attributes, social skills, and project management competencies. This indicates that authors have different views about the competencies required by a successful project manager.

However, scholars have not reached an agreement about the competencies required by project managers to deliver successful innovation in projects (Afsar, Badir & Khan, 2015; Crant, 2000;

Montani, Odoardi & Battistelli, 2014; Vila, Pérez & Coll-Serrano, 2014). Crant (2000) have pointed out creativity (that includes idea creation and application) and proactivity or pro-activeness (that incorporates detecting new opportunities, acting well on them, having initiative, taking positive action, and persevering until major changes take place are main competencies for innovation. Montani, Odoardi and Battistelli (2014) have argued that proactive planning and goal generation are core competencies for innovation. Vila, Pérez and Coll-Serrano (2014) have mentioned that the main competencies that can increase the probability of delivering successful innovation are the ability to present ideas, reports, or products, and the alertness to novel opportunities. While, Afsar, Badir and Khan (2015) have stated that trust (in terms of person–job fit as well as person–organization fit) can be a critical competency. The reason is that trust (particularly for project managers) gives individuals the chance to present more innovative ideas, and trust helps project managers to be persuaded about adopting and implementing new ideas (Afsar, Badir & Khan, 2015). Here, it is clear that Afsar, Badir and Khan (2015) have different views about the competencies required by project managers to deliver successful innovation in projects. However, Aragón-Correa, García-Morales and Cordón-Pozo, (2007) have reached an agreement about the important PM competencies for innovation such as leadership competency; it has been conventionally highlighted as one of the most imperative individual effects on organizations' innovation. According to them, leadership has a substantial, strong effect on organizational learning, which indirectly influences organizations' innovation. Organizational learning positively affects performance, but interestingly through innovation (Aragón-Correa, García-Morales & Cordón-Pozo, 2007). This indicates that innovation can influence performance. Leadership has main influence on creativity at individual and organizational levels. At individual level, there is a positive relationship between leadership and employees' creativity, since leadership affects employees' creativity through emphasizing psychological empowerment. At organizational level, leadership is positively related with organizational innovation that is measured with a market-oriented criterion (Gumusluoglu & Ilsev, 2009). Leaders can ensure that the organizational environment is conducive to successfully implement innovation (Kelley & Lee, 2010). Problem-solving competency; it allows for the translation of market knowledge competence into a positional advantage and enhanced outcome. Problem solving, a process of pursuing, defining, assessing, and employing solutions, is considered a converter that has the ability to interpret organizational contributions into valued product and service yields. This implies that there is a need for managers to reassess how to measure and reward market knowledge activities during product development. The diverse market knowledge competencies (i.e. customers and competitors) have different influences on the speed and creativity of problem solving (i.e. positive, negative, or none), which underline the need for a well-established view of market knowledge competence. This gives managers the chance to promote and reward project team members' accomplishments and hence ensure a greater efficiency of market knowledge competence in product development (Atuahene-Gima & Wei, 2010). Collaboration competency; it can be indirectly, positively related to innovation. This indicates that project managers can measure the collaboration competency, such as absorptive ability, relational proficiency, and coordination skill. They can detect areas in which their organizations may be lacking and cultivating specific skills for enhancing collaboration competency. Project managers are required to vigorously manage their organization's' relational assets through applying collaboration practices to boost their aptitude to manage knowledge sharing, analysis, and application. The reason is that knowledge integration can inspire creative and innovative ideas that can ultimately lead to successful innovation. As a result, it is essential to establish a link between collaboration competency and favorable innovation, as project managers can recognize the significance of knowledge integration, and utilize their collaboration competency to cultivate it, which, in turn, can result in favourable innovation outcomes (Tai Tsou, 2012).

Further, the activities of innovation professionals often consist of three main tasks that are handling the inter-organization cooperation process, managing innovation process, and producing new knowledge (Chatenier et al., 2010).

However, Shea and Higgins (2005) have provided some competency-measures that can be used to identify individuals (including project managers), who are welling to promote and adopt successful innovations in organizations as summarized in Table 3.25.

Table 3.25: Project manager innovation competencies (Howell, Shea & Higgins 2005, p. 655)

Sl. No.	Innovation competencies
1	Enthusiastically promote the innovation's advantages
2	Expresses strong conviction about the success of innovation
3	Expresses confidence in what the innovation can do
4	Shows optimism about the success of innovation
5	Points out reasons why innovation will succeed
6	Keeps pushing enthusiastically
7	Sticks with it
8	Shows tenacity in overcoming obstacles
9	Continues to be involved with the innovation until it is implemented
10	Knocks down barriers to the innovation
11	Does not give up when other say it cannot be done
12	Persists in the face of adversity
13	Gets problems into the hands of those who can solve them
14	Gets the right people involved
15	Gets key decision makers involved

Further, Vila, Pérez and Coll-Serrano (2014) have provided a list of specific competencies that can explain the tendency of project managers to deliver successful innovation as shown in Table 3.26.

Table 3.26: Project manager innovation competencies (Vila, Pérez & Coll-Serrano, 2014, p. 755)

	Competencies for innovation		
1	Present products, ideas, or reports	11	Question your own and others' ideas
2	Write and speak in a foreign language	12	Coordinate activities
3	Analytical thinking	13	Perform well under pressure
4	Alertness to new opportunities	14	Use computers and the internet
5	Come up with new ideas and solutions	15	Make your meaning clear to others
6	Mobilize the capacities of others	16	Rabidly acquire new knowledge
7	Knowledge of other fields	17	Mastery of your own field
8	Assert your authority	18	Use time effectively
9	Negotiate effectively	19	Work productively with others
10	Write reports, memos or documents		

3.3.4 Project manager competency challenges to deliver innovation

Organizations that are willing to promote their products, knowledge, or technological innovation can focus on recruiting, promoting, and assisting project managers who acquire the appropriate competencies, thereby inspiring an increase in propensity to be innovative (Vila, Pérez & Coll-Serrano, 2014). This indicates that selecting the project manager who has the right competencies may not be an easy task. However, project manager’s multifaceted role in innovation has a substantial influence in accomplishing project targets and objectives in order to develop innovative practices on site. Such a significant role should be complemented by a project manager’s competency and professionalism (Dulaimi, Nepal & Park, 2005). Here, another challenge is that project managers may not have the competencies that fulfil their roles, which may result in failure to deliver the required aims. Further, project managers are progressively expected to satisfy their potential for innovation at work, and to challenge and develop their professional competencies. Their contribution in innovative activities has become an essential element in organizations' strategies to retain and attract human talent in order to foster success in business (Vila, Pérez & Coll-Serrano, 2014). This means that developing competencies that can allow project managers to contribute to innovation and cope up with organizational strategies in another challenge. In addition, Edum-Fotwe and McCaffer (2000) have added that the fundamental roles of project managers is to maintain their professional competencies, and to be responsible for the overall success that can be reached when delivering the owner's innovation targets within the agreed constraints of schedule, cost, safety, and quality requirements. This shows that maintaining the right competencies that can deliver an owner’s innovation goals considering constrains of cost, time, quality, and safety is a main challenge for project managers working in a particular industry. Yet, project managers are urged to identify and cultivate their key skills and competencies (that they may need to improve) in order to foster both project team members’ effectiveness and project’s success (Trivellas & Drimoussis, 2013). This signifies that identifying and improving the right competencies that can achieve team's effectiveness and overall project success in another critical challenge.

3.3.5 Personality traits and the delivery of successful innovation

Now that it is clear that there is an association between project managers' competencies and innovation, it is essential to emphasise the strong influence that personality traits have on the delivery of successful innovation. In order "… to increase the probability of project management success, the project manager must understand the leadership competencies that are required and what personality traits he or she has that compliments or competes with these competencies" (Gehring, 2007, p. 50). Thal and Bedingfield (2010) have agreed that there are associations between personality traits and the success of a project manager. Dvir, Sadeh, and Malach-Pines (2006) have highlighted that the significance of aligning a PM's personality and management style with the existing project type. These views indicate the importance of the PM personality traits for the success of projects and its project management. But the main concern (in particular) is the successful delivery of innovation in projects. Thus, a closer look is required. The personality traits are coupled with the successful completion of each single phase in the innovation process, given that the way of influence may differ considerably from stage to another (Stock, von Hippel & Gillert, 2016). For example, individuals who are openness to experience can significantly have more innovative ideas, individuals who are introverted and conscientious can recognize the ideas in the form of a product prototype, and individuals who are highly conscientious can commercially spread their innovations, but are less likely to disperse peer-to-peer (Stock, von Hippel & Gillert, 2016). In other words, Personality traits can impact the successful completion of innovation at all stages starting from idea generation, prototyping, diffusion, and up to the successful delivery of innovation (Stock, von Hippel & Gillert, 2016). Moreover, diffusion of innovation can comprise tasks and personality traits found in successful individuals. At least in some cases when a particular innovator is vigorously trying to "sell" innovation to organization for implementation as a product, or service (Stock, von Hippel & Gillert 2016). For example, Openness to experience and extraversion can positively affect the innovation and creativity for diverse groups of employees (Feist, 1998; Rothmann & Coetzer, 2003). In respect to conscientiousness, some scholars found out that innovative scientists are commonly less conscientious (Feist, 1998; George & Zhou, 2001), while other studies have pointed out the existence of positive links between innovation and conscientiousness (Feist, 1998; Rothmann & Coetzer, 2003). Sometime, agreeableness has correlated negatively with innovative achievements. Similarly, sometimes, neuroticism have also have been found out to relate negatively with innovative endeavors (Rothmann & Coetzer, 2003).

3.4 Competency Models

3.4.1 Background about competency models

Mansfield (1996) have pointed out that a competency model can be defined as a behavioural and descriptive instrument to find out the characteristics and skills that employees need to be effective in their jobs. Competency models are applied for different reasons within Human Resource Management such as succession planning, performance management, employee selection, employee development, and career development (Shippmann et al., 2000). Thus, scholars have proposed numerous competency models. For example, Boyatzis (1982) have explained that competencies related to individual, job demands, and organisational environment are considered when creating a competency based training models that can produce certain outcomes or output with respect to performance, products, business processes and procedures. Accordingly, Boyatzis (1982) have suggested an integrated model of managerial competence, where this model clarifies the interrelationship of the existing characteristics and their association with the internal organizational environment as well as the management functions. In addition, Spencer and Spencer (1993) have presented the “Iceberg Model” that has divided resultant behaviours and basic characteristics and performance in a particular job profile into five main categories, which are knowledge, skills, self-image, traits, and motives. Spencer and Spencer (1993) have also developed a job-competence assessment technique that have encouraged organizations to change their focus from conventional job descriptions to adopting a competency model through evaluating the key individual characteristics correlated with excellent and average job performance. Moreover, in the field of project manager’s competencies, Lynn Crawford provides a valuable project manager competency model that has been developed and expanded through time. Crawford (2000) has presented a thorough understanding about competencies through suggesting three main categorizations, namely personal competencies, input competencies, and output competencies. The personal competencies are personal characteristics presenting an individual's ability to perform a job. Input competencies stand for knowledge and skills that an individual conveys to a job. While, output competencies are linked to the final outcome that an individual reveals at the job place. These categories are combined together to evaluate competence (Crawford, 2000). Later, Crawford (2005) has provided an integrated model of competence that consists of knowledge, skills, personality, and performance. The integral model presented by Crawford (2005) that is shown in Figure 3.2 divides competence into three main types that are input, personal and output. Input competencies cover the knowledge and skills that an individual brings to a particular job. Personal competencies include the basic personality characteristics, which is known as an individual's ability to achieve a job. Output competencies involve the capability to achieve the activities within a specific occupational area to the required level of performance (Crawford, 2005). Nijhuis, Vrijhoef and Kessels (2015) have argued that this model can be considered as taxonomy in itself, as competencies are being classified into different sub-competencies.

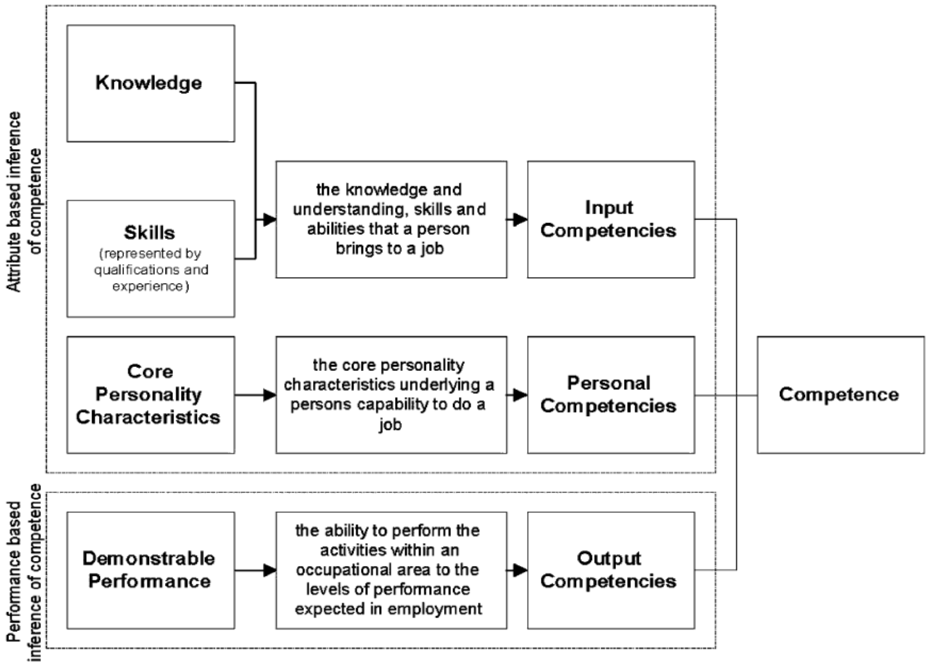

Figure 3.2: Project management competency model (Crawford, 2005, p. 9)

Crawford's competency model has been successful in bridging the gap between the hard and soft skills that project managers need to achieve the best outcomes in their projects (Crawford, 2006). This model is basically outlined as such: input competencies involve the knowledge provided by industry works and the experience of a project manager; personal competencies incorporate soft skills such as adaptability and open mindedness; and output competencies include definitions, metrics, processes, and documentation (Crawford, 2006). It is significant to point out that Crawford's aim is to provide a base for recognition of the competencies of those who can show ability to achieve but have not had the chance to gain the qualifications needed for entry to a certain occupations, jobs, or professions (Crawford, 2006). Later, Crawford (2013) has argued that there are two distinct and main approaches to study competencies. These approaches are the Competency Model approach (CMA) and the Competency Standards approach (CSA):

The Competency Model Approach (or attribute based approach): has begun in 1970s and is centred on the work of (McClelland, 1973). McClelland (1973) have indicated that a test for competence can be considered as an alternative approach to the traditional intelligence test. For some reasons it could be needed to evaluate competencies that are more commonly beneficial in groups of life outcomes, involving not only covering occupational outcomes but also the social ones, such as leadership, interpersonal skills, etc. (McClelland, 1973). One of the greatest weaknesses of almost all present tests is that they structure a situation in advance and request for a certain kind of response from the test taker. They are designed to assess the capacity of an individual to make a specific kind of response or choice. But real life outside of tests rarely presents individuals with such clear alternatives (McClelland, 1973). In the 1970s, McClelland (1973) have used the notion of competency to challenge the existing conventional intelligence evaluation criteria in many higher education systems. He found that there are numerous factors that distinguish excellent performers from average ones such as personal attributes, experience, and motives. Hence, the study of McClelland has established the conceptual basis to foster further researches on competencies in various fields such as human resource management, vocational/teacher education, and business (Spencer & Spencer, 1993). Considering McClelland's study, when a competency-based approach is applied, emphasis should be placed on behaviours that can influence job performance (Brophy & Kiely, 2002). In the early 1980s, it has been reported by Boyatzis (1982). Considering this approach, Spencer and Spencer (1993, p.9) have defined a competency as an "underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation". Inherent in this tactic is the distinction between the threshold and high performance or discriminating competencies. The Competency Model approach is well known among HR professionals and most of the existing institutions have a specific corporate competency model, which identifies behaviors that can drive better performance in their companies. Such behaviors are highly contextual and cannot simply form the base for generic standards for a particular workplace performance (Crawford, 2013).

The Competency Standards Approach (or performance based approach): provides the base for the national criterions and prerequisites frameworks of the UK (National Vocational Qualifications), the Australian Prerequisites Framework, and other similar frameworks in other countries such as New Zealand and South Africa (Crawford, 2013). Heywood, Gonczi and Hager (1992) have provided valuable work to assist professionals with the development of competency standards. In the next year, competencies have been linked to stands through the definitions of Gonczi, Hager and Athanasou (1993). They have mentioned that a competency-based assessment can be defined as ‘‘the assessment of a person's competence against prescribed standards of performance’’ (Gonczi, Hager & Athanasou, 1993, p. 5) or ‘‘the process of determining whether a candidate meets the prescribed standards of performance’’(Gonczi, Hager & Athanasou, 1993, p. 5). However, the competency model assumes that any identified personal characteristics will be translated into competent performance at work, while the assumption of the competency standards approach is that competence can simply be incidental from evidence of revealed performance at a pre-known adequate standard (Gonczi, Hager & Athanasou, 1993). Additionally, the competency model approach is keen about identifying behaviours associated with superior performance, the competency standards approach, and inline with the majority of "standards", concentrates on threshold performance to be in the minimum level of performance that can be accepted or expected in a workplace. Both of these approaches include evaluation of a different characteristic of competence (Crawford, 2013), and each one of them has both advantages and disadvantages (Cheng et al., 2003). Yet, Heywood, Gonczi and Hager (1992) have agreed that an intensive consideration of both approached can be very effective.

It is worthwhile to mention that it is possible to integrate the CMA and the CSA. The model shown in Figure 3-4 conveys together the competency model (attribute-based) and the competency standards (performance-based) methods to competence and links it to present guides and standards for competence in project management functions. This model determines the harmonizing nature of attribute-based and performance-based methods (Crawford, 2013). Figure 3.3 shows that mainstream of project management criterions and certifications can undertake both or either of the identified input and output competencies (Crawford, 2013).

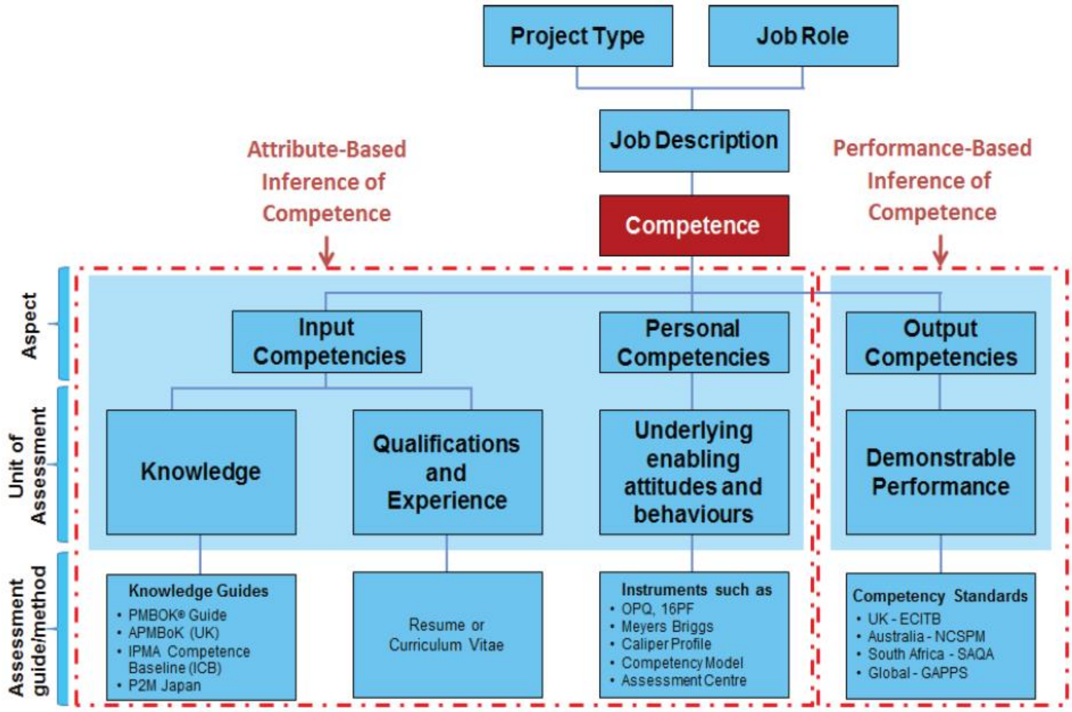

Figure 3.3: Integrated model of competence for project management functions based on Crawford, 2005 (Crawford, 2013, p. 3)

Holistic Competence Approach: Porvaznik (2013) have demonstrated a general approach to create a competency model that is called Holistic Competence Approach as shown in Figure 3.4. The holistic model of managerial competence highlights the need for assessing managerial competence holistically through measuring three basic pillars that are knowledge ability, social maturity, and application skills of each manager. By adopting the holistic competence model, it becomes easier to select the right qualified managers who can perform their jobs successfully (Porvaznik, 2013 in Skorková 2016).

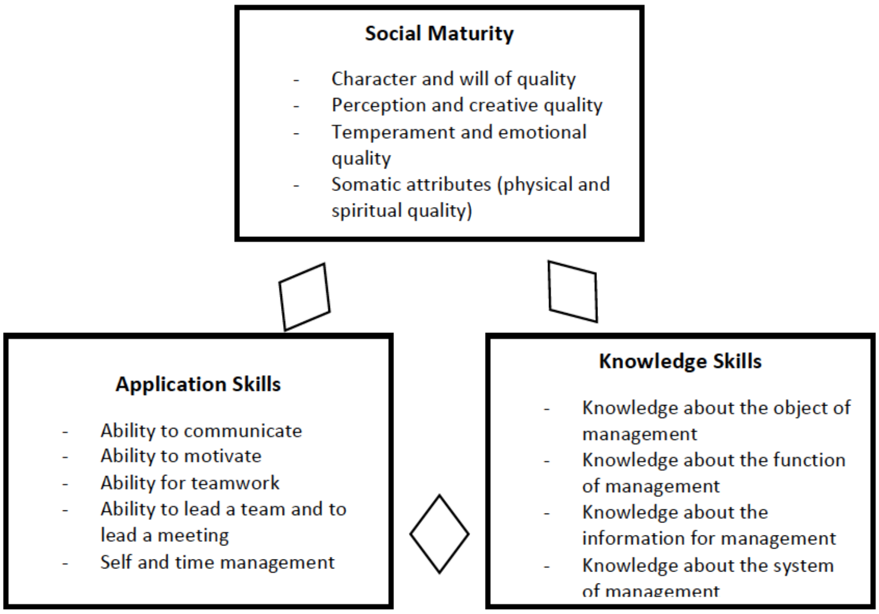

Figure 3.4: Holistic competence model (adapted from Porvaznik, 2013 in Skorková, 2016, p. 229)

3.4.2 Project manager competency model

Dziekoński (2017) has established a project manager competency model that involves four clusters as shown in Figure 3.5. In this model, Cluster 1 specifies some features that reveal fundamental management skills, and is combined with abilities, creativity and intelligence to handle stress. A PM's role demands a combination of rational strength with organised work proficiencies. Cluster 1 and its variables can be called ''basic managerial skills''. Cluster 2 involves personality attributes and interpersonal abilities. Personal attributes are needed to facilitate effectual employment of the other skills presented in this cluster. For example, these skills can cover communication with concerned team members and stakeholders, negotiation with subcontractors, and the ability to solve problems. Besides, this cluster highlights all interpersonal potentials of a PM and experience that are required to proficiently realize managerial tasks. Cluster 2 and its variables can be called ''team management abilities supporting managerial skills''. Cluster 3 includes emotional intelligence attributes. These are known as human abilities not only to realize their own and other individual's emotions, but also to deal with emotions of others. Cluster 3 and its variables can be called ‘‘emotional intelligence skills’’. Cluster 4 can be considered as balancing elements of any competency profile. They often come from training, certification, and fundamental knowledge about using the necessary tools. It also stresses the importance of methodological suggestions and recommendations. Cluster 4 along with its variables can be called ‘‘formal skills’’ that effectively presents a generic attitude.

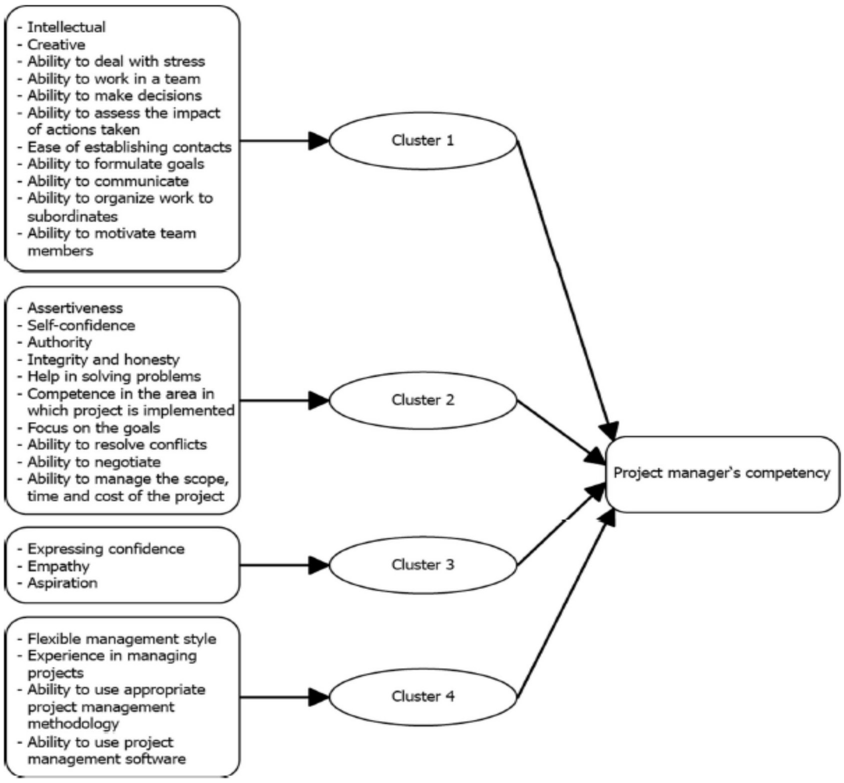

Figure 3.5: Project manager competency model (Dziekoński, 2017, p. 179)

Nevertheless, all of the previously mentioned models are important and add value to this study, as they provide necessary details and help in attaining a thorough understanding about competencies. Yet, among all of the mentioned models, the project manager competency model is inspiring for this study. The reason is that it makes it clear that project manager innovation competencies can also be categorized into clusters. This will not only make it easier to study the relationship between the project manager innovation competencies and the delivery of successful innovation in projects, but also study the mediation effect of the project manager innovation personality traits and the project manager innovation environment on the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

3.5 Summary

In summary, this chapter has presented a thorough literature review about the concept of competency (i.e. leadership, communication, teamwork, creativity, and commitment competencies), and how it can be distinguished from other terms such as capabilities, and skills. It has provided details about the threshold and high performance managerial competencies theory, and its relevance to project managers competencies. It has also explained how the personality traits and competencies can be related. At the same time, this chapter has described the influence of project manager competencies on the delivery of innovation covering management competency and the delivery of innovation; project manager competencies and innovation; project manager competency challenges to deliver innovation; and personality traits and the delivery of successful innovation. It has concluded with details about competency models in general, and project manager competency model in particular.

Chapter 4 Conceptual Framework and Model development

4.1 Introduction

This chapter mainly describes the research conceptual framework and the conceptual model development. It points out that this study is based on two theories that are the innovation diffusion theory and the threshold and high performance managerial competencies theory. It also provides details about the criteria used for the developed model and the operational definitions used for the study. At the same time, the chapter includes a detailed describtion about hypothesis development for this study. It also identified the direct and mediation hypotheses.

4.2 The Research conceptual framework and model

The main aim of this research is to critically examine the relationship and associations between project managers' competencies and the delivery successful innovation in projects. The study also highlights the influence of the PM personality traits and PM environment on the PM competencies and their ability to deliver successful innovation in projects. Hence, the research is considering the project manager as a unit of analysis, while the PM competencies, PM personality traits, PM environmental factors, and the criteria of successful delivery of innovation in projects that are most frequently mentioned in literature are examined. Accordingly, the research key question is:

RQ: What is the relationship between project manager innovation competencies and the delivery of successful innovation in projects?

Accordingly, the research question will be critically examined through developing hypotheses related to project managers' competencies and their influence on the successful delivery of innovation in projects

In particular, the research conceptual framework of this study proposes a causal relationship between project managers' competencies and the delivery of successful innovation in projects.

Crawford (2006) have emphasized this idea through explaining that competency models have been successful in bridging the gap between the competencies that project managers need to achieve the best innovation outcomes in their projects. Furthermore, it is important to understand that the conceptual framework of this study is built on two main theories. The first theory is concerned about innovation, innovation diffusion theory, which argues that innovation gets diffused through potential users, who can make judgments to adopt or reject innovation in accordance to the beliefs that they have about innovation (Agarwal, 2000). The second theory is concerned about project managers' competencies, high performance managerial competency theory, which addresses aspects of competency in general; covering strategic, personal interactions, inspirational and achievement orientated behaviors, and that is longitudinal in nature and has been thoroughly validated (Tedstone & McWilliams, 2008)

Nevertheless, in order to achieve this main target, project managers' competencies are considered as independent variable that includes facets relate to the project managers' ability to deliver successful innovation. Thus, the PMs' competencies are clustered under five global factors: leadership, communication, teamwork, creativity, and commitment. Each of the global factors will include specific measurements related to the delivery of successful innovation in projects. However, there are some moderator variables that will influence the delivery of successful innovation in projects such as the PMs' personality traits, and the PMs' environment. The PMs' personality traits controller (moderator) variables are clustered into five global factors: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. The PMs' environment moderator variables are clustered into four factors that are stakeholders, resources, culture, and market. The dependent variable is the delivery of successful innovation in projects, whicg is clustered into three global factors that are innovation for successful time outcome, innovation for successful cost outcome, and innovation for successful quality outcome. Accordingly, and based on the comprehensive literature review of this study, Figure 4.1 represents the research conceptual model.

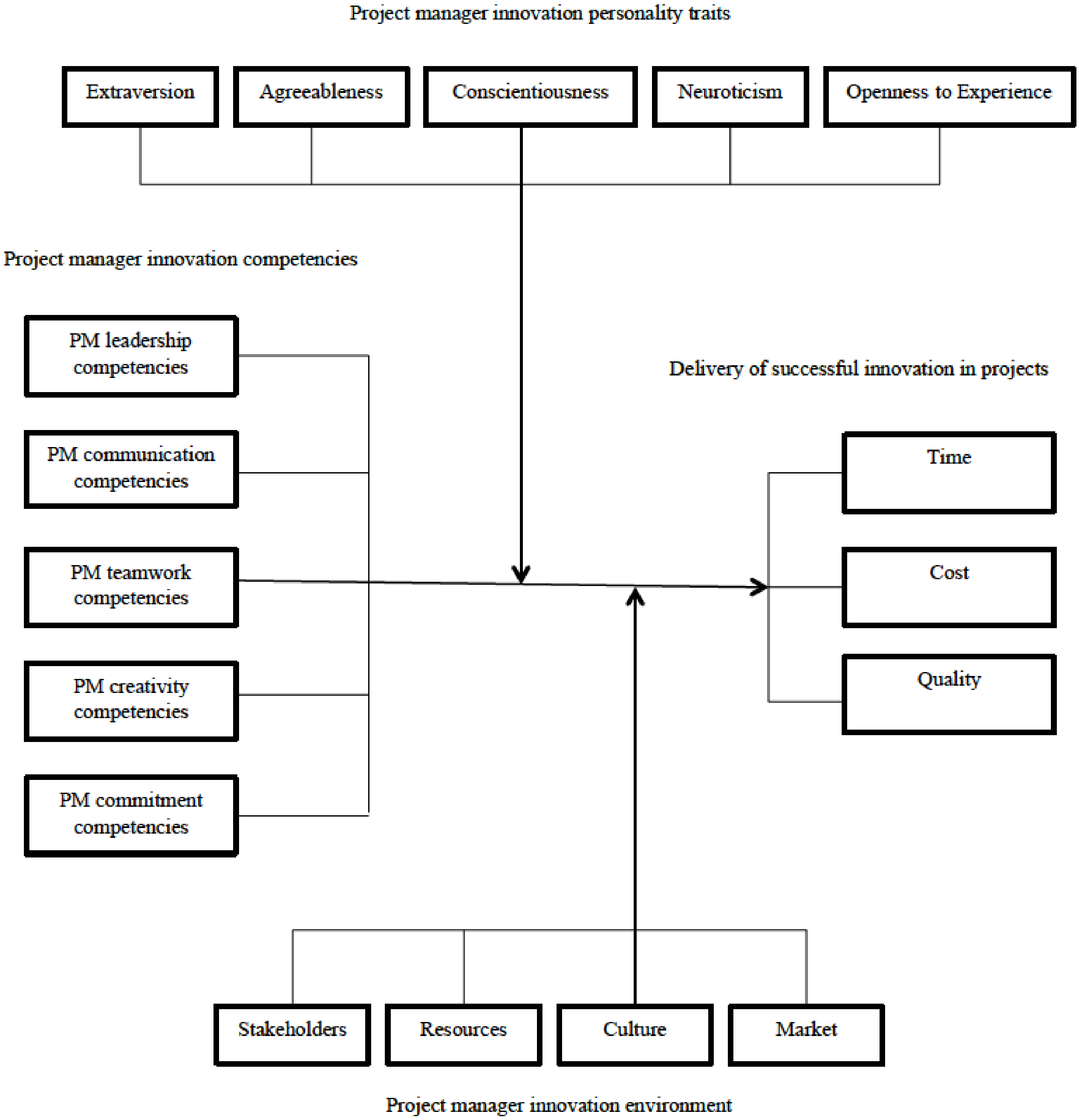

Figure 4.1: Research conceptual Model

4.3 Operational definitions and measurements from Literature

In this research, the used criteria have been collected from the literature review, and they cover the following:

4.3.1 Project manager innovation competencies

Table 4.1 briefly summarizes the PM innovation competencies that are most frequently mentioned in literature, to have an influence on the delivery of successful innovation in projects.

Table 4.1: Project manager innovation competencies influencing the delivery of successful innovation from literature

Item	PM competencies	References
1	Leadership competencies	Anderson, 1992; Dainty, Cheng & Moore, 2003; Dainty, Cheng & Moore, 2005; Guillén & Saris 2013; Howell, Shea & Higgins 2005; Ríos-Carmenado, Rahoveanu & Gallegos, 2014; Liikamaa, 2015; Rojas, 2013; Takey & Carvalho, 2015; Vila, Pérez & Coll-Serrano, 2014
2	Communication competencies	Abu Bakar et al., 2011; Anderson, 1992; Dainty, Cheng & Moore, 2003; Dainty, Cheng & Moore, 2005; Dziekoński, 2017; Howell, Shea & Higgins 2005; Liikamaa, 2015; Ríos-Carmenado, Rahoveanu & Gallegos, 2014; Rojas, 2013; Skulmoski & Hartman 2010; Takey & Carvalho, 2015; Vila, Pérez & Coll-Serrano, 2014
3	Teamwork competencies	Abu Bakar et al., 2011; Cheng, Dainty & Moore 2005; Dulaimi, Ling & Bajracharya, 2003; Dziekoński, 2017; Guillén & Saris 2013; Ling, 2003; Ríos-Carmenado, Rahoveanu & Gallegos, 2014; Liikamaa, 2015; Skulmoski & Hartman 2010; Takey & Carvalho, 2015; Vila, Pérez & Coll-Serrano, 2014
4	Creativity competencies	Abu Bakar et al., 2011; Crant, 2000; Dziekoński, 2017; Powl & Skitmore, 2005; Ríos-Carmenado, Rahoveanu & Gallegos, 2014; Rojas, 2013; Takey & Carvalho, 2015; Vila, Pérez & Coll-Serrano, 2014
5	Commitment competencies	Abu Bakar et al., 2011; Anderson, 1992; Hollenbeck, McCall and Silzer, 2006; Howell, Shea & Higgins 2005; Liikamaa, 2015; Ling, 2003; Ling et al., 2007; Ozorhon, 2013; Rojas, 2013; Samson and Gloet, 2014

This study is concerned about the project manager competencies that are most frequently mentioned in literature to have an influence on the delivery of successful innovation in projects, which are leadership, communication, teamwork, creativity, and commitment competencies. Each one of the project manager innovation competencies has its own operational definition and is elaborated to more specific measurements from the study literature, as follows:

Leadership competencies: they are extremely important for project managers. These competencies allow project managers to be effective and understand how to delegate different missions appropriately. They also involve relinquishing control and permitting others to decide by their own (Rojas, 2013). However, in this study, the measurements for leadership competencies that are most frequently mentioned in literature to influence the delivery of innovation are shown in Table 4.2.

Table 4.2: Leadership competencies measurements from literature

No.	Measurement	Measurement Description	References
1.1	Inspiring others	Inspire others to create ideas and find new opportunities	Seaden et al., 2003
1.2	Initiative	Proactively take initiative to innovate	Liikamaa, 2015
1.3	Influencing	Use appropriate influence strategies to get rid or navigate around any obstacles	Howell, Shea & Higgins, 2005
1.4	Decision making	Make decision that helps in delivering innovation	Boss, 2000
1.5	Action-Oriented	Avoid analysis paralysis when new opportunities are identified through exhibiting a preference towards action	Liikamaa, 2015
1.6	Flexibility	Be alerted to new opportunities and can easily get adapted to challenges	Liikamaa, 2015; Takey & Carvalho, 2015
1.7	Relationship building	Care about building and developing new relationships	Liikamaa, 2015
1.8	Conflict resolution	Find practical and creative ways to resolve existing conflicts	Anderson, 1992; Takey & Carvalho, 2015
1.9	Team building	Forming, and developing an effective team that can deliver successful innovation	Abraham et al., 2001

Communication competencies: they complement tasks of project managers as they can articulate ideas in a clear, brief, logical, and simple way to improve individuals' effectiveness. PMs are encouraged to possess excellent verbal and written communication competencies. Those who have the ability to communicate effectively know how to analyze a composite activity into simple tasks that team members can effortlessly understand. Project managers are supposed to be good listeners. Only by listening, PMs can learn about the different challenges of project team members. Effective communicators listen carefully to others to expand their understanding about different situations (Rojas, 2013). Hence, in this research, the measurements for communication competencies that are most frequently mentioned in literature to influence the delivery of innovation are demonstrated in Table 4.3.

Table 4.3: Communication competencies measurements from literature

Item	Measurement	Measurement Description	Reference
2.1	Listening	Listen to others without interrupting them	Rojas, 2013
2.2	Speaking	Speak using a clear (local or foreign) language that is appropriate to the audience	Rojas, 2013; Vila, Pérez & Coll-Serrano, 2014
2.3	Writing	Write (emails, memos, report, etc.) clearly and concisely using a local or foreign language	Abu Bakar et al., 2011; Vila, Pérez & Coll-Serrano, 2014
2.4	Presentation	Present products, ideas, or reports	Vila, Pérez & Coll-Serrano, 2014
2.5	Computer skills	Use computers and the internet effectively	Vila, Pérez & Coll-Serrano, 2014
2.6	Communication tone	Communicates in a tone and manner that shows respect	Rojas, 2013
2.7	Communicate systematically and openly	Communicate the importance of innovative solutions systematically and openly	Chen, 2002; Hartmann, 2006
2.8	Demonstrate awareness	Demonstrate strong awareness about innovation	Wei et al., 2013

Teamwork competencies: they are considered to be a combined action of a group of individuals, particularly when these actions are efficient and effective (Oxford Online Dictionary, 2017). Hence, in this research, the measurements for commitment competencies that are most frequently mentioned in literature to influence the delivery of innovation are specified in Table 4.4.

Table 4.4: Teamwork competencies measurements from literature

Item	Measurement	Measurement Description	Reference
3.1	Sharing	Share expertise, accountability, and knowledge to strengthen team performance	Bossink, 2002; Tewari, 2011
3.2	Supporting and collaborating	Support and collaborate with team members to solve any problems that may occur	Shieh, 2011
3.3	Conflict resolution	Attain constructive resolution of conflict	Anderson, 1992; Takey & Carvalho, 2015
3.4	Building, developing, and motivating	Build, develop, and motivate teams to bring forward new ideas	Abu Bakar et al., 2011; Anderson, 1992; Dainty, Cheng & Moore, 2003; Dainty, Cheng & Moore, 2005; Dziekoński, 2017; Guillén & Saris 2013; Liikamaa, 2015; Ríos-Carmenado, Rahoveanu & Gallegos, 2014Takey & Carvalho, 2015
3.5	Recognition and reward	Recognize and award original ideas and ideas for improvement	Abu Bakar et al., 2011
3.6	Challenging others	Frequently challenge others to think and act entrepreneurially (be initiative and take risk)	Takey & Carvalho, 2015

Creativity competencies: they are significant skills that are required to stay novel and generate new ideas, irrespective of practicality or quantity (Racela, 2014). However, in this research, the measurements for creativity skills that are most frequently mentioned in literature to influence the delivery of innovation are shown in Table 4.5.

Table 4.5: Creativity competencies measurements from literature

Item	Measurement	Measurement Description	Reference
4.1	Combine ideas	Usually create new ideas by combining existing ideas	Tewari, 2011
4.2	Improve things	When examining products, he/she critically evaluate them to see how they can be improved	Tewari, 2011
4.3	Find different ways	Usually think about how to do things in a different way	Abu Bakar et al., 2011; Dziekoński, 2017; Ríos-Carmenado, Rahoveanu & Gallegos, 2014
4.4	Try ideas from other fields	Usually look for new ideas outside of my field, and try to apply them	Tewari, 2011
4.5	Create value in a new way	Look for new techniques to create value in capabilities, products, processes, services, and strategies	Tewari, 2011
4.6	Find new links	Look for surprising connections between things	Tewari, 2011
4.7	New approach for challenges	Approach challenges creatively though thinking outside the box	Anderson, 1992; Dziekoński, 2017; Howell, Shea & Higgins 2005; Takey & Carvalho, 2015;Tewari, 2011

Commitment competencies: project managers can be completely committed to their work through being cautious about what they accomplish. They are supposed to be ambitious individuals who work because it entirely satisfies them, not because they need to make money. They are expected to show themselves as team members who are fully devoted to their job and the organization targets, in someway that the attentiveness of their project comes first all time. They are self-motivated, self-starter, and overachiever individuals (Rojas, 2013). Thus, in this study, the measurements for commitment competencies that are most frequently mentioned in literature to influence the delivery of innovation are provided in Table 4.6.

Table 4.6: Commitment competencies measurements from literature

Item	Measurement	Measurement Description	Reference
5.1	Central focus	Consider innovation as a main goal and central focus at work	Howell, Shea & Higgins 2005; Katzenbach & Smith, 1993
5.2	Satisfaction	Believe that he major satisfaction in life comes from making and implementing innovative ideas	Ling, 2003; Rojas, 2013
5.3	Important achievement	Believe that the most important achievements that take place involve innovation	Ling, 2003.
5.4	Hard work	Willing to put in a great deal of extra effort to support and implement innovative ideas	Dulaimi, Ling & Bajracharya, 2003; Jiao & Zhao, 2013
5.5	Engagement	Get fully engaged when performing innovation relevant activities	Ríos-Carmenado, Rahoveanu & Gallegos, 2014;
5.6	Adaptability	Have the ability to modify and change any course of action in order to get adapted as needed	Liikamaa, 2015

4.3.2 Project manager innovation personality traits

Although the ‘‘Big Five’’ personality traits are most frequently mentioned in literature to have an influence on the delivery of innovation, this research is keen about breaking them down to more specific traits and performing an empirical study to find out the most relevant items. Table 4.7 demonstrates the items that are considered for this research.

Table 4.7: PM innovation personality traits from literature (Atalah, 2014; Guillén & Saris, 2013; John & Srivastava, 1999)

Item	PM Personality Traits	Item	PM Personality Traits
	Extraversion		**Neuroticism**
1	Sociable	19	Tense
2	Assertiveness	20	Irritable
3	Energetic	21	Depression
4	Adventurous	22	Self-consciousness
5	Enthusiastic	23	Impulsiveness
6	Outgoing	24	Self-confidence
	Agreeableness		**Openness**
7	Trust	25	Curious
8	Straightforwardness	26	Imaginative
9	Altruism	27	Artistic
10	Compliance	28	Wide interests
11	Modesty	29	Excitable
12	Sympathetic	30	Unconventional
	Conscientiousness		
13	Efficient		
14	Organized		
15	Dutifulness		
16	Achievement striving		
17	Self-discipline		
18	Deliberation		

In this study, the operational definition of *Personality traits* states that they are the fairly enduring patterns of thoughts, feelings, and behaviors that differentiate individuals from one another and that disclose the tendency to react in certain ways under specific circumstances (Roberts, 2009). Personality traits are considered to be stable characteristics of people that can be used for selection, measured in percentages, and predicted to be normally distributed in a population (Yilmaz, et al., 2017, P. 101). This is in line with Golsteyn & Schildberg-Hörisch (2017) who have agreed that personality traits are assumed to have a high level of stability over time. However, in this study, each one of the project manager innovation personality traits, that can have an influence on the delivery of successful innovation in projects, is elaborated into more specific measurements from the study literature, as demonstrated in Table 4.8.

Table 4.8. Project manager innovation personality traits measurements from literature

No.	Measurement	Measurement Description	Reference
Extraversion			
1	Sociable	I support innovation by exerting social efforts and removing some of the social barriers that can prevent it	Jenssen & Jorgensen, 2004; Klerkx & Aarts 2013
2	Assertiveness	I have the confidence to present my ideas and apply my skills in new and unfamiliar situations	Chong, 2013; Howell, Shea & Higgins 2005; Nichols & Cottrell, 2014
3	Energetic	I seek out new ideas and sell them energetically	Howell & Higgins, 1990; Jenssen & Jorgensen, 2004; Lichtenthaler & Ernst, 2009
4	Adventurous	I am welling to take risk to implement successful innovation in projects	Jenssen & Jorgensen, 2004; Kelley & Lee, 2010; Walter et al., 2011; Pinto & Patanakul 2015
5	Enthusiastic	I look for new ideas and opportunities and apply them enthusiastically	Howell & Higgins, 1990; Jenssen & Jorgensen, 2004; Lichtenthaler & Ernst, 2009
6	Outgoing	I take up new ideas and fight pressures to turn such ideas into successful innovations	Jenssen & Jorgensen, 2004; Kelley & Lee, 2010; Klerkx & Aarts 2013; Lichtenthaler & Ernst, 2009; Pinto & Patanakul 2015
Agreeableness			
7	Trustworthy	I show trust in other people's ideas and actions	Liikamaa, 2015; Nichols & Cottrell, 2014
8	Straightforward	I frequently challenge others to think	Takey & Carvalho, 2015

		and act entrepreneurially (be initiative and take risk)	
9	Altruism	I avoid being rude to others	John & Srivastava, 1999;
10	Compliance	I continue to be involved with the innovation until it is implemented without giving up	Howell, Shea & Higgins 2005; Takey & Carvalho, 2015
11	Modesty	I am modest in dealing with others to get the best of them towards innovation	Bakker-Pieper & de Vries 2013
12	Sympathetic	I have passion to achieve innovation	Espíritu-Olmos and Sastre-Castillo, 2015; McCrae & Costa, 1987
Conscientiousness			
13	Efficient	When examining products, I critically evaluate them to see how they can be improved efficiently	Tewari, 2011
14	Organized	I approach challenges creatively though being organized and thinking outside the box	Tewari, 2011
15	Dutifulness	I look for new techniques to create value in capabilities, products, processes, services, and strategies	Tewari, 2011
16	Achievement striving	I avoid analysis paralysis when new opportunities are identified through exhibiting a preference towards action	Liikamaa, 2015;
17	Self-discipline	I have self discipline towards innovation, as it is a main goal and central focus at work	Howell, Shea & Higgins 2005; Katzenbach & Smith, 1993
18	Deliberation	I communicate issues openly and in a tone and manner that shows respect	Chen, 2002; Rojas, 2013
Neuroticism			
19	Tense	I remain calm in tense situations	Feist,1998; John & Srivastava, 1999; McCrae and Costa, 1987
20	Irritable	I get nervous easily	John & Srivastava, 1999;
21	Depression	I am depressed, blue	John & Srivastava, 1999;
22	Self-consciousness	I am emotionally stable, not easily upset	John & Srivastava, 1999;
23	Impulsiveness	I can be described as moody	John & Srivastava, 1999;
24	Self confidence	I worry a lot and may lack confidence	John & Srivastava, 1999; Nichols & Cottrell, 2014
Openness			
25	Curious	I am curious about many different things	John & Srivastava, 1999;
26	Imaginative	I have an active imagination	John & Srivastava, 1999;
27	Artistic	I am sophisticated in art, music, or literature	John & Srivastava, 1999;
28	Wide interests	I prefer work that is routine	John & Srivastava, 1999;
29	Excitable	I like to reflect, play with ideas	John & Srivastava, 1999;
30	Unconventional	I values artistic, aesthetic experiences	John & Srivastava, 1999;

4.3.3 Project manager innovation environment

Table 4.9 includes the PM innovation environment criteria that are most frequently mentioned in literature, to have an influence on the delivery of successful innovation in projects.

Table 4.9: Project manager innovation environment from literature

Item	PM Environment Criteria	References
1	Stakeholders	Ahsan, Ho & Khan, 2013; Bossink, 2002; Cheng, Dainty & Moore 2005; Khang & Moe, 2008; Howell, Shea & Higgins, 2005; Lahi & Elenurm 2015; Ozorhon, 2013; Pellicer, Yepes & Rojas, 2010; Murphy, Perera & Heaney, 2015; Powl & Skitmore, 2005; Samson & Gloet, 2014; West & Bogers, 2014;
2	Resources	Bohlmann, et al., 2013; Chatenier et al., 2010; Cunha, et al. 2014; Dulaimi, Nepal & Park, 2005; Evanschitzky, et al. 2012; Gambatese & Hallowell, 2011; Khang and Moe, 2008; Lahi & Elenurm 2015; Paladino, 2007; Pellicer, Yepes & Rojas, 2010; Vila, Perez & Coll-Serrano, 2014; Weiss, Hoegl & Gibbert, 2014; West & Bogers, 2014;
3	Culture	Belassi & Tukel, 1996; Büschgens, Bausch & Balkin, 2013; Dulaimi, Nepal & Park, 2005; Evanschitzky, et al. 2012; Lahi & Elenurm 2015; Pellicer, Yepes & Rojas, 2010; Samson & Gloet, 2014; Shenhar & Dvir, 1996; Tanner, 2008; Wei et al., 2013; West & Bogers, 2014;
4	Market	Bohlmann, et al., 2013; Belassi & Tukel, 1996; Evanschitzky, et al. 2012; Lahi & Elenurm 2015; Paladino, 2007; Pellicer, Yepes & Rojas, 2010; Reichstein, Salter & Gann, 2005; Prahalad & Hamel, 1990; Rese & Baier, 2011; Shenhar & Dvir, 1996; Song & Chen, 2014;

The operational definition of the *Project manager environment* states that it is the environment surrounding the project manager, which can be an innovation 'poor' environment or an innovation-supporting environment. The poor environment can influence innovation negatively. For example, in a poor-resource environment problems can occur form the lack of experienced resources, the managers' dissatisfaction about innovation initiatives, or the low cost provided by the organization that may not be acceptable to attain experienced resources who can deal with the complexity of the technological solutions. These can potentially lead to unfavorable results (Cunha, et al. 2014). On the other side, an innovation-supporting environment is more advanced in terms of innovation development. The reason is that such an environment can support the creativity of employees, improve innovation in short term, and shape organizational cultures in long term (Dul & Ceylan, 2014). Supporting environments does not only focus on physical elements (i.e. furniture, colours, and plants), but also concentrates on social elements (i.e. individuals, and groups) (Dul & Ceylan, 2014). This environment also attains support from key stakeholders, creates positive conditions, provides suitable resources, obtains support from management, and presents adequate rules and regulations (Khang & Moe, 2008). Generally, a favourable environment for innovation positively influences product and process innovation (Jayaram, Oke & Prajogo, 2014), and maximizes collaborations and decisions making abilities (Lloyd-walker, Mills & Walker, 2014). However, the project manager innovation environment is elaborated into more specific measurements from the study literature, as demonstrated in Table 4.10.

Table 4.10: Project manager innovation environment measurements from literature

Sl. No.	**Key Measurements**	**Environmental Factors**	**References**
1	**Stakeholders**		
1.1	Decision-making	Stakeholders agree on decisions in the favor of innovation	Olander, 2007; Song, et al., 2015
1.2	Collaboration	Stakeholders work well together to deliver successful innovation	Khang & Moe, 2008; Samson & Gloet, 2014
1.3	Satisfaction	Stakeholders' satisfaction can indicate the success of innovation	Hills et al., 2008; Ozorhon, 2013
2	**Resources**		
2.1	Selection/ appropriate resources	Selecting the right resources for the success of innovation	Bohlmann, et al., 2013; Khang and Moe, 2008
2.2	Allocation/ combine and utilize	Allocating resources in effectively to deliver innovation	Drejer, 2001; Vila, Perez & Coll-Serrano, 2014
3	**Culture**		
3.1	Leveraging diversity	Understand the cultural differences and focus together on innovation as a main target	Evanschitzky, et al., 2012); Hartmann, 2006; Liikamaa, 2015;
3.2	Overcome diversity	Work together to capture opportunities in spite of any cultural differences	Büschgens, Bausch & Balkin, 2013; Chen, 2002; West and Bogers, 2014)
3.3	Innovative culture	Create and emphasize innovative cultures	Dulaimi, Nepal & Park, 2005; Wei et al., 2013
4	**Market**		
4.1	Competitive advantage	Innovation creates competitive advantage in the market	Ji, 2012; Prahalad & Hamel, 1990): Williams (1992)
4.2	Market orientation	Innovation plays an important role in influencing the existing and future market orientation	Evanschitzky, et al. 2012; Paladino, 2007
4.3	Emergence of new markets	New markets emerge as a result of innovative products	Ernst et al., 2015; O'Connor & DeMartino, 2006

4.3.4 The delivery of successful innovation in projects

The criteria for the influence of the delivery of successful innovation in projects, which are most frequently motioned in literature are: innovation for successful time outcome, innovation for successful cost outcome, and innovation for successful quality outcome (Bossink, 2002; Chuang, Jason & Morgan, 2011; Halbesleben et al., 2003; Hartmann, 2006; Jayaram, Oke & Prajogo, 2014; Kelley & Lee, 2010; Ozorhon, 2013; Piening & Salge, 2015; Slater, Mohr & Sengupta, 2013).

In this study, the operational definitions are as follows:

The delivery of successful innovation: it refers to a successful implementation of innovation that satisfies the initial requirements that are associated with time, quality and cost.

In order to be more specific, the operational definitions for time, cost, and quality of this study are:

Time: it can be defined as the unlimited continuous progress of existence and events in the past, present, and future considered as a whole (Oxford Dictionary, 2017). In particular, the significance of time is increased in the social setting of organizational creativity, as innovation has become a main strategic orientation of any organizations that are trying to accomplish a continuous competitive advantage in today's global environment (Halbesleben et al., 2003). As the case with many complex innovations, the implementation process demands a considerable amount of time investment on the part of employees and particularly from managers responsible for scheduling (Chuang, Jason & Morgan, 2011). Its also essential to point out that time constraints can reduce the potential to improve an idea that is ready for implementation (Hartmann, 2006). Thus, a main challenge for organizations pursuing to advance their innovation management lies in finding out when to offer direct support, and how much support is needed to deliver successful innovation in projects (Kelley & Lee, 2010).

Cost: the cost (of an object or action) requires a payment of a definite amount of money before it can be acquired or completed (Oxford Dictionary, 2017). However, it is imperative to be aware that innovation may bring extensive financial benefits in one case, while it may only improve the environmental performance in other cases (Ozorhon, 2013). Innovation can also offer significant cost reductions in many applications (Slater, Mohr & Sengupta, 2013). Still, cost constraints can decrease the potential to develop an idea that is ready for implementation (Hartmann, 2006).

Quality: it refers to the standard of something (i.e. product or service) as measured against other things of a comparable kind; the level of excellence of something (Oxford Dictionary, 2017). However, 'Quality management of innovation' is a subcategory of `innovation management' that can contribute directly, or in most of the cases indirectly, to the improvement of innovations. Quality management can help deliberately the management of innovation. In particular, tools in strategic quality management can generate organizational conditions that improve innovations, initiate and manage innovation process, create precise innovation content, and employ innovations in main processes of a specific organization. In short, quality tools can be used indirectly and sometimes directly to accomplish innovation processes (Bossink, 2002).

Hence, in this study, the measurements for the successful delivery of innovation in projects that are most frequently mentioned in literature to influence the successful delivery of innovation are provided in Table 4.11.

Table 4.11: The successful delivery of innovation measurements from literature

Item	Measurement	Measuring the delivery of innovation in projects	References
1	Time	1. Creative ideas resulted in better control over project schedule 2. Ability to respondent to scope change in a timely manner 3. Speed of time from ideas submission to scope change feedback 4. Ability to access project data and knowledge in a timely manner 5. Speed and ability to exploit ideas to improve project success	Chason et al., 2013; Dainty, Cheng & Moore, 2003; Chuang, Jason & Morgan, 2011; Halbesleben et al., 2003; Hartmann, 2006; Ozorhon, 2013; Rogers, 2003
2	Cost	1. Creative ideas resulted in better control over project costs 2. Amount of earnings achieved through innovation relative to objectives, industry competitors, and overall competitive position 3. Shareholder payments that reflect the growth achieved through applying new ideas 4. Workplace payments for employee attraction, retention, and motivation 5. Customer and market payments for market share and customer loyalty	Chason et al., 2013; Dainty, Cheng & Moore, 2003; Gambatese & Hallowell, 2011; Hartmann, 2006; Slater, Mohr & Sengupta, 2013
3	Quality	1. Creative knowledge acquired by the project through the project 2. Creative ideas improved overall control exercised over the project 3. Enhanced quality of communication between the project members and users 4. Creative ideas improved users' feelings regarding participation in the project 5. Richness coupled with robustness of innovation platforms, sets of ideas, or opportunities chosen and improved. 6. Strength of the existing leadership commitment to progress through innovation as mentioned in the strategic initiatives and targets	Bossink, 2002; Chason et al., 2013; Dainty, Cheng & Moore, 2003; Jayaram, Oke & Prajogo, 2014; Malinoski & Perry, 2000

4.3.5 The demographics influencing the Study

There demographics that can moderate the influence of PM's competencies on the delivery of successful innovation in projects, are divided into three parts that are demographics, work related determinants, and organizational determinants, and are detailed as follows:

Demographics:

The demographics of this study include the following:

- Age: Obtaining knowledge about innovation is often mediated by personality variables and other socioeconomic attributes such as age (Franceschinis et al., 2017). Hence, age is measured as a continuous variable where respondents are asked to select the option that fits with their age. It is coded as 1 (1-5), 2 (6-10), 3 (11-15), 4 (16-20), and 5 (Above 20).
- Gender: Agnete Alsos, Ljunggren and Hytti (2013) have studied innovation from a gender perspective. They have clearly verified innovation to be a highly gendered field. This is in line with an earlier study by Wajcman (2010), who have also argued that innovation is a source and consequence of gender relations. Thus, gender is covered in the study as a categorical variable, and coded as 1 (Female) and 2 (male).
- Education: The ability to deliver innovation can be influence by the project manager's educational qualifications (Park, Nepal & Dulaimi, 2004). Ahsan, Ho & Khan, (2013) have emphasized that the educational background of project managers can indicate their knowledge level. This is inline with Franceschinis et al. (2017) who have stated that acquiring knowledge about innovation is often mediated by personality variables and socioeconomic attributes such as education level. Interestingly, Ramazani and Jergeas (2015) have argued that education and training have significant influence in preparing PMs on their journey from being good to becoming great. Hence, education considered in this research as a categorical variable, and coded as 1 (completed less than high school), 2 (completed high school), 3 (completed college), 4 (completed bachelors), and 5 (completed post graduate studies).

Work-related Determinants

- Experience level: The ability to deliver innovation in projects can be influence by the project manager's experience (Park, Nepal & Dulaimi, 2004). Edum-Fotwe and McCaffer (2000) have mentioned work experience is one of the most important considerations to find out and develop project manager innovation competencies. Rojas (2013) have added that that experience can be considered as one of the main skills of a successful PM, as no amount of academic knowledge can balance a noticeable lack of experience. Chatenier et al. (2010) have concluded that inexperienced individuals may hesitate to accept and deal with innovative ideas. Hence, the experience level is measured as a continuous variable, where respondents are requested to indicate their years of experience, and coded as 1 (1 year or less), 2 (2-7 years), 3 (8-13 years), 4 (14-19 years), and 5 (20 years or above).

- Job Position: knowing the job position is significant as it indicates the level of authority, responsibilities, duties and tasks that a participant (a project manager or other) is familiar with (Rojas, 2013). Yet, Cheng, Dainty & Moore, 2005 have argued that the appropriate type of competencies is an attribute of both job position and the jobholder. Generally, competency research often concentrates on specifying which sets of competencies are substantial to the work position being analyzed, and to what extent (Sparrow & Boam, 1992). Hence, the participants' current position is measured as a categorical variable, and coded as 1 (project manager), 2 (project manager assistant), 3 (project management office member), and 4 (project team member).

Organizational Determinants

- Industry nature: understanding the nature of the industry is critical, as each industry has its own policies, practices, procedures, and culture (Hills et al., 2008). Besides, innovation occurs less in some industries compared to others due to the characteristics and structure of that industry (Gambatese & Hallowell, 2011). Hence, the nature of industry is measured as a categorical variable, and coded as 1 (business), 2 (construction), 3 (health care), 4 (information technology), and 9 (other).

- Organization type: Understanding the type of organization is significant, as each organization type has its own organizational culture (Büschgens, Bausch & Balkin, 2013; Evanschitzky, et al. 2012;West & Bogers, 2014), organizational design (Evanschitzky, et al. 2012; Song & Chen, 2014), capabilities (Reichert et al., 2016; Zawislak et al., 2012), resources (Evanschitzky, et al. 2012; Paladino, 2007; Weiss, Hoegl & Gibbert, 2014), and management practices (Büschgens, Bausch & Balkin, 2013; Samson & Gloet, 2014; Song & Chen, 2014) that can influence the delivery of successful innovation in projects. Hence, the organization type is measured as a categorical variable, and coded 1 (government), 2 (semi-government), 3 (private), and 4 (not-for-profit).

However, although associations are found between demographic variables and the literature of PMIC and DSI, this study has never intended to investigate any demographics that are associated with the study variables. The focus of the study (and the interest of the researcher) is on PMIC and the DSI in projects, involving the mediation effect of PMIPT and PMIE. While the understanding of the literature associated with demographics is imperative, this PhD thesis has not covered a thorough analysis of the demographics due to time and word limit restrictions. Nevertheless, incorporating demographics in the survey is essential to gather some fundamental information in case that another researcher may be inspired to thoroughly track the demographic side in future research, and also to represent an overview about the overall sample.

4.4 Developing the Research Hypotheses

Referring to the comprehensive literature review provided in Chapter 2 and Chapter 3 and the conceptual framework and model demonstrated in section 4.2 of this Chapter, the following research hypotheses are developed:

4.4.1 Direct Hypotheses

The study main hypotheses are listed below and illustrated in Figure 4.2:

H1: There is a positive relationship between project manager innovation competencies and the delivery of successful innovation in projects.

H1-a: There is a positive relationship between PM leadership competencies and the delivery of successful innovation in projects

H1-b: There is a positive relationship between PM communication competencies and the delivery of successful innovation in projects.

H1-c: There is a positive relationship between PM teamwork competencies and the delivery of successful innovation in projects.

H1-d: There is a positive relationship between PM creativity competencies and the delivery of successful innovation in projects.

H1-e: There is a positive relationship between PM commitment competencies and the delivery of successful innovation in projects.

4.4.2 Mediators' Hypotheses

In this study, the project manager innovation personality traits, and the project manager innovation environment are suggested to have a mediating effect on the relationship between project manager innovation competencies and the delivery of successful innovation in projects. The mediation hypotheses that describe these relationships are demonstrated in Table 4.12.

Table 4.12 Mediation initial hypotheses

H2	**Project manager innovation personality traits mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects**
H2-a	PM innovation extraversion personality traits mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects
H2-b	PM innovation agreeableness personality traits mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects
H2-c	PM innovation conscientiousness personality traits mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects
H2-d	PM innovation neuroticism personality traits mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects
H2-e	PM openness to experience personality traits mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects
H3	**Project manager innovation environment mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects**
H3-a	The stakeholders mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects
H3-b	The resources mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects
H3-c	The culture mediates the relationship between PM innovation competencies and the delivery of successful innovation in projects
H3-d	The market mediates the relationship between PM innovation competencies and the delivery of successful innovation in projects

Nevertheless, in order to have a complete picture about the hypotheses of this study, Figure 4.2 illustrates the direct and mediational hypotheses.

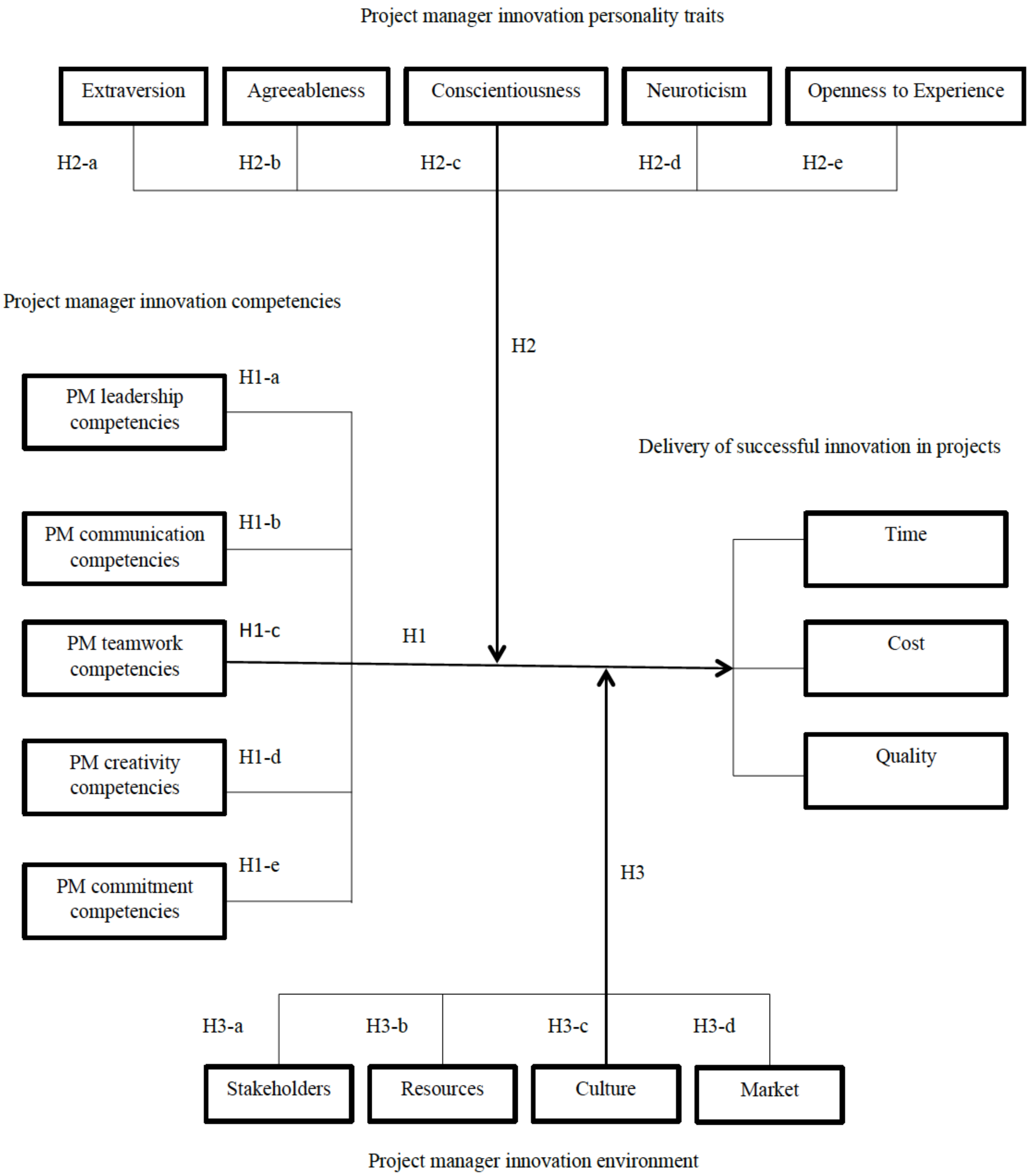

Figure 4.2: Direct and mediation hypotheses of the study

4.5 Summary

This chapter has described the conceptual framework and the conceptual model development. It has clarified that this research adopts the innovation diffusion theory and the threshold and high performance managerial competencies to develop the conceptual model. It has also provided thorough information about the study criteria and the operational definitions. Furthermore, this chapter has presented the development of the direct and mediation hypotheses of the study. In particular, the hypotheses cover the direct relationship between the project manager innovation competencies and the delivery of successful innovation in projects. While, the mediator hypotheses cover the effect of the project manager innovation personality traits/ the project manager innovation environment on the relationship between the project manager innovation competencies and the delivery of successful innovation in projects.

Chapter 5 Research Methodology

5.1 Introduction

This chapter explains the research design and the methodological approach applied to conduct the study. It includes in detail the research method starting with an explanation about the research purpose, which is to investigate if project managers' innovation competencies can affect the delivery of successful innovation in projects. In addition, this study examines the mediation effect of project manager innovation personality traits and environment on the relationship between project manager innovation competencies and the delivery of innovation in UAE projects. This chapter represents a description of how the research is designed and the data are collected. It also discusses the conversion of the research instruments, provides information about the current study population and sample size used, and describes how the measurements are tested. This chapter concludes with a description about the statistical methods that are used in the analysis, confidentiality issues, and ethics compliance.

5.2 Research Methods

There are three main categories of research methods that are qualitative, quantitative, or mixed methods. Quantitative method refers to research that reflects large samples and uses statistical procedures to examine relationships among the variables concerned (Tsang, 2014). In quantitative research, the mission is to establish a 'representation' of what participants do or what they believe. This helps in investigating some behavioral and mental facts (Barnham, 2015). Qualitative research is an investigation aimed at describing human experience in the actual way it emerges in individual's lives (Polkinghorne, 2005). In qualitative research, the answers of how? why? in what way? can be found out, as it aims to understand why respondents think or act in particular ways (Barnham, 2015). Mixed methods research combines quantitative and qualitative research methods in the same research. Such an approach can help in developing rich insights and intensive verification about various phenomena of interest that cannot be entirely understood using only a quantitative or a qualitative method (Johnson et al., 2007; Venkatesh, Brown & Bala, 2013).

Qualitative methods have been used effectively in many studies. For example, interviews are used to examine the competency profile of outstanding project managers (Cheng, Dainty & Moore, 2005). Interviews are also conducted to investigate the soft skill quantifications of project managers (Muzio et al., 2007). They have been performed to categorize the soft competencies of project managers during project phases (Skulmoski & Hartman, 2010). Wesselink, et al. (2015) have used interviews to study the competencies of managers required to achieve corporate social responsibility targets within a particular context, and the specific stage of implementation process. Ramazani and Jergeas (2015) have reported a qualitative study of project managers working in oil and gas construction sector in Calgary. They have used interviews to study how project managers competencies can prepare them for the future. They also have argued that education as well as training can do more to prepare PMs on their journey from being good to become great. Other researchers have used both interviews and focus groups to find out the competencies in which specialists need to implement innovation, and deal with any associated challenges (Chatenier et al., 2010). Recently, Loufrani-Fedida and Missonier (2015) have performed four case studies to study three main levels of competencies that are individual, collective, and organizational of project managers operating in different sectors and disclose the relations that unite them.

Quantitative methods have also been used in numerous studies to examine competencies. For example, questionnaires have been useful to identify the main competencies of PMs required to implement innovation for some organization in Poland (Szczepańska-Woszczyna & Dacko-Pikiewicz, 2014). A survey has also been applicable to examine the competencies of managers working in Sweden, and to evaluate if the lack of equivalence between male and female managers is due to the dissimilarities in the competencies they own (Arditi & Balci, 2009). Vila, Pérez and Coll-Serrano (2014) have used questionnaire items as the basis for determining an individual's competency profiles, incorporating their organizations, personal characteristics, and working environment in order to find out the key competencies that can explain the tendency of an individual to become innovator in his or her working environment. Another example is the questionnaire, which has been used to find out the association between competencies' preference and organizational change. This study has included an investigation of the competencies required to attain business success among PMs working in Malaysia (Salleh & Mat, 2009). Chipulu et al. (2013) have studied the competencies of project managers using surveys of small samples, which suffered from uncontrollable biases and could not be generalizable. Another study has also used questionnaires to examine the estimated value of multisource ratings of competencies, which can be interrelated to managerial as well as organizational efficiency of Dutch organization (Semeijn, Van Der Heijden & Van Der Lee, 2014).

Mixed methods have rarely been used to study competencies. One good example that can be presented is the work of Ahsan, Ho and Khan (2013), who have used mixed methods to assess project manager innovation competencies. Their study has incorporated a qualitative and quantitative content analysis, which has covered the subject entirely. The qualitative approach has produced a conceptual framework, while the quantitative method has delivered measurable observations for the obtained framework.

However, the researcher has decided to use quantitative research method for the current study. In justification, and considering all of the above findings, the researcher has observed that most of studies about project manager innovation competencies use either qualitative or quantitative methods, and are less likely to use mixed methods for such studies. Yet, qualitative research methods concentrate on the interpretation of a particular phenomenon through observing and interpreting. Researchers who decide to adopt qualitative methods need to collect their empirical data through listening, observing, and interpreting a social phenomenon instead of analyzing numerical measures using statistical methods (Zikmund et al., 2013). On the other side, quantitative research techniques deal with measures that generate the quantified data needed for statistical analysis; regularly this is accomplished through distributing a questionnaire or through means of structured interviews. In the current research, it is important to have quantified data to figure out if there is a relationship between project manager innovation competencies and the delivery of successful innovation in projects. Also, the quantified data are necessary to test the meditational relationship of the project manager innovation personality traits and the project manager innovation environment on the relationship between project manager innovation competencies and the delivery of successful innovation in projects. Furthermore, considering the differences between qualitative and quantitative methods that are shown in Table 5.1 (along with a detailed clarification in section 5.3 and 5.4 about the link between the quantitative method and both the philosophical assumption (positivism) and research approach (deductive), respectively), a quantitative research method is considered to be appropriate for the current study.

Table 5.1: Differences between qualitative and quantitative methods (Thyer, 2010, p. 343)

Selection criteria	Qualitative method	Quantitative method
Main purpose	To describe individuals and events in natural settings	To explore, describe, test, or assess phenomena
Philosophical perspective	Phenomenological	Existentialism
Logical orientation	Inductive (G → S)	Hypothetical-deductive (S → G)
Dynamism	Process-oriented: experiential and systemic	Deterministic: linear and prescribed
Theory use and Generation	Integrated throughout; requisite grounded theory	To justify hypothesis questions and to validate
Researcher's role	Active (immersion)	Passive (immersion optional)
Problem specification	May emerge at the end or early on	May emerge at the end or early on
Method	Created as one evolves or predetermined	Created as one evolves or predetermined
Generalisability	Low / High	Low / High

Nevertheless, to get more organized, the selected (quantitative) method for this empirical study is conducted following the systematic approach illustrated in Figure 5.1 (Flynn et al. 1990). This method covers six main parts. First, the theoretical base is made and a theory verification methodology is followed. Second, an appropriate research design is selected (survey). Third, regarding data collection methods, the researcher has selected questionnaires as they can be used efficiently in combination with the research design. Forth, the implementation phase includes the selection of a proper sample, an appropriate design and a suitable administration of the instruments used for data collection. Fifth, data are sensibly processed and precisely analysed. Finally, the research report is expected to be ready for publication. Underlying all stages are robust considerations of reliability and validity. The reason is that following reliability and validity techniques at every phase guarantees that the results can successfully be generalized and will most propbaby merit publication as an effective contribution to research (Flynn et al., 1990).

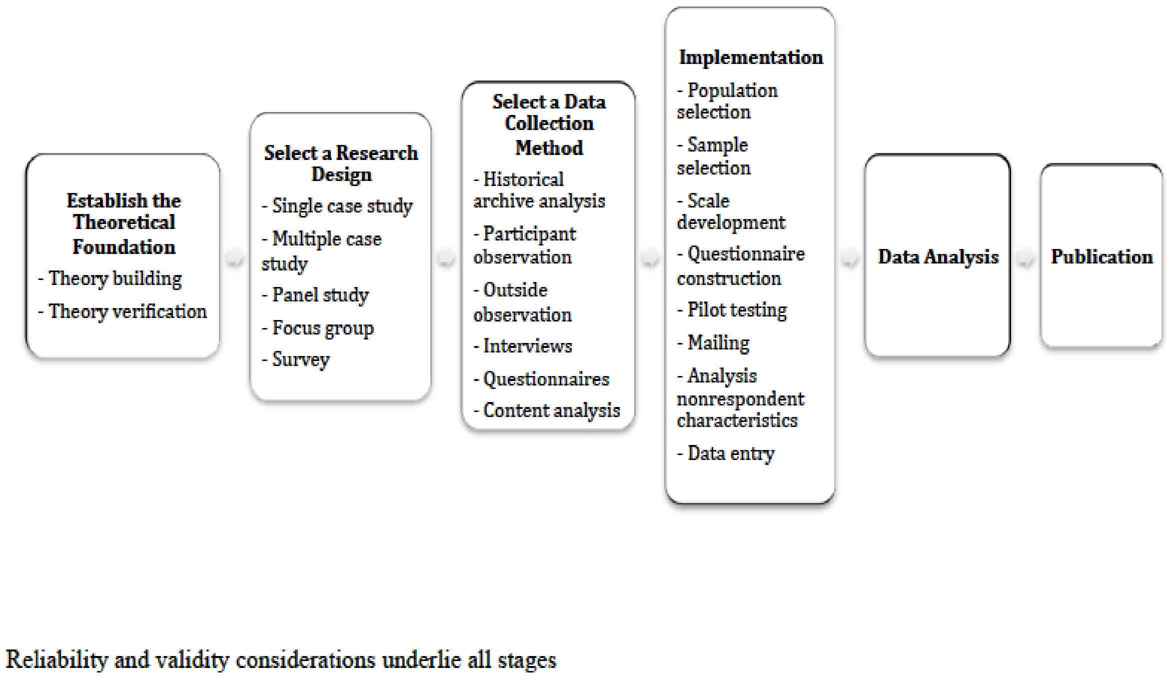

Figure 5.1: Conducting empirical research using a systematic approach (Flynn et al. 1990, p. 254)

Now that that the selection of a quantitative method is justified; the research philosophical assumptions and approach can be clarified. Hence, Guba & Linclon (1994) have argued that the basic belief system that guides a research method selection in relation to ontological and epistemologically concerns is referred to as the research paradigm. Likewise, Saunders et al. (2016) has agreed that a research paradigm is the way of inspecting definite social phenomenon in an endeavor to understand it. The relationships between the research paradigms, commonly used philosophies, and possible methods are demonstrated using the onion metaphor as shown in Figure 5.2. Then, the research philosophical assumptions and approach are detailed in sections 5.3 and 5.4, respectively.

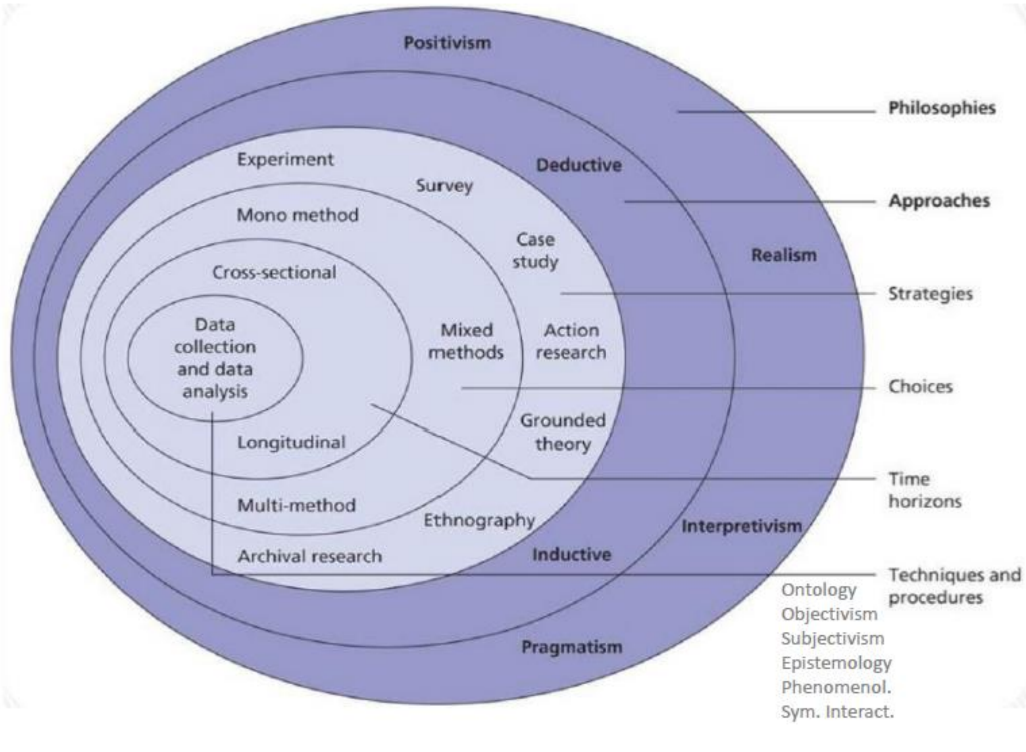

Figure 5.2: Research onion (Saunders et al. 2016, p. 124).

5.3 Philosophical Assumptions

Researchers are urged to understand and think using philosophical assumptions prior to conducting their studies to obtain adequate outcomes. Understanding the philosophical assumptions (positivism, interpretivism, and pragmatism) helps researchers to clarify the research design (in terms of the evidence required, the gathering and interpretation techniques, and the limitations associated with the different research approaches) to provide reasonable answers to the research questions (Easterby-Smith, Thorpe & Lowe, 2002).

The nature of this study is considered relevant to social science research (in specific, management research) within the field of construction and built environment, as it investigates into relationships between socio-psychological factors (the competencies of PMs) and the delivery of successful innovation in projects. In social science research, there are two main and contrasting philosophical traditions that are positivism and social constructionism (Easterby-Smith, Thorpe & Lowe, 2002). Positivism (Deduction) is the methodology of natural sciences that emphasizes the application of organized methods, which combines a deductive logic of an existing theory with precise empirical comments of individual behaviour, to formulate and confirm some hypotheses that can be used to expect patterns of human action (Love, Holt & Li, 2002; Neuman, 2006). Social constructionism or interpretivism (Induction) is the approach that focuses on understanding and clarifying the reality of why people, individually or collectively, have dissimilar experiences and perceptions, rather than looking for external causes and regulations to explain their behaviour (Easterby-Smith, Thorpe & Lowe, 2002; Love, Holt & Li, 2002). Social constructionism is inductive because it systematically analyses social actions through a detailed observation of individuals in a natural setting, to arrive at general principles or laws of how individuals create and maintain their social worlds (Love, Holt & Li, 2002; Neuman, 2006). Still, Guba and Lincoln (1994) have argued that philosophical considerations' questions often come before the questions associated with research methods and that researchers' need to select their philosophical position and decide between positivism (deductive) and interpretivism (inductive) research philosophies. Later, Saunders et al. (2016) have pointed out that it is fine to adopt more than one research philosophy. Here, pragmatism appears, as it takes place when researchers' do not embrace a definite research philosophy, and when the research questions are the emphasized critical basis of axiology, epistemology, and ontology. Simultaneously, pragmatist researchers' design their research whilst having discrepancies in their research philosophical situations and hence enabling them to implement mixed research methods (Saunders et al., 2016).

However, in this study, the researcher is persuaded to adopt positivism philosophical assumptions for many reasons, which are: the research aims to find out the project managers' competencies, and explore their relationships with the delivery of successful innovation in projects rather than explaining the competencies themselves; the nature of the research as it investigates on a social science field (Easterby-Smith, Thorpe & Lowe, 2002; Saunders et al., 2016); the highly organized methodology (Bryman & Bell, 2015; Love, Holt & Li, 2002; Neuman, 2006; Saunders et al., 2016); and the use of quantitative methods to collect data (Saunders et al., 2016). In addition, the implementation of positivism philosophy allows the researcher to work with the real data that are collected from PMs using questionnaires. At the same time, using this philosophy enables the researcher to perform the study in an objective manner. In other words, the researcher has no influence on the collected data. The reason is that the researcher can be considered external to the data collection procedure and independent from the research subjects (i.e. participants). Eventually, positivism philosophy enables the researcher to apply a well-organized approach that relies on quantitative techniques and statistical investigation of the research data.

5.4 Research Approach

Understanding the philosophical assumptions is essential, as this can guide researchers to appropriately decide the kind of data and research approach required to address the research problem as shown in Figure 5.3.

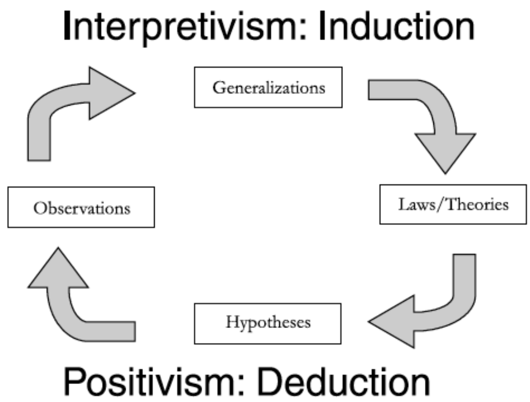

Figure 5.3: Deduction and inductive approaches (Love, Holt & Li, 2002, p. 296)

In addition, Table 5.2 provides brief description about the deductive and inductive research approaches. In particular, quantitative research focuses on large samples and uses statistical techniques to examine relationships among the variables concerned (Tsang, 2014). This approach is associated with positivism (deduction), as it uses statistical procedures to compare a large number of observations so that the obtained findings can be generalized to a larger population. Whereas, qualitative research relies on describing and clarifying human experience in the actual way it appears in people's lives (Polkinghorne, 2005). Thus, this approach is considered to be more relevant to social constructionism (induction) tradition.

Table 5.2: deductive and inductive research approaches (adapted form Saunders et al. 2016, p. 145)

Deduction emphasises	**Induction emphasises**
Scientific principles	Gaining an understanding of the meaning of humans attach to events
Moving from theory to data	A close understanding of the research context
The need to explain casual relationships between variables	The collection of qualitative data
The collection of quantitative data	A more flexible structure to permit changes of research emphasis as the research progresses
The application of controls to insure validity of data	A realization that the researcher is part of the research process
The operationalization of concepts to insure clarity of definition	Less concern with the need to generalize
A highly structured approach	
Researcher independence of what is being researched	
The necessity of selecting samples of sufficient size in order to generalize conclusions	

Accordingly, the deductive research approach is appropriate for this study for many reasons, which are: aiming to find out what competencies of project managers will result in delivering successful innovation in projects; employing a highly structured research methodology for repetition purposes; conducting a study that is independent of any observed social object; measuring the findings quantitatively; selecting adequate samples in order to facilitate the generalization of the research results; testing hypotheses; and exploring a causal relationship between numerous variables. On the other hand, adopting a deductive approach allows the researcher to examine existing theories and test the developed research hypotheses (as detailed in Chapter 4). Simultaneously, the deduction method is more attached with positivism, which has been embraced earlier by the researcher as a suitable a research philosophy. Ultimately, the consecutive steps for accomplishing the research in a deductive approach are: hypotheses deduction through testing the relationship between project manager innovation competencies and the delivery of successful innovation in projects, presenting the hypotheses and measuring the variables, testing the hypotheses and investigating the findings for hypotheses modification or confirmation. Similarly, the deductive approach is used to test the mediation hypotheses of the project manager innovation personality traits/ project manager innovation environment on the relationship between the project manager innovation competencies and the delivery of successful innovation in projects.

5.5 Research design and process

Understanding research approaches helps in making appropriate selection of the research design and strategies and ultimately implementing the research design that is proper for the study constraints (Easterby-Smith et al., 2012). However, research design entails series of rational decision-making alternatives that can be chosen sensibly by researchers. Bearing in mind the objectives of the study, such decisions can include the unit of analysis, the time constrain, the setting of the study, and the interference level of the researcher (Cavana et al., 2001). Hence, it is important to (1) describe the

unit of analysis, (2) identify and examine the associated operational definitions, and (3) interpret the proposition into hypotheses (Forza, 2002). Specifically, the ‘‘unit of analysis’’ stands for the accumulation level of data during a proceeding analysis, and it can refer to a projects, person, group, division, companies, systems, etc. (Flynn, 1990). In this study, item (1) the unit of analysis is the project manager, items (2) and (3) have been covered in the previous chapter.
Regularly, in theory verification, large samples are not essentially needed and a single case is often enough to reject a hypothesis. If a sufficient number of participants are involved, an proper statistical analysis can easily be done (Flynn et al., 1990). The reliability of all collected data is verified (Kvale & Brinkmann 2009). The validity of the results is checked and the practical part of the study is addressed (Kvale & Brinkmann 2009; Stake 1995). Unfortunately, some organizations and participants still hesitate to complete surveys, although such responses to questionnaires should be considered as a social conversation (Forza, 2002). Hence, the access to any individual or data is done after attaining permissions. The level of confidentiality is agreed with the respondents before starting any work (Stake 1995).

Questionnaires for theory verification pass through specific sub-processes that are interpretation of the conceptual framework into an empirical domain, design, pilot test, data collection, analysis, results interpretation, and report preparation. It is significant to tackle all constrains, embrace the needed information, assure quality of the research process, retain sustainability of the methods, and guarantee the feasibility of the study (Forza, 2002). At the same time, it is imperative to understand that a well-organized survey with accurate instructions, introduction, and an organized set of questions with a suitable alignment and response options, can help respondents to answer questions (Forza, 2002). Other options such as data collection techniques, methods for measuring variables, and analysis of concepts and variables are considered to be part of the study design (Cavana et al., 2001). Yet, before collecting data from participants, permissions are attained and confidentially of information are assured, to protect them from any harm that may occur (Fraenkel & Wallen, 1993).

During the execution stage of a survey, both the organizations and participants should be approached to collect data, clean data, avoid providing missing data (optional), control problems, and assess the quality of the measurement (Fraenkel & Wallen, 1993). Though, it is preferred to approach organizations first and then request the participants to be involved. The reason is that some of the required information may be confidential and the participants must be protected from any harm (Fraenkel & Wallen, 1993). At the same time, it is favorable to provide a feedback of the study to the participants in order to motivate their presence and future contribution (Forza, 2002). Besides, the required permissions are attained from participants, and the participants are informed in advance that their answers are confidential and are collected to be used only for research purpose. However, Halo effects are controlled and most of the times avoided by the researcher as the questionnaire will be mailed to the participants, and there is no face-to-face contact with the respondents. In explanation, the halo effects are rational biases that humans have, particularly when making a first impression about other people. Unfortunately, they do not only influence individual's decisions, but also the way in which people react toward behaviors. Thus, acknowledging the matter of halo effects (i.e. mood and arousal) helps in understanding most of the social encounters, improving the needed protocols, and applying cognitive strategies to avoid possible biases that may lead to vague or unfair impression about others (Lammers et. al, 2016).

In the next step, the findings of the questionnaires are analysed. The findings of the questionnaires are studied using the Statistical Package for the Social Sciences (SPSS) version 22. The SPSS helps in conducting preliminary data analysis such as testing the frequency distributions, central tendencies, dispersions, and correlations. In general, this tool can be applied to measure the following

- Demographics’ frequency distributions.
- Dependent and independent variables’ mean, standard deviation, variance and range.
- Variables’ inter-correlation matrix.

Nevertheless, the content of the research report is expected to include well-defined concepts, identified issues, and reliable data sources (Stake 1995). However, Figure 5.4 demonstrates the steps of the research plan that are undertaken to achieve the research aims and objectives.

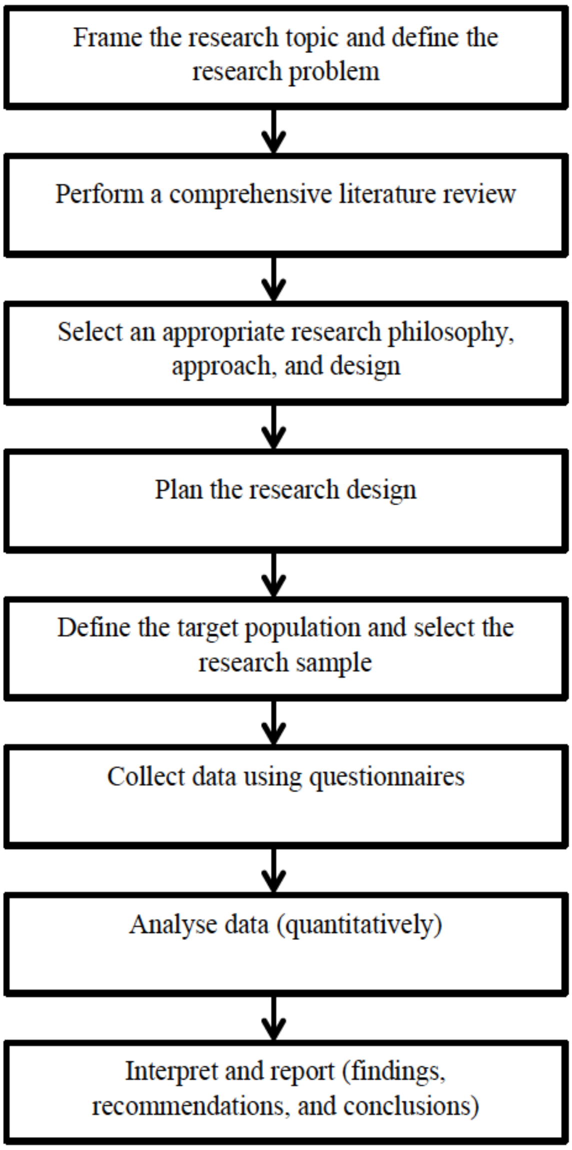

Figure 5.4: The research plan of this study

5.6 Questionnaire design and structure

‘‘Survey research is one of the most common research methods in social science and education’’ (Muijs, 2004, 60). This is mostly because it is not only an effective way to collect a large amount of data, but also it is adjustable in the sense that even a large number of topics can easily be studied (Muijs, 2004). Further, Saunders et al. (2016) have mentioned that questionnaires are terms that cover data collection methods, structured interviews, telephone and online surveys. They also have added that surveys’ response rates, reliability and validity can be maximized through careful survey design, defined layout, pilot testing and well-planned execution. However, it is important to point out that the researcher has adopted online questionnaires as the primary research method due to the nature of the research, which is descriptive and explanatory at the same time. In justification, explanatory research entails an appropriate conceptualization of the proposed theory before designing the survey questions (Ghauri & Gronhaug 2005). Dillman (2007) has added that there are three types of data variables that can be collected using surveys, which are attributes, opinion, and behavior. Again, this makes the selection of questionnaires effective, as the designed questionnaire includes attribute data such as demographic variables, PM competencies, PM personality traits, PM environment, and the criteria of delivering successful innovation in projects.

Deciding an appropriate type of questions is critical. The questions can be open-ended or close-ended questions. In particular, Open-ended are useful when the researcher is unsure of the response, and when a detailed answer is required. It is broadly in-depth and semi-structured interviews (Saunders et al., 2016). Open-ended questions give the chance for participants to elaborate on their responses while closed-ended questions limit participants to choose their answer from some definite alternatives (Fink 2003). This study is concerned about closed-ended (also known as forced-answered) questions, as they demand little time from participants and simpler for comparisons purposes. However, there are six types of closed-ended questions that are category, quantity, list, ranking, rating and matrix (Saunders et al., 2016). *List* presents a list of items where participants can choose any of them; *category* offers only one answer that can be chosen from a specified set of categories; *ranking* expects the participants to place something in order; *rating* provides a rating device that is used to record participants' responses; *quantity* requires the participants to provide an answer as a number giving the amount; and *matrix* presents participants' replies to two or more questions that can be recorded through the same grid (Saunders et al., 2016). In this study, the researcher has selected close-ended question, particularly rating. The reason is that the purpose of this study is to collect opinion data about project managers' competencies and the delivery of successful innovation in projects. In addition, rating questions normally requires Likert-style rating scale, where participants express their level of agreement with proposed options often on a rating scale involving four to seven choices (Corbetta 2003). The likert scales used for this study includes five-point likert scale rating: Importance starting from not important, slightly important, moderately important, important, to very important (1 to 5, respectively); agreement starting from strongly disagree, disagree, undecided, agree, to strongly agree (1 to 5, respectively); and influence starting from never, seldom, sometimes, often, to almost always (1 to 5, respectively). Eventually, it is essential to keep in mind that there is a need to use positive and negative statements to assure cautious response selection by participants (Saunders et al., 2016).

Moreover, as the researcher aims to cover a large number of respondents for this study, a questionnaire is the best instrument to meet this aim. Generally, surveys can be mailed to participants, handed-in personally, or done through telephone (Forza, 2002). Forza (2002) has also added that telephone (phone) calls can be used to enhance the response rate of surveys through making former notification calls. However, for this study, the questionnaires are posted online using the Surveymonkey tool, and the website link of the online questionnaires are mailed to the study participants. Yet, prior notification calls are done to remind and urge them to fill in the questionnaire. The questionnaire designed for the current research is demonstrated in Appendix B, and the estimated time to complete this questionnaire online is 20 to 25 minutes.

Nevertheless, the insight that conducting a survey research is easy is incorrect. In justification, what is the needed population and how to take a sample from it requires to be sensibly considered because only probability samples can be unbiased. Non-response is very usual and can cause bias in survey research, as can the poorly designed surveys do. Avoiding the occurrence of double negatives, unclear or ambiguous questions; keeping questionnaires to the point; and being culturally intelligent can help minimize bias (Muijs, 2004).

It is imperative to understand the quantitative data, which are mainly classified under categorical and numerical data. First, categorical data are concerned about categorizing data into sets according to identified attributes where it can be further grouped into nominal (descriptive) data and ranked data (Brown & Saunders, 2007). Descriptive data refers to counting the occurrence of a specific number under each classification or variable wherever it is hard to numerically describe the classification or rank it (Saunders et al. 2016). Descriptive data can be categorized under both dichotomous data cluster and ordinal (ranked) data group. Dichotomous data is when the variable is divided into two groups (i.e. ranking gender to female or male). Ordinal data is accurate, as participants are asked about the importance, the influence, or level of agreement with specific statements (Brown & Saunders, 2007). Second, numerical data stand for quantifiable data that are counted or measured in quantities, and it is more accurate than categorical data due to data values that are assigned to specific positions on a numerical scale and since more statistical tests can be done on them (Brown & Saunders, 2007). Numerical data can be categorized into interval or ratio data or it can possibly be classified into continuous and discrete data. Interval data refers to mentioning the interval variance between two data values for a specific variable where the obtained values can only be added or subtracted but cannot be multiplied or divided. Ratio data relates to computing the relative ratio variance between two data values for a specific variable (Saunders et al. 2016). Continuous data stands for data that can take any value whilst being measured precisely. Discrete data can be measured more accurately where each item can take a determinate integer of values from a scale that determines variations in discrete elements (Dancey & Reidy, 2008).

However, it is crucial to recognize data types when performing a quantitative data analysis. The reason is that selecting precise measurement scale leads to having a wide-range of analytical techniques and the gathered data can be reordered to less accurate level for additional analysis. For instance, in this study there are five experience categories that are 1-5, years, 6-10, 11-15, 16-20, and above 20 that can be re-categorized into three experience level categories that are 1-5 years, 6-19 years, 20 years and above. The reason is that it is simpler to generate proper statistics for data types when using software analysis. But, in the current study, the researcher has not re-categorized the collected data using this technique in order to present a complete set of descriptive statistics for this study.

Nevertheless, the research data has been collected using a survey that is divided into two main parts, which are general and specific information, as follows:

The general information part is used to collect PMs' data related to individual attributes such as: demographics, work-related characteristics, and organizational data, as follows:

- **Demographic:** this includes age (determined as a continuous variable); gender (determined as a categorical variable and coded as 1 for female and 2 for male); and education (determined as a categorical variable and coded as 1for less than high school, 2 for high school, 3 for college, 4 for bachelor, and 5 for post graduate).
- **Work-related information:** this involves work experience (measured as a continuous variable and coded as 1 for one year or less, 2 for 2-7 years, 3 for 8-13 years, 4 for 14-19

years, and 4 for 20 years or more); and current job position (measured as a categorical variable and coded as 1 for Project manager, 2 for Project management office member, 3 for project manager assistant, and 4 for project team member).

- **Organizational information:** this covers the nature of industry (measured as a categorical variable and coded as a categorized variable and measured as 1 for business, 2 for construction, 3 for health care, 4 for information technology, and 5 for other industries); and organization type (measured as a categorical variable and coded as 1 for governmental organizations, 2 for semi-governmental organizations, 3 for private organizations, and 4 for not-for-profit organizations).

The specific information part of the questionnaire aims to measure the project managers' competencies that influence the delivery of successful innovation in projects. The selected competencies have been carefully extracted from the thorough literature review as discussed in the framework chapter. In particular, the project manager competencies are grouped under five global variables that are leadership, communication, teamwork, creativity, and commitment. Each global construct is measured through specific measurements, as mentioned in Chapter 4. At the same time, the project manager personality traits are looked as one global variable that covers 30 items that are detailed in Table 4.8 of the previous chapter. Each global construct is measured through specific skill measurements, as mentioned in framework chapter. In general, Arditi, Gluch and Holmdahl (2013) have argued that competencies can be primary elements that enable individuals to accomplish their targets, advance themselves, and improve their innovation outcomes. Competencies are also essential to distinguish progressing PMs from their equals (Chong, 2013). Further, establishing a competence profile that identifies the required skills and personality traits by project managers can add a new perception to innovation management through concentrating on how individuals involved in innovation teams have great opportunity to enhance innovation success

(Chatenier et al., 2010). Moreover, this part also involves the project manager environment that can influence the delivery of successful innovation in projects. This PM environment is categorized into four main clusters that are stakeholders, resources, culture, and market that have also been collected from the comprehensive literature review. Hence, Cunha, et al. (2014) have argued that it is substantial to encourage innovation-supporting environments, as 'poor' environments can affect innovation negatively. Later, Lahi & Elenurm (2015) have argued that the environmental factors that can act as catalysts or barriers to innovation. Nevertheless, the delivery successful innovation in project is divided into three main groups that have been extracted form the literature review as well. These global variables are time, cost, and quality (the detailed measurements of each cluster are provided in Table 4.11). These three clusters are essential for the study as many scholars have mentioned that the main measures of projects that are time, cost, and quality can influence and be influenced by innovation (Bossink, 2002; Chuang, Jason & Morgan, 2011; Halbesleben et al., 2003; Hartmann, 2006; Jayaram, Oke & Prajogo, 2014; Kelley & Lee, 2010; Ozorhon, 2013; Slater, Mohr & Sengupta, 2013).

5.7 Questionnaire data coding

There are many general-purpose statistical analysis software packages (i.e. SAS, BMDP, Stata, Splus, GBStat, SPSS etc.). In this study, the Statistical Package for the Social Sciences (SPSS) is used. This is because SPSS is the most popular statistical data analysis software package used in academic research and is often available at most institutions of higher education (Muijs, 2004). Thus, the questionnaire items are coded by the Survey Monkey software, which is used to collect data. In particular, specific coding systems are followed to enter the data into SPSS software to assure right grouping of the items under the global variables. Accordingly, the PM competencies are grouped into five clusters that are summarized under the LCTCC acronym: leadership, communication, teamwork, creativity, and commitment. The coding of the PM competencies is:

LD: leadership, CM: communication, TM: teamwork, CR: creativity, and CT: commitment. The PM personality traits are considered as one cluster coded as PT, the 30 items are coded based on the measurement item number (PT37, PT38, PT39, etc.). The PM environment is grouped into four clusters that are summarized under the PME acronym: stakeholders, resources, market, and culture. The coding of the PMs' environment is: SK: stakeholders, RS: resources, CU: culture and MK: market. The delivery of successful innovation in projects is categorized into three clusters that are summarized under the TCQ acronym. The coding of the measurements of the delivery of successful innovation in projects is: TI: time, CS: cost, and QL: quality. Moreover, all items under each cluster are numbered. This is done through coding each cluster using a letter, and then setting series of numbers to cover all items of that particular cluster (e.g.: LD1, LD2, LD3, etc.). At the same time, all variables are coded based on the question number as demonstrated in Appendix C. The label also has item number (i.e. 1 of 8, 2 of 8, etc.) that can easily be understood through referring to Section 4.3 of the previous chapter, as the tables include detailed description of each item.

5.8 Questionnaire validity and reliability

Validity is doubtless the most significant aspect of the design of any instrument in research. However upright the study design or high-level the statistical analyses, the outcomes will be pointless if researchers are not really measuring what they are claiming to measure (Muijs, 2004). Validity refers to the reasons available to believe a truth claims. Such claims may take the form of descriptions, propositions, statements of fact, accounts, inferences, interpretations, generalizations, judgments or arguments. Irrespective of their form what is critical is why we believe the things that we do and how we validate or justify the claims we make (Norris, 1997). Validity stands for the extent to which the data collection tool measures what it is initially intended for (Matthews & Ross, 2010). It other words ''[v]alidity asks the question: are we measuring what we mean to measure?'' (Muijs, 2004, p. 65). The main types of validity test are internal, content, criterion validity, and construct validity (Cooper & Schindler 2008; Muijs, 2004). Internal validity is the ability of the questionnaire to measure what it intends to measure, and that it is able to present actuality of what is being measured (Cooper & Schindler 2008). Content validity is whether or not the content of the observed variables (i.e. questions of a questionnaire) is accurate to measure the latent concept that a certain study is trying to measure (Muijs, 2004). It also refers to the sufficiency of the measurement questions in truly measuring the research questions (Cooper & Schindler 2008). Similar to content validity, criterion validity can be linked to theory. When researchers develop a measure, they typically expect it (in theory) to predict a certain outcomes or to be related to other measures (Muijs, 2004). Criterion validity includes predictive validity as well as concurrent validity (Muijs, 2004). Predictive validity is whether or not the study instrument forecasts the results that are theoretically expect (Muijs, 2004). It also refers to the ability of the survey questions to generate accurate future predictions (Cooper & Schindler 2008). Concurrent validity has a less rigorous assumption, as the main question here is whether scores on the study instrument match with scores on other elements that are anticipated to be related to it (Muijs, 2004). Construct validity refers to the ability of the survey questions to measure the study constructs and variables (Cooper & Schindler 2008). It ‘‘is a slightly more complex issue relating to the internal structure of an instrument and the concept it is measuring (Muijs, 2004, p. 68). However, it is time to select an appropriate validity test for this study. The internal validity is irrelevant to this research, as the researcher knows that reality is being measured (PMs’ competencies in relation to the delivery of successful innovation in projects). The prediction validity is not considered as well because the questions aim to measure current situations not future predictions. The construct validity is not checked, as finding another survey that is designed to measure the same construct has been extremely difficult (Huff et al. 1997). Instead, due to the prominence of validating the survey questions’ ability to measure the research exploratory questions and constructs, the researcher has made a decision to assess the content. Content validity is performed through comprehensive and thorough literature review. Also, having some experts in the field to assess the usefulness, and suitability of the research questions to the research topic has helped in checking the content validity. Figure 5.5 summarizes the process of checking the survey content validity.

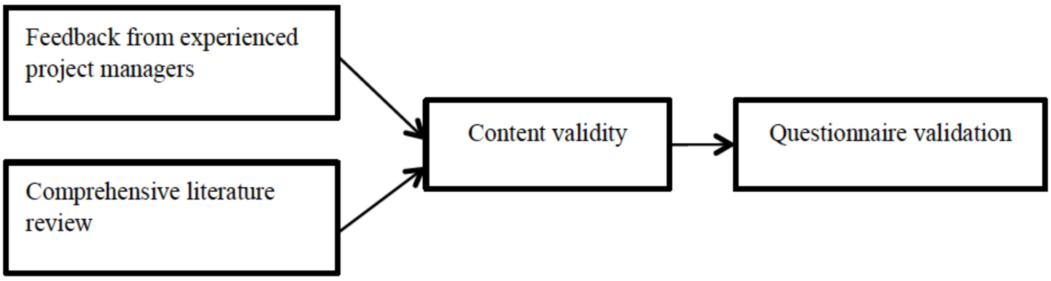

Figure 5.5: Survey validation process

‘‘A second element that determines the quality of our measurement instruments is reliability’’ (Muijs, 2004, p. 71). Basically, whenever a researcher is measuring something, there is some amount of error that is called ‘‘measurement error’’. Thus, reliability stands for the extent to which the obtained test scores are entirely free of any measurement error (Muijs, 2004). It also describes the degree of which two or more indicators share their ability to measure a particular construct (Hair et al., 1995). Reliability indicates dependability, accuracy, stability, consistency, predictability, and signifies any measurement technique that leads to the same outcomes on repeated trials (Kerlinger, 1986). However, reliability, in quantitative studies, has two basic forms that are repeated measurement and internal consistency (Muijs, 2004). Repeated measurement is the researchers capacity to measure the same item at dissimilar times, as the same study instrument is expected to provide the same answer when used with the same participant (Muijs, 2004). In order to find out whether the study measures are reliable, it is essential to re-use them with the same participants and investigate whether the provided responses have not changed too much. This method is knows as test-retest method (Muijs, 2004). Test-retest approach is about asking respondents to answer the questionnaire twice to correlate the data under similar conditions (Saunders et al. 2016). Another kind of the repeated measurement is the inter-rater reliability. In this type researchers can apply more than one assessor to investigate a certain situation. Here, respondents are expected to provide the same rating to a certain event that they have already observed (Muijs, 2004). The second kind of reliability is the internal consistency reliability. This type of reliability is only appropriate to study instruments that include more than one element, as it refers to how consistent the test items are or how accurately they can measure a particular construct (Muijs, 2004). Internal consistency test stands for the correlation of the participants' answers to each question in the survey with the other questions, within the same survey (Mitchell, 1996). There are two ways to calculate internal consistency reliability that are split-half reliability and coefficient alpha (Muijs, 2004). The split-half method evaluates the internal consistency of a test, such as questionnaires and psychometric tests. It assesses the extent to which all parts of the conducted test contribute equally to what is being measured (McLeod, 2013). The split half reliability is performed through randomly splitting the test into two, calculating participants' scores on each 'half test', and checking whether the two scores are related to each other. If both of them are measuring the same thing, then they can be strongly related, with a correlation coefficient of over 0.8 (Muijs, 2004). The most popular method for testing the internal consistency is Cronbach's alpha that is usually selected due to its easiness of use (Mitchell, 1996). This is in line with Churchill (1979), who has argued previously that the items must be comparable and independent to be reliable where reliability is measured using Cronbach's Alpha coefficient. This author has also added that this coefficient is preferred to be the first measurement to guarantee the survey quality. A reliable measure of Cronbach's alpha has a minimum score of 0.5 - 0.6 on a scale from 0 to 1 (Nunnally, 1967). Whereas, Muijs (2004) has pointed out that coefficient alpha is expected to be over 0.7 before researchers can conclude that a test is internally consistent. In addition, some scholars have mentioned the alternative form reliability (Forza, 2002; Mitchell, 1996). This form is applied when the participants' answers are compared to other forms of the same cluster of questions within the survey (Mitchell, 1996). However, the research has decided not to use the test re-test reliability test. The reason is that it is hard to ask the participants to answer the questions twice and because the probability of the participants answering the questions in the same way is very low, specifically if the time between administrating the two surveys is partially long. On the other side, the researcher has decided to inspect the survey of the current study using internal consistency test; explicitly using Cronbach's alpha, as all elements will be measured for internal consistency in accordance to the correlations between the items. At the same time, it is essential to understand that the purpose for finding out these measurements is to guarantee that all the elements under the construct are accurately measuring the construct with the right scores. The process that is followed to test the reliability of this study is demonstrated in Figure 5.6.

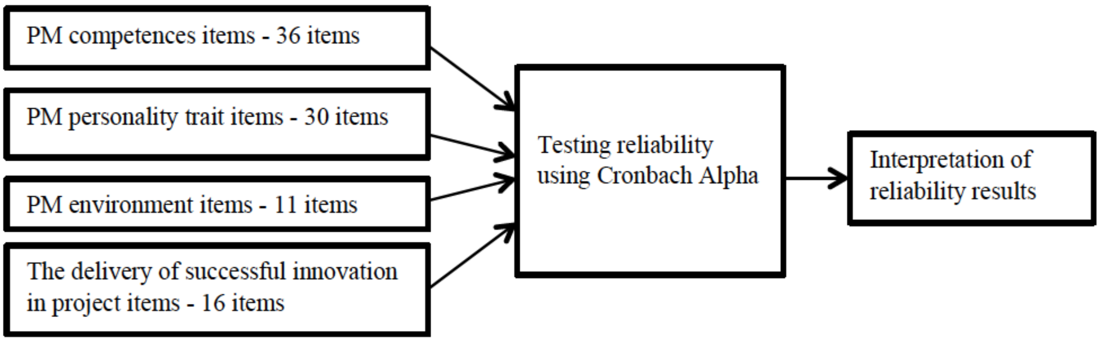

Figure 5.6: Reliability analysis process

In explanation, the measures demonstrated in the survey are tested. Reliability test; Cronbach alpha helps in determining if the measurements assigned to each item are consistent. This is followed by a validity test; an exploratory factor analysis (EFA) to assess if the measures assigned to each factor are cross loading on a different factor. The reliability and validity tests main points are briefly summarized in Table 5.3.

Table 5.3: Tests applied to validate the survey measures (Bryman & Cramer, 2011; Cua et al., 2001; DeVellis, 2003; Hair, Black & Babin, 2010; Nunnally, 1978; Tomlinson, 2010)

Measures' test	Selected method	Description	Threshold
Reliability	Cronbach's alpha	The extent to which a set of questions, which is expected to reflect a specific factor, has high inter-correlation (sharing a high inter-consistency)	The acceptable cut-off point is 0.7 (Cronbach's alpha > 0.7)
Validity	Exploratory factor analysis)	Number of factors that can be extracted from an overall list of questions, and can decrease the number of questions used to measure factors. This is performed through deleting the less significant ones for more accuracy.	Loading should exceed 0.45 (using varimax rotation).

After conducting the reliability and validity tests, the measures for each item are basically found and the variables are obtained through computing the mean of its measures. Hence, the study variables are tested to find out if they satisfy the regression requirements. This is typically achieved through performing the normality, homoscedasticity, and multicollinearity tests, as detailed in Table 5.4. Following these tests, the variables and their attained data become ready for both descriptive and regression analysis.

Table 5.4: Tests used to prepare data for regression analysis (Aluja et al., 2005; Field, 2009; Hair, Black & Babin, 2010; Tabachnick & Fidell 2007)

Test Name	Description	Threshold
Normality	The distribution of a variable/factor follows a normal distribution.	± 1 of skewness and kurtosis scores
Homoscedasticity	The dependent variable shows equal levels of variance across the predictor variables to strengthen the analysis.	Leven's test must be non-significant with p>0.5.
Multicollinearity	The correlation between independent variables is examined, as a high correlation does not only influences the regression coefficient, but also their statistical significant.	Correlation coefficient between variables must be less than 0.9 and variance inflation factor less than 10

5.9 Sampling strategy

Population is a group a researcher aims to generalize the findings to. In most cases researchers need to take a sample from their population to generalize the found results of the sample to the population (Muijs, 2004). The term 'sampling' is largely used in qualitative research to refer to the appropriate selection of participants and documents. Sampling indicates that a sample of a population is selected to enable findings to be applied to a population (Polkinghorne, 2005). A careful selection of participants can provide significant inputs to the structure as well as the character of the practice under examination (Polkinghorne, 2005).

However, in order to collect data for the current quantitative research, a seven-stage process that is defined by Zikmund et al. (2013) and shown in Figure 5.7 is applied to obtain an adequate sample.

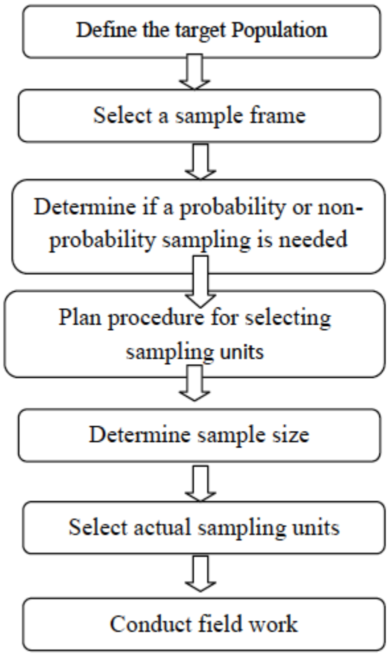

Figure 5.7: Sampling process (Zikmund et al., 2013)

First step: it is important for the researcher to identify the target population (Creswell, 2012). The target population for the current study is project managers who delivered successful innovation in projects performed in the UAE. Using feedback from experts in different field, it has been assumed that the population of this study is 300 project managers, who have delivered successful innovation in UAE projects.

Second step: it is imperative to create a sample frame, where a sample frame is defined as a list of population components from which a study sample can be drawn (Zikmund et al., 2013). It has been difficult for the researcher to provide a sample frame. The reason is that presenting lists of participants' names, phone numbers, and emails is against the confidentiality agreements with the participants, especially when collecting sensitive information like the project manager competencies and if the project has delivered successful innovation or not. Consequently, the researcher has decided to create a sample frame for the current study, considering confidentially. The sample frame is project manager who have delivered successful innovation in projects performed in UAE, and who work in different organizations, in a full-time job.

Third step: it is essential to select a proper sampling method. At this stage, the researcher decides the units of data collection, and whether to proceed with probability or non-probability sampling.. Probability random sampling is a sampling technique that selects participants in a random basis, where the researcher sets up a process to ensure that all individuals or objects in the target population has an equal chance of being selected for study (Bryman & Bell, 2007). On the other side, with non-probability samples a researcher can determine the probability of any individual or unit that is being included in the survey, similar to a purposive sample when researchers depend on their judgments to reach an accurate representative sample. This type of sampling does not truly represent a population, and is limited with regard to generalization. It can be acceptable when a researcher does not aim to generalize the result beyond the selected study sample (Robson, 2011). Thus, the researcher has selected a probability random sampling method for the current study because this research is keen about generalizing the findings.

Fourth step: it is important to construct a plan for selecting the research method. In this regards an online questionnaire is used to collect data; in order to assure the precision and clarity of the questionnaire, a pilot study is performed before the questionnaire has been administered to the real sample. The details of the pilot test of the current study are provided in Section 5.10.

Fifth step: it is crucial to identify the sample size: In addition it is critical to deciding a reasonable sample size, as the size of a sample can be influenced by both theoretical and practical considerations. In some occasions, an estimated sample size range can be provided, with a minimum and a maximum (Robinson, 2014). Yet, the research sample size can affect the statistic tests applied to evaluate the statistical significance of the study variables' relationships (Saunders et al., 2016). Generally, it is hard to complete a substantial test statistic using a small sample. Contrariwise, relationships and differences become more significant when using large samples (Anderson, 2003). The reason is that the used sample size appears to get closer to the population size. In other words, small population samples may lead to insufficient statistical tests whereas very large population samples may lead to excessively sensitive statistical tests. In this regards, Ghasemi and Zahediasl (2012) have argued that large samples including more than 30 or 40 can result in normal sampling distributions irrespective of the shape of the study data.

However, the sample size of the current study has been selected using Table 5.5, which is as proposed by Bartlett, Kotrlik and Higgins (2001). According to this table, for the assumed study population that equals 300 project managers who have delivered successful innovation in projects performed in UAE, the minimum required sample size is 85 respondents with a significance level of 0.05 (t =1.96) and a margin of error that equals 0.03. This indicates that the sample size of 88 respondents is sufficient for the current study.

Table 5.5: Minimum sample size for a given population size for continuous and categorical data (Bartlett, Kotrlik & Higgins, 2001, p.48)

Population size	Sample size					
	Continuous data (margin of error=.03)			Categorical data (margin of error=.05)		
	alpha=.10 t=1.65	alpha=.05 t=1.96	alpha=.01 t=2.58	p=.50 t=1.65	p=.50 t=1.96	p=.50 t=2.58
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250
500	72	96	147	176	218	286
600	73	100	155	187	235	316
700	75	102	161	196	249	341
800	76	104	166	203	260	363
900	76	105	170	209	270	382
1,000	77	106	173	213	278	399
1,500	79	110	183	230	306	461
2,000	83	112	189	239	323	499
4,000	83	119	198	254	351	570
6,000	83	119	209	259	362	598
8,000	83	119	209	262	367	613
10,000	83	119	209	264	370	623

Sixth step: it is necessary to select the sample units and decide which components will be used in the study sample: project manager who deliver successful innovation in projects in UAE are considered to be the sample unit for the current study.

Seventh step: it is important to conduct the field study. This stage involves two parts, which are accessing and collecting data. The data of this study has been collected from the beginning of September 2017 up to the end of October 2017. Duration this period of time, the researcher has sent 500 email/ social media invitations to fill the online questionnaire, and received 88 responses. This indicates that the response rate is 17.6%. However, the researcher has successfully accessed and collected data for the current study.

5.10 Pilot study

‘‘The single most effective strategy to minimise problems is to make sure you pilot your instruments’’ (Muijs, 2004, p. 51). A pilot test assists the investigator with the refinement and modification of the research questions, and it is usually conducted with participants who have similar interests such as those who are participating in this study (Turner III, 2010). The pilot studies can be used to develop ideas and research plans, but it essential to realize that cannot be considered as a study in itself (Glesne 2011). Besides, the pilot test is valuable for examining the proposed research perceptions such as the interest in the study topic, the rationality of the research questions and statements (Glesne, 2011). For this study, the questionnaire has been given to five participants to provide a feedback about the completion time, the items that have to be deleted, items that have to be added, items that have to be modified, the selected methods, and the validity of the study questions. Hence, adjustments have been done in accordance with the outcomes obtained from the pilot test.

5.11 Data Analysis Methods

5.11.1 Descriptive Analysis

Data analysis stands for the use of tools, methods, software or reasoning to understand, interpret, and explain information or data that have been gathered (Flick 2006). However, Forza (2002) has summarized the most commonly used descriptive statistics, which can be applied to find out the results of a wide range of studies, as shown in Table 5.6. Among these options, the researcher has decided to report the demographic data frequencies using pie charts because they display numerical and categorical data by classifying the data in a way that does not exceed six segments in a pie chart (Morris, 2003).

Table 5.6: Descriptive statistics (Forza 2002, p. 182)

Type of analysis	Explanation	Relevance
Frequencies	Refers to the number of times various subcategories of certain phenomenon occur	Generally obtained for nominal variables
Measures of central tendencies	Mean (the average value), median (half of the observation fall above and the other half fall below the median) and mode (the most frequently occurring value) characterise the central tendency (or location or centre) of a set of observations	To characterise the central value of a set of observations parsimoniously in a meaningful way
Measures of dispersion	Measures of dispersion (or spread or variability) include the range, the standard deviation, the variance, and the interquartile range	To concisely indicate the variability that exists in a set of observations
Measures of shape	The measures of shape, skewness and kurtosis describe departures from the symmetry of a distribution and its relative flatness (or peakedness), respectively	To indicate the kind of departures from a normal distribution

In addition, it is crucial to determine the values distribution for variables embracing numerical data. The reason is that histograms or frequency polygons are often used for continuous data, whereas bar chart or frequency polygons can be successfully used for discrete data. The frequency polygons can allow researchers to observe the positive or negative skewedness within data distribution and or normal (symmetrically) distribution (Saunders et al. 2016). Furthermore, descriptive statistics help researchers to numerically define and associate variables. Descriptive statistics have two components that are central tendency and spread. Central tendency is often measured through finding out the mean, median and mode of the data (Muijs, 2004; Saunders et al. 2016). Mean is the average of all values. Median is the middle category of distribution after ranking the data. Mode is the most common or frequently occurring values (Muijs, 2004; Saunders et al. 2016). The spreads of values around the mean or median are different. This makes it important to measure the spread to provide a good description of variables. The first way is to look at spread is through subtracting the lowest from the highest scores to get the range of values in the available dataset. The second way is through measuring the standard deviation (SD). SD is a measure of the extent to which the obtained values are distributed around the mean. It is associated with a value called the variance, which can also be encountered. The variance is calculated through looking at the extent to which each observation is different from the mean (Muijs, 2004).

The importance or hypothesis testing mainly aims to compare the collected data with an appropriate theoretical prospect to reduce the possibility of having outcomes that can occur due to a random variation in the study sample (Robson, 2002). In particular, significance (p-value) and hypotheses testing can be performed through two main techniques, which are parametric and non-parametric statistics. Parametric statistics are more prominent due to the use of numerical data, whilst non-parametric statistics are basically used for non-normally distributed data (Blumberg, Cooper & Schindler, 2008). Further, the probability of significance test signifies the relationship significance, as any p-values less than 0.05 gives an indication that there is a significant relationship between studied variables. In this case the study hypotheses can be supported and the null hypotheses can be rejected (Saunders et al., 2016).

However, regression methods can be used to evaluate the strength of relationships statistically, as it becomes feasible to find out if the relationships between variables are positive or negative (Saunders et al. 2016). The following sections provide details about the regression analysis techniques.

5.11.2 Regression analysis

Regression analysis is a statistical test that is used for investigating the relationships between study variables and to expect the values of the dependent variables from the independent variables. This can be achieved through computing regression equations. It is also applied when the researcher is concerned about detecting the causal effect of a particular variable upon the other, as it is a basic step to analyse the cause/effect relationships between the study dependent and independent variables (Bryman, 2008).

5.11.3 Statistical significance

Statistical significance stands for the level of predictive precision that researchers can accept, or the degree to which researchers can have confidence in their obtained results (Nachmias & Nachmias, 1996); many researchers use 5 % as an acceptable level of significance that signifies the extend of risk researchers may accept, here, it becomes clear that a relationship between variables can occur where there is no such a relationship. In other words, there is a 5% chance that the data may present a false relationship (Bryman & Bell, 2007). This research is embracing 5% as the acceptable level for statistical significance.

5.11.4 Structural equation modelling analysis

Structural equation modelling (SEM) is a practical method when attempting practical problems in social science through assessing the level to which a hypothesized model can fit the empirically observed data, since it is applied to identify tentative cause and effect (Joreskog & Sorbom, 1982). There is eternally risk in human research that some errors can take place when a particular sample does not signify the aimed population specifically with studies that employ a questionnaire to produce empirical data. Most of the behavioral and psychological instruments are not formulated for directly available data (such as data that measure individual's attitudes, behaviour, and motivation), measurement instruments have thus been generated to measure distinctive variables (Joreskog & Sorbom, 1997). Each study variable has many indicators, which are combined together to create a complete instrument. Most of the instruments that are applied in social studies can measure error; such an error comes from the variances between the study population and sample (Bryman, 2008). Structural equation modelling is a statistical technique that enables the researcher to modify the measure error until it reaches an acceptable level.

In addition, the current study is concerned about testing the study hypotheses using SEM analyses in accordance with the maximum likelihood technique through adopting Anderson & Gerbing's

(1988) process. This is achieved through performing two-step analysis of the study data. The first part contains a multi-stage process. The main purpose of this process is to confirm the construct validity and point out the relationship between the study observed measures and the constructs. The second part applies SEM to evaluate the structural model in order to find out whether the proposed model can be considered a good fit to the empirical data.

Once a model is identified and the covariance matrix between the variables is provided, an approach can be chosen for parameter estimation. Estimation approaches have dissimilar distributional assumptions, and distinctive discrepancy functions that have to be minimized. Ullman (2006) has described the structural equation modelling as a combination of CFA and multiple-regression techniques, while Schreiber et al. (2006) has described it as a confirmatory method that is applied for exploratory determinations. Hence, this research follows Schreiber's et al. (2006) assumption to decide whether the proposed model is acceptable rather than to finding out a new model. Furthermore, SEM analyses include an exploratory component, in this study the relationship between PMICs, PMIPTs, PMIE and DSI in projects.

Typically, once the model's parameters are anticipated, the model-implied covariance matrix is compared to the empirical covariance matrix. In case the two matrices are consistent, the SEM is considered to be a trustworthy explanation for the existing relationships between the study measures. This can advance the overall credibility of the current study. For that reason structural equation modelling is selected as an analytical approach for this study. Nevertheless, the present study intends to examine the fundamental theoretical construct of the project manager innovation competencies and their effects on the delivery of successful innovation in projects; using SEM offers advantages over the other traditional techniques, as complicated theoretical models can be assessed in a single analysis.

In addition, structural equation modelling deals with observed and unobserved variables. Observed variables are defined as indicators, which can directly be measured by a researcher, using a rectangle or square to illustrate them graphically. In this study the project manger innovation competencies' clusters are the observed variables. On the other side, unobserved variables are known as latent variables, factors or constructs that may not be measured directly, typically inferred by relationships among the study measures and are illustrated graphically by a shape of circles or ovals (Byrne, 2013). For example, in this study, the perceptions of project manager innovation competencies and the project manager innovation environment are considered to be latent variables. The straight line directed from the latent to the observed variable signifies a causal influence of the latent variables on the observed variables. Also, there is a small circle that appears to present the measurement error. A correlation between the latent variables is demonstrated using a curved arrow. The coefficient leading from a latent variable to an indicator is referred to as lambda (XY), and typically it is set as equal to 1 to modify any existing measurement error in the construct values (Bollen, 1989).

When applying SEM, it is essential to differentiate between exogenous and endogenous variables. Exogenous variables are associated with the independent variable of project manager innovation competencies, while endogenous variables are linked to the dependent variable that is affected by the exogenous variable (Byrne, 2013). In the current research such variables are the perception of project manager innovation personality traits and project manager innovation environment that are hypothesized to have an influence on the relationship between project manager innovation competencies and the delivery of successful innovation in projects

Furthermore, researchers are expected to address issues relevant to the study sample such as the actual sample size and the survey missing data before using the SEM method. Here, it is important to recognise that the selection of an appropriate sample size can be affected by: data normality, and the number of free parameters in a particular model (Schermelleh-Engel, Moosbrugger & Müller, 2003). On the other hand, missing data can be handled appropriately, as the pairwise deletion technique can lead to a non-positive covariance matrix; besides the possibility of using other techniques to deal with missing data (i.e. adding the mean), as Schumacker & Lomax (1996) have mentioned that they can lead to heteroscedastic errors that can influence the outcomes. Despite this, structural equation modelling offers more options to overcome problems with missing data easily, for instance the minimum likelihood estimation usually helps in such cases (Muthén & Muthén, 2012).

In particular, the SEM tool enables the researcher to examine theoretical propositions about the way in which the study constructs are theoretically linked. It also allows the researcher to determine the direction of significant relationships using multiple measurements for each individual latent variable. Yet, it is essential to be aware about the main terms that are used to decide if a model fit is acceptable or not, which are:

- **Confirmatory factor analysis (CFA):** Once the EFA is accomplished (which has yielded a 'clean' pattern matrix) the following step is to commence a confirmatory factor analysis (CFA). CFA assists in developing a measurement model that is precise using the construct structure underlying the observed data (Matsunaga, 2010, Russell, Christopher & Emilija, 2011). This research also utilizes AMOS 20 software package (in addition to the SPSS 22 software) to perform CFA.

  The CFA can be considered as a relatively modern statistical technique that inspects the validity of measurements used to collect data. Checking validity through CFA is necessary, especially when a measurement instrument is applied within a different culture. CFA is an assenting tool and its most popular use is to assess the validity of empirical variables. It is also applied to evaluate covariance and interrelationships among latent variables through assessing a population covariance matrix for a hypothesized model compared with the observed covariance matrix, to achieve the least distinction between estimated and observed matrices. These are examined using confirmatory factor analysis to establish a conceptual judgment about the construct used in the final structural model (Arbuckle & Wothke, 1999). In this study, CFA is undertaken using AMOS 20 to examine multidimensionality and latent variable validity. The purpose of CFA is to present evidence for the viability of the study factors and the measurement model. With such robust evidence, the researcher can have confidence in the results of the hypothesized model.

- **Maximum likelihood (ML):** it is a widely used technique to fit SEM function. It suggests that variables are multivariate, and represent a normal distribution. ML produces estimates for the parameters, which maximize the likelihood that an observed covariance matrix is extracted from a specified population, at this point; the model-indicated covariance matrix is considered to be acceptable and valid (Mueller & Price, 1990). However, this research adopts several fit indexes ($\chi 2$, GFI, CFI, SRMR and RMSEA) to assess the goodness of fit. Any problems that may take place due to measurement error will not influence the statistical inference, because the measurement error is calculated using AMOS software and attuned in accordance to the program findings (Anderson & Gerbing, 1988; Klein & Moosbrugger, 2000).
- **Evaluation of goodness-of-fit of the model:** Model fit indicates the degree to which a particular structural equation model fits the available sample data. In structural equation modelling it is crucial to apply multiple criteria to evaluate the model fit that takes numerous measures into consideration. The structure (goodness-of-fit) of the initial model does not only describe the modifications in parameter constraints of the hypothesized model, but also explain the final model (Cheung & Rensvold, 2002). Typically, no single fit index can be adequate to capture all possible characteristics of the model fit. Hence, it is a worthwhile to

apply multiple fit criteria to assess the study constructs (Hair et al., 1998).

- **Chi-squared (χ 2) test:** this test estimates whether the obtained population covariance matrix is equivalent to the model-implied covariance matrix. Commonly, a sufficient model fit provides an insignificant value at 0.05 (Barrett, 2007). The restraints of chi-squared is driven from two main sources. First, because it is a multivariate normality test, there is an opportunity that a well-identified model will not be accepted due to normality issues (McIntosh, 2007). Second, the sample size influences the chi-squared outcomes; for example, when the sample size is large, chi-squared will most likely reject the model (Bentler & Bonnet, 1980; Jöreskog & Sörbom, 1997), whereas this test may not demonstrate precise result with (relatively) small samples, and (if used alone) it may not help in distinguishing between a strong and a weak model fit. In AMOS, the chi-square for the model is called the discrepancy function, chi-square goodness of fit, or likelihood ratio chi-square, while the value of chi-square is known as CMIN (Moss, 2016). Further, the relative chi-square is named the normed chi-square, which equals the chi-square index divided by the degrees of freedom (CMIN/df). The acceptable value for this ratio varies ranging from less than 2 (Ullman, 2001) to less than 5 in some cases (Schumacker & Lomax, 2004).
- **Root Mean Square Error of Approximation (RMSEA):** this test evaluates whether the null hypothesis of the initially generated fit is consistently false in common situations, and whether it will be rejected in case the sample size is considerably large. This means that it considers the error of approximation in the study population (Kaplan, 2000). The null fit hypothesis is often reported together with RMSEA, and in a good fit model the lower limit should be close to 0, whereas the upper limit is commonly less than 0.08 (McQuitty, 2004).
- **Root mean square residual (RMR) and standardized RMR (SRMR):** Both are known as “fitted residuals”; as they are derived from the remaining variations between the covariance

matrices as well as the model-implied covariance matrix for the parameters of the models (Joreskog & Sorbom, 1982). The RMR is influenced by discrepancies in scale levels. For example, some surveys include Likert scale replies ranging from 1 to 5, whereas others range from 1 to 7. In such case, it becomes hard to interpret RMR (Klein & Zhang, 2005). Hence, SRMR resolves this difficulty and gives a clear meaning for the values of RMR. SRMR values range from 0 to 1, keeping in mind that acceptable values are 0.08 and lower, the value of 0 specifies a perfect fit, and 0.05 signifies a good fit (Byrne, 2013).

- **Goodness-of-fit (GFI) statistics:** This is an alternative to chi-squared test. It estimates the percentage of variance, which is accounted for, specifically when the population covariance is obtained. This is done through evaluating the model's variances as well as population covariance that typically range from 0 to 1 with an increased value in larger samples; commonly the cut-off point for GFI is 0.90 (Tabachnick & Fidell, 2007).
- **Comparative fit index (CFI):** this is a revised index of the comparative non-centrality index, which works well in small sample (Tabachinic & Fidell, 2007). It assumes that all constructs are uncorrelated (null model) and compares sample covariance matrix with the obtained null model. The cut-off value of CFI is 0.90, which signifies an acceptable fit (Bentler, 2007; Hu & Bentler, 1999); for this study, CFI is used considering this cut-off value.
- **Tucker-Lewis Index (TLI):** The non-normed fit index (NNFI) is known as the Tucker-Lewis index. The reason is that it is based on an index established by Tucker and Lewis, in 1973 (Tucker & Lewis, 1973). It resolves some of the issues related to negative bias. The values for NNFI range between 0 and 1 (Bentler, 1990; Hu & Bentler, 1999). If this index is lower, model is considered to be less acceptable (Moss, 2016).

Hence, the researcher has used these indices to confirm the fit of the measurement models.

5.12 Ethical considerations

Conducting a successful study can be achieved through following the ethical standards and processes. Unfortunately, in the last decades organizations have suffered from favoritism, corruption, conflicts of interest, etc., as a result more offenses have occurred. This has urged the current organizations to strive for honesty through ethical practices and effective decision-making to guarantee ethical organizational behaviour (Snellman, 2015). Hence, the research ethics can be defined as the actions that are applied to protect the research participants' to guarantee the ethics of the research (Flick, 2014). For this study, the researcher has explained the research aim and methodology to respondents in the body of the email, and has sensitively explained the expected benefits of this research. At the same time, this study is based on surveys, and scholars have classified many considerations to achieve them ethically (Agee, 2009; DiCicco-Bloom & Crabtree, 2006; Flick, 2014; Fraenkel & Wallen, 1993; Kvale & Brinkmann, 2009; Qu & Dumay, 2011). For example, Fraenkel and Wallen (1993) have stated that in order for the researcher to protect the respondents from any harm or any probability of risk, the following ethical questions can be asked before starting the study:

1. Will the participants be harmed physically or psychologically during this study?

2. If yes, is it possible to perform the study in a different way to explore what the researcher wants to find out?

3. Does the information that will be collected from this study substantial that it can bring any possible harm to the participants?

In addition, DiCicco-Bloom and Crabtree (2006) have argued that there are four main ethical issues, which are to (1) reduce the risk of unanticipated harm, (2) protect the interviewee's information, (3) inform participants effectively about the actual nature of the study, and (4) reduce the risk of exploitation. Later, Qu and Dumay (2011) have mentioned that the ethical considerations cover imposing no harm with regard to the participants, respecting relationship-based ethics, disclosing the research intent, maintaining privacy and confidentiality. In addition, Agee (2009) have pointed out that developing decent research questions requires understanding that investigations into other people's lives are considered to be an imporatnt exercise in ethics, as assessing risk when formulating the research questions may be difficult, and some questions may require specific responses that may jeopardize the participants' job and professional live due to issues of coercion and authority.

Furthermore, Flick (2014) has emphasized that informed consent specifies states that participants' should realize the risks and benefits associated with the participation in the research, given that an informed consent refers to participants' agreement to contribute to the research based on the information given to them by researchers. Flick (2014) has also added that the consent should be given voluntarily (by the respondents) in a way that protects their dignity and privileges (Flick 2014). Therefore, the research is conducted based on informed consent. Appendix B presents the questionnaire cover letter that is prepared to invite the respondents to participate in this survey. Yet, the researcher have ensured confidentiality of any gathered data, as the participants are informed in advance that only the researcher and possibly few other key researchers can access the obtained data (Fraenkel & Wallen, 1993).

5.13 Summary

This chapter has concentrated on the methodology used in the study. First, a discussion about the research philosophies is provided, followed by a detailed explanation about the research approach and design; then the data collection methods adopted for this study are presented. Following this, a description of the instruments used to evaluate the constructs of the research is demonstrated along with a view of the pilot study. Thereafter, the sampling plan is provided, and this chapter has concluded with an account of ethics and confidentiality issues with which the researcher has complied.

Chapter 6 Preliminary data analysis

6.1 Introduction

The methodology selected to examine the study hypotheses is described in Chapter Five. This chapter aims to assess the data obtained from the current study. In particular, the chapter explains the process of data preparation: response rate, reversing negatively worded items, test of missing date, replacing missing data, test of outliers, reliability test using Cronbach alpha, and details about the descriptive analysis used in this study.

6.2 Survey Data and Response Rate

The primary data of this study is attained form respondents working in different industries (i.e. business, construction, health care, business, information technology, etc.), in the United Arab Emirates (UAE). The actual survey, shown in Appendix B, is different from the one used in the pilot study. In justification, some of the items have been combined due to their similarity, while other items have been modified to clarify any vague measurements. Thus, the responses from the pilot study are excluded as some items are combined or modified in the actual survey. However, among the 500 questionnaires that are sent, 88 responses have been received. This leads to a response rate of 17.6% of the total respondents targeted in this research. Accordingly, in this study, the responses received from the 88 participants are used to perform the needed (reliability, validity, and normality) assessments, and achieve the required (descriptive statistics, factor, and regression) analysis of the findings.

6.3 Reversing negatively worded items

‘‘Negatively worded items have been used as an attempt to get respondents to attend more to the survey items’’ (Barnette, 2000, p. 362). However, at this stage, the researcher has reversed the negatively worded items, before checking the scale reliability, in order to get accurate results. The questionnaire of this study has included nine items that are negatively worded. The nine items that are negatively worded in the questionnaire are: PT42, PT45, PT46, PT50, PT51, PT56, PT57, PT59, and PT60. Henceforth, these negatively worded measurements are reversed before conducting any additional statistical analysis to assure that a high score signifies a high level of each personality trait. Using the SPSS software, reversing the negatively worded items is accomplished using the functions of “transform” and “record into same variable”.

6.4 Checking and replacing missing values

It is imperative to realize a high level of credibility for the study data through minimizing any possibility of violating regression analysis requirements (Hair, Black & Babin, 2010). Hence, scholars have suggested numerous tests that help realize precise results from the regression analysis, such as testing missing values and outliers (Hair, Black & Babin, 2010 & Tabachnick & Fidell, 2007). In particular, Tabachnick and Fidell (2007) have argued that non-random missing values can affect the ability to generalize results. Analyzing missing data includes two assessment techniques that are evaluating the amount of missing data and assessing the pattern randomness of the missing data (Tabachnick & Fidell, 2007). It is important to realize that missing data that appear in a non-random pattern can affect the ability to generalize the results (Tabachnick & Fidell 2007). At the same time, all variables are supposed to be listed with their corresponding missing data (Hair, Black & Babin, 2010). Later, Van den Berg (2013) has argued that there are two types of missing values that are (1) system missing values: values that are entirely absent from the study data, and (2) user missing values: values that are present in the study data but should be excluded from calculations in order for them to be correct. This does not only help in identifying any variable that has a high amount of missing data, but also provides an overall picture of the amount of missing data in the sample. The missing data of all of the study variables (using the IBM SPSS software) are shown in

Appendix D.

This study is based on 99 variables including control variables such as age, gender, experience, organization nature, and organization type. Out of the 99 variables, 87 had missing data ranging from 9.3 to 12.4%. “[V]ariables with as little as 15% missing data are candidates for deletion” (Hair, Black & Babin, 2010, p.48). It is clear from Appendix D that there are no variables with significant missing data. Thus, the researcher has not eliminated any measurement from the study.

However, missing observations can be very problematic during the analysis, and occasionally series measures cannot be calculated if there are some missing values in the series. Sometimes the value for a certain observation is merely not known (IBM Knowledge Center, 2017). Here, it is essential to mention that the missing data analysis involves the assessment of its pattern to assess how randomly the missing data appear. Little’s Missing Completely at Random (MCAR) test is applied to evaluate the randomness of the pattern of the missing data. “[T]his test analyzes the pattern of missing data on all variables and compares it with the pattern expected for a random missing data process” (Hair, Black & Babin, 2010, p. 51). The Little’s MCAR test is expected to be non-significant to specify random patterns of missing data. In this regards, Hair, Black and Babin (2010) have agreed that 10% for each individual response and 15% in total is considered to be an acceptable threshold for missing data test. If this test discloses a non-significant level (p-value is greater than 0.05), a researcher can realize that the missing data appear in a randomly (Tabachnick & Fidell, 2007). Using IBM SPSS, Little’s MCAR test provides value of: Chi-Square = 1045.968, DF = 1046, and Sig. = 0.494. This indicates that there is no significant difference between the pattern of the data and the pattern anticipated for random missing data. Thus, it is adequate to use any kind of remedy to treat the study missing data (Hair, Black & Babin, 2010).

The missing data have three alternative treatments, which are list-wise deletion, pair-wise deletion, and imputation methods (Hair, Black & Babin, 2010). In list-wise treatment, the whole case is omitted from the analysis if it contains any missing values. This treatment is the most commonly used approach to handle the missing data, yet this approach leads to a significant amount of data exclusion. In pair-wise deletion treatment, the case with missing data is expelled from a certain analysis where the analysis confronts missing data; sill the case is available for other analysis that includes a variable with no missing data. This treatment preserves more data compared with the list-wise approach because the remaining data (with missing values) are still available for analysis. But, at the same time, it is worthwhile to mention that the pair-wise treatment may lead to discrepancy of correlation or a covariance matrix (Roth, 1994). In imputation method treatment, missing data is treated by different procedures, such as replacing with expectation maximization (EM), replacing with mean, multiple imputation, and regression imputation (Hair, Black & Babin, 2010; Tabachnick & Fidell, 2007). In the imputation method, missing data is basically replaced with a proper value such as a mean or expectation maximization (EM) value. EM is based on the maximum likelihood method (Von Hippel, 2004) that creates a less-biased value and more precise estimations in comparison to both list-wise and pair-wise methods (Roth, 1994). Considering these arguments, this research applies the EM to substitute all missing data with the maximum likely values through applying the Missing Value Analysis (MVA) function in IBM SPSS 22 software. As a result, the set of data being used for the current study does not include missing values.

6.5 Test of Outliers

Outliers can result in a significant distortion of statistical tests (Hair, Black & Babin, 2010). They can be referred to as observations that are different in magnitude from the remaining observations that an analyst decides to treat them as a singular case (Churchill & Iacobucci, 2004). Outliers refer to responses that are largely different in magnitude from the rest, and can result in a significant distortion of statistical tests (Hair, Black & Babin, 2010). The acceptable threshold in this case is ±4 of the standardized scores of the variable (Hair, Black & Babin, 2010). Further, outliers can limit the analysis results' generalisation, which can only be generalised to other samples that have comparable outliers (Tabachnick & Fidell, 2007).

However, there are three main kinds of analysis to assess outliers that are univariate detection, bivariate detection, and multivariate detection tests (Hair, Black & Babin, 2010). In this study, univariate detection is selected. The reason is that this technique deals with all variables that can be tested individually to identify observations, which fall outside the upper and lower thresholds (Hair, Black & Babin, 2010). Here, it becomes essential to identify the upper and lower thresholds. All variable values should be converted to standard scores that have a mean and standard deviation of 0 and 1 respectively. Standardising variables allows for an easier interpretation process (Hair, Black & Babin, 2010). However, in this study the IBM SPSS software is used to create all of the standardised variables. Considering that the outliers' threshold in a sample, which is larger than 80 observations, is 4 and higher (Hair, Black & Babin, 2010).

In particular, the researcher has checked data outliers using the IBM SPSS Boxplots that has confirmed the absence of any outliers among the data. In details, the variables 5% trimmed mean is calculated using the IBM SPSS through eliminating the top and bottom 5% of the data. Then, the new mean values for all variables are calculated. Comparing the 5% trimmed mean with the original mean indicated that there are no outliers in the study data set. Table 6.1 presents the comparison between original mean and 5% trimmed mean values for the study variables. Accordingly, there is no need to eliminate any variable, and the sample size remains the same (88 respondents).

Table 6.1: The original mean and 5% trimmed mean values for the study variables

Variable code	Mean	5% Trimmed Mean	Variable code	Mean	5% Trimmed Mean
LD1	3.9205	4.0177	PT51	3.5341	3.5934
LD2	4.0795	4.1995	PT52	3.9205	3.9798
LD3	3.7386	3.8207	PT53	4.1023	4.1818
LD4	3.9091	4.0051	PT54	3.9545	4.0606
LD5	3.3636	3.3990	PT55	3.7045	3.7828
LD6	3.8295	3.9217	PT56	3.5568	3.6187
LD7	3.8182	3.8914	PT57	3.7273	3.8081
LD8	3.9091	4.0051	PT58	3.5341	3.5934
LD9	4.1250	4.2197	PT59	3.4432	3.4924
CM10	3.9432	4.0303	PT60	3.1591	3.1768
CM11	3.8750	3.9722	PT61	3.6250	3.6894
CM12	3.8636	3.9545	PT62	3.8295	3.9217
CM13	3.8750	3.9419	PT63	3.2386	3.2652
CM14	3.7386	3.8207	PT64	3.3977	3.4419
CM15	4.0114	4.1061	PT65	3.7045	3.7828
CM16	3.6364	3.7071	PT66	3.5455	3.6061
CM17	3.7045	3.7778	TI67	3.7500	3.8333
TM18	4.0000	4.0934	TI68	3.7955	3.8535
TM19	4.0682	4.1692	TI69	3.7159	3.7778
TM20	3.7273	3.8081	TI70	3.7159	3.7904
TM21	4.1364	4.2323	TI71	3.8182	3.8914
TM22	3.8295	3.9040	CS72	3.8864	3.9672
TM23	3.3523	3.3864	CS73	3.6250	3.6768
CR24	3.4205	3.4621	CS74	3.6023	3.6692
CR25	3.6818	3.7273	CS75	3.8636	3.9596
CR26	3.8182	3.9040	CS76	3.8068	3.8662
CR27	3.4432	3.4924	QL77	3.7159	3.7904
CR28	3.7045	3.7828	QL78	3.8864	3.9419
CR29	3.3295	3.3662	QL79	4.1591	4.2702
CR30	3.9886	4.0985	QL80	4.0341	4.0934
CT31	3.5682	3.6313	QL81	3.6477	3.7146
CT32	3.4318	3.4798	QL82	3.9886	4.0682
CT33	3.5000	3.5556	SK83	3.4886	3.5253
CT34	3.7841	3.8662	SK84	3.5341	3.5631
CT35	3.7159	3.7904	SK85	3.5909	3.6515
CT36	3.7727	3.8586	RS86	3.8750	3.9545

PT37	3.7273	3.8081	RS87	3.9773	4.0556
PT38	3.6932	3.7652	CU88	3.7500	3.8333
PT39	3.8182	3.9040	CU89	3.9091	3.9924
PT40	3.8864	3.9672	CU90	3.9318	4.0051
PT41	3.7727	3.8157	MK91	3.8523	3.9419
PT42	3.0000	3.0000	MK92	3.7273	3.7904
PT43	3.4318	3.4798	MK93	3.7045	3.7778
PT44	3.6023	3.6692	Job.Position	2.1023	2.0581
PT45	3.5000	3.5505	Gender	1.7500	1.7652
PT46	3.4318	3.4747	Education	4.2727	4.3157
PT47	3.9659	4.0429	Experience	2.5568	2.5076
PT48	3.9205	4.0177	Ind.Nature	2.6477	2.6086
PT49	3.9886	4.0556	Org.Type	2.4205	2.4167
PT50	3.6136	3.6818			

6.6 Reliability Test

In order to efficiently measure a factor through a set of questions, it is imperative that they display a high level of homogeneity to acquire a measure that is internally consistent (Hair, Black & Babin, 2010; Peter, 1979). Internal consistency that is mainly a measure of reliability, evaluates the degree to which a set of measures is designed to attain a specific factor, have a high intercorrelation, or share high similarity (DeVellis, 2003). Basically, the Cronbach’s alpha is a very common test that effectively assesses the internal consistency of the study measurement set (Hair, Black & Babin, 2010; Wang, et al., 2013) with a minimum acceptable cut-off point of 0.7 (Nunnally, 1978 & Tomlinson, 2010).

The results of the reliability analysis of this study are presented in Table 6.2. The table shows the acceptable level of internal consistency (Nunnally, 1978; Hair, Black & Babin, 2010; Tomlinson, 2010; Bryman and Cramer, 2011). It also demonstrates how the internal consistency can be improved if one measure is deleted from the set. Fortunately, the overall results of the Cronbach alpha test support all of the factors’ measurement set. In other words, all of the study measures have passed this test, as the value of Cronbach alpha for each measurement is greater than 0.7. Thus, all measurements are reliable and there is no need to eliminate any item.

Table 6.2: Results of Cronbach Alpha test for the study measures using the primary data

Factor	Code	Item	Alpha if deleted	Cronbach Alpha (α)
Leadership competencies	LD1	Inspire others to create ideas and find new opportunities	0.882	0.902
	LD2	Proactively take initiative to innovate	0.883	
	LD3	Use appropriate influence strategies to get rid or navigate around any obstacles	0.895	
	LD4	Make decisions that help in delivering innovation	0.885	
	LD5	Avoid analysis paralysis when new opportunities are identified through exhibiting a preference towards action	0.910	
	LD6	Be alerted to new opportunities and can easily get adapted to challenges	0.894	
	LD7	Care about building and developing new relationships	0.890	
	LD8	Find practical and creative ways to resolve existing conflicts	0.885	
	LD9	Forming, and developing an effective team that can deliver successful innovation	0.893	
Communication competencies	CM10	Listen to others without interrupting them	0.917	0.923
	CM11	Speak using a clear (local or foreign) language that is appropriate to the audience	0.911	
	CM12	Write (emails, memos, report, etc.) clearly and concisely using any language	0.919	
	CM13	Present products, ideas, or reports effectively	0.912	
	CM14	Use computers and the internet efficiently	0.916	
	CM15	Communicate in a tone and manner that shows respect	0.910	
	CM16	Communicate the importance of innovative solutions systematically and openly	0.909	
	CM17	Demonstrate strong awareness about innovation	0.913	
Teamwork competencies	TM18	Share expertise, accountability, and knowledge to strengthen team performance	0.883	0.897
	TM19	Support and collaborate with team members to solve any problems that may occur	0.875	
	TM20	Attain constructive resolution of conflict	0.882	
	TM21	Build, develop, and motivate teams to bring forward new ideas	0.860	
	TM22	Recognize and award original ideas and ideas for improvement	0.869	
	TM23	Frequently challenge others to be initiative and take risk	0.899	
Creativity competencies	CR24	Create new ideas by combining existing ideas	0.893	0.901
	CR25	Evaluate ideas/ products/ services to see how they can be improved	0.881	
	CR26	Think about doing things in a different way	0.879	
	CR27	Look for new ideas outside of the work field, and	0.887	

		try to apply them		
	CR28	Look for new methods to create value in capabilities, products, processes, services, and strategies	0.871	
	CR29	Look for surprising connections between things	0.892	
	CR30	Approach challenges creatively though thinking outside the box	0.896	
Commitment competencies	CT31	Consider innovation as a main goal and central focus at work	0.868	0.897
	CT32	Believe that the major satisfaction in life comes from attaining successful innovation	0.884	
	CT33	Believe that the most important achievements that take place involve innovation	0.873	
	CT34	Willing to present a great deal of extra effort to support and implement innovation	0.878	
	CT35	Get fully engaged when performing innovation relevant activities	0.879	
	CT36	Have the ability to modify and change any course of action in order to get adapted as needed	0.889	
Personality traits	PT37	I am sociable and talkative	0.867	0.873
	PT38	I have an assertive personality	0.866	
	PT39	I am full of energy	0.865	
	PT40	I am adventurous and welling to take risk	0.867	
	PT41	I generate a lot of enthusiasm	0.867	
	PT42	I am sometimes shy, inhibited	0.881	
	PT43	I am generally trust others	0.871	
	PT44	I challenge others to be initiative and take risk	0.867	
	PT45	I am sometimes rude with others	0.874	
	PT46	I tend to find fault with others	0.874	
	PT47	I like to cooperate with others	0.864	
	PT48	I am kind to almost everyone	0.866	
	PT49	I perform things efficiently	0.865	
	PT50	I tend to be disorganized	0.873	
	PT51	I can be somewhat careless	0.876	
	PT52	I persevere until the task is finished	0.866	
	PT53	I am a reliable employee	0.869	
	PT54	I make effective plans and follow them	0.867	
	PT55	I remain calm in tense situations	0.869	
	PT56	I get nervous easily	0.871	
	PT57	I am depressed, blue	0.867	
	PT58	I am emotionally stable, not easily upset	0.864	
	PT59	I can be described as moody	0.877	
	PT60	I worry a lot	0.877	
	PT61	I am curious about different things	0.869	
	PT62	I have an active and vigorous imagination	0.863	
	PT63	I am refined in art, music, or literature	0.868	
	PT64	I prefer work that is routine	0.882	
	PT65	I like to reflect, play with new ideas	0.866	
	PT66	I values artistic, aesthetic experiences	0.866	
Innovation for successful time outcome	TI67	Creative ideas resulted in better control over project schedule	0.849	0.857
	TI68	Ability to respondent to scope change in a timely manner	0.818	
	TI69	Speed of time from ideas submission to scope change feedback	0.829	
	TI70	Ability to access project data and knowledge in a	0.820	

		timely manner		
	TI71	Speed and ability to exploit ideas to improve project success	0.820	
Innovation for successful cost outcome	CS72	Creative ideas resulted in better control over project costs	0.878	0.890
	CS73	Amount of earnings achieved through innovation relative to objectives, industry competitors, and overall competitive position	0.865	
	CS74	Shareholder payments that reflect the growth achieved through applying new ideas	0.861	
	CS75	Workplace payments for employee attraction, retention, and motivation.	0.853	
	CS76	Customer and market payments for market share and customer loyalty	0.871	
Innovation for successful quality outcome	QL77	Creative knowledge acquired by the project through the project	0.880	0.904
	QL78	Creative ideas improved overall control exercised over the project	0.876	
	QL79	Enhanced quality of communication between the project members and users	0.884	
	QL80	Creative ideas improved users' feelings regarding participation in the project	0.890	
	QL81	Richness and robustness of existing innovation platforms, groups of ideas, or opportunities chosen and developed	0.902	
	QL82	Strength of existing leadership commitment to growth through innovation as stated in the strategic initiatives and main targets	0.886	
Innovation environment - Stakeholders	SK83	Stakeholders agree on decisions in the favor of innovation	0.775	0.828
	SK84	Stakeholders cooperate together to deliver successful innovation	0.758	
	SK85	Stakeholders are satisfied about the outcome of innovation	0.754	
Innovation environment - Resources	RS86	The right resources are selected to accomplish successful innovation	0.773	0.871
	RS87	The resources are allocated effectively to deliver successful innovation	0.773	
Innovation environment - Culture	CU88	Leveraging cultural diversity leads to successful innovation	0.801	0.859
	CU89	Working together to capture opportunities in spite of any cultural differences increases the chance of innovation success	0.783	
	CU90	Innovative cultures enhance the delivery of successful innovation	0.824	
Innovation environment - Market	MK91	The market creates competitive advantage that emphasizes the success of innovation	0.770	0.834
	MK92	The market orientation influences the success of innovation	0.710	
	MK93	New markets can emerge as a result of successful innovation	0.831	

* Cronbach's alpha below 0.7; ** Improved if deleted.

6.7 Descriptive Statistics

6.7.1 Demographics

Descriptive statistics help researchers to numerically describe and compare variables (Saunders et al. 2016). In particular, the demographic data frequencies are reported using pie charts. Pie charts can effectively display numerical and categorical data by categorizing the data in order not to exceed six segments in the pie chart (Morris, 2003). The demographic characteristics of this research cover all of the 88 participants.

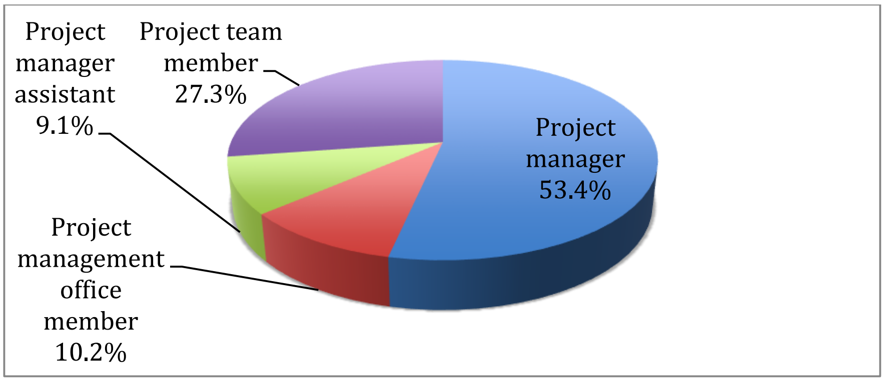

Figure 6.1: Respondents' job position

The pie chart shown in Figure 6.1 describes the respondents' job position as follows: 47 respondents (53.4%) are project managers, 24 respondents (27.3%) are project team members, 9 respondents (10.2%) are management office member, and 8 respondents (9.1%) are project manager assistants.

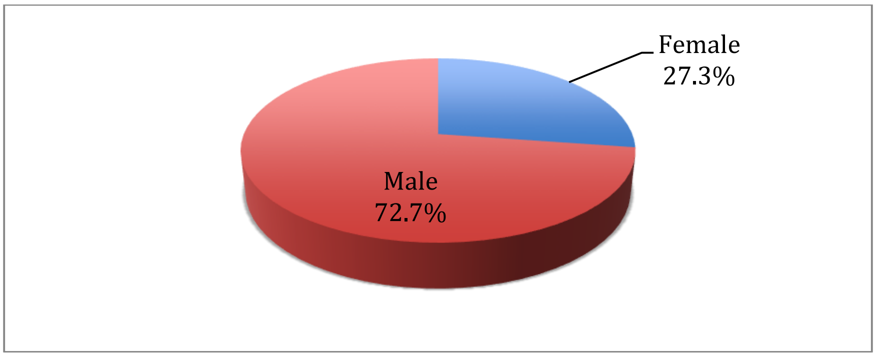

Figure 6.2: Respondents' gender description

The pie chart illustrated in Figure 6.2 represents the respondents' gender as follows: 24 respondents (27.3%) are females and 64 respondents (72.7%) are males.

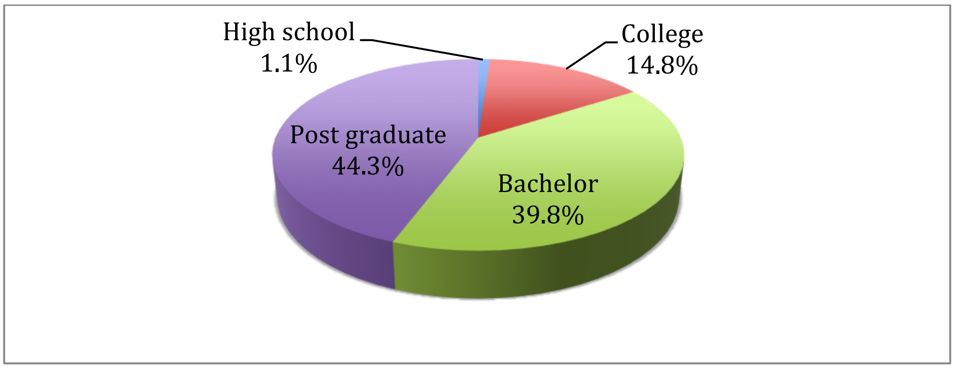

Figure 6.3: Respondents' education levels

The pie chart demonstrated in Figure 6.3 describes the respondents' education as follows: 39 respondents (44.3%) with post graduate education, 35 respondents (39.8%) with bachelor education and, 13 respondents (14.8%) with college education, 1 respondent (1.1%) with high school, and none of the respondents has an educational degree less than high school (0%).

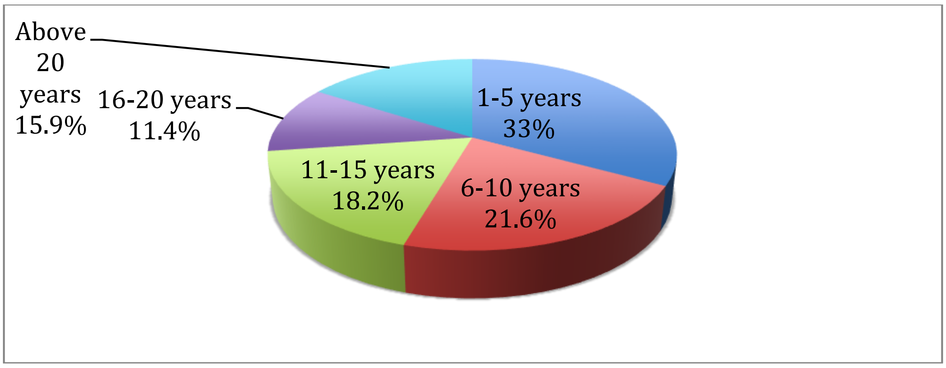

Figure 6.4: Respondents' experience

In this study, it is valuable to describe and clarify respondents' experience in the actual way it happens (Polkinghorne, 2005). The pie chart shown in Figure 6.4 demonstrates the respondents' experience in managing projects as follows: 14 respondents (15.9%) with above 20 years of experience, 10 respondents (11.4%) with 16-20 years of experience, 16 respondents (18.2%) with 11-15 years, 19 respondents (21.6%) with 6-10 years of experience, and 29 respondents (33%) with 1-5 years of experience.

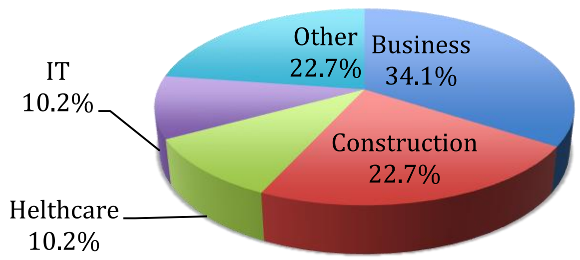

Figure 6.5: Respondents' industry nature

The pie chart shown in Figure 6.5 demonstrates the industry nature where the respondents' are working as follows: 30 respondents (34.1%) are in business, 20 respondents (22.7%) are in construction, 9 respondents (10.2%) are in health care, and 9 respondents (10.2%) are in information technology, and 20 respondents (22.7%) are in other industries.

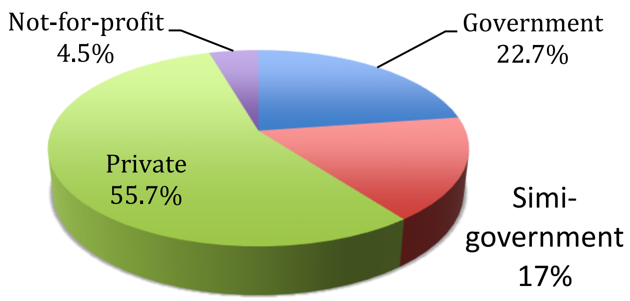

Figure 6.6: Respondents' organization type

Ultimately, The pie chart illustrated in Figure 6.6 describes the participants' organization type as follows: 49 respondents (55.7%) are working in private organizations, 20 respondents (22.7%) are working for government organizations, 15 respondents (17%) are working for semi-government organizations, and 4 respondents (4.5%) are working for not-for-profit organizations.

6.7.2 Project manager innovation competencies

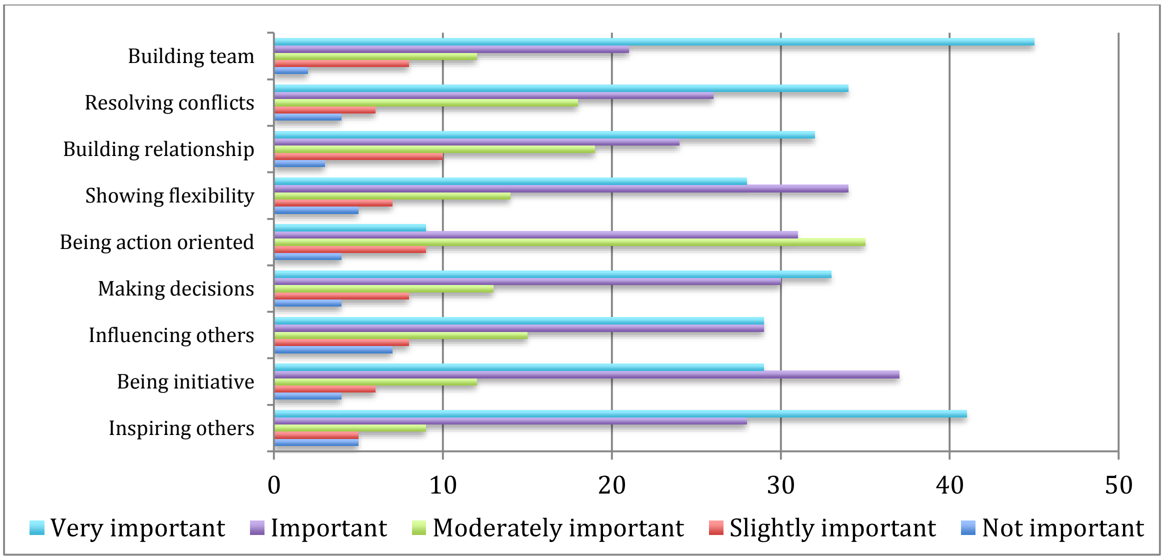

Figure 6.7: Frequencies for project manager innovation leadership competencies

Innovation leadership competencies are based on knowledge, responsibility for the degree to which innovations can be advanced, on passion and interest, or on accountability for an enhancement (Bossink, 2002). The bar chart shown in Figure 6.7 demonstrates the frequency scores of each one of the leadership measurements that are essential for the delivery of successful innovation in projects. The leadership competencies 1-9 are inspiring others, being initiative, influencing others, making decisions, being action oriented, showing flexibility, building relationship, resolving conflicts and building team, respectively (refer to Table 4.2). Here, it is observed that most of the items have scored either very important or important. Yet, most of the respondents have rates item 5, which is avoid analysis paralysis when new opportunities are identified through exhibiting a preference towards action, as moderately important. This indicates that some of the respondents are not sure if this is an important competency to deliver successful innovation in projects or not. But, at the same time, the amount of respondents who strongly agree or agree that this is an important competency for the deliver of successful innovation cannot be ignore. Thus all items in this cluster are important project manager innovation (leadership) competencies that can lead to delivering successful innovation in projects. These results are unsurprising, as scholars have agreed that leadership competencies have imperative influences on organizations' innovation (Aragón-Correa, García-Morales & Cordón-Pozo, 2007).

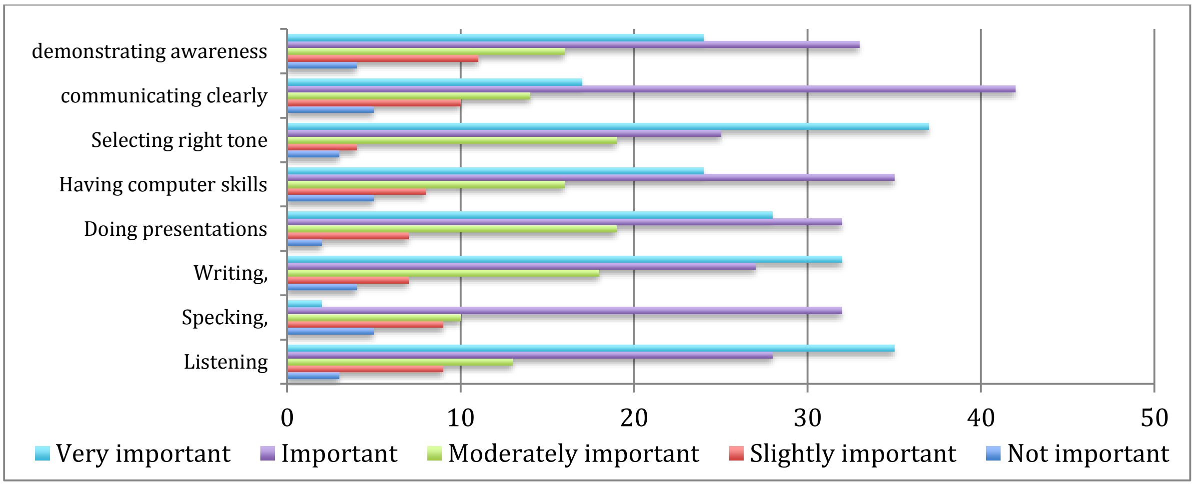

Figure 6.8: Frequencies for project manager innovation communication competencies

Innovation can be delivered through effective communication competencies (Gambatese & Hallowell, 2011). It is essential for project managers to communicate the usefulness of innovation to project team members in order to generate a strong awareness toward innovation (Wei et al., 2013). Dziekoński (2017) have pointed out that communication competencies cover communication with project team members and stakeholders, negotiation skills with subcontractors,

and conflict solving abilities. However, the bar chart illustrated in Figure 6.8 presents the frequency scores of each one of the communication measurements that are essential for the delivery of successful innovation in projects. The communication competencies 1-8 are listening, specking, writing, doing presentations, having computer skills, selecting a proper communication tone, communicating systematically and clearly, and demonstrating awareness about innovation, respectively (refer to Table 4.3). Here, it is observed that all of the items have scored either very important or important. Therefore, all of these items are important project manager innovation (communication) competencies that can lead to delivering successful innovation in projects. These findings are reasonable and in line with the argument of Rojas (2013), who have emphasized that communication competencies complement the tasks of PMs, as they can articulate ideas in a simple, clear, brief, and logical way to expand individuals' effectiveness towards innovation.

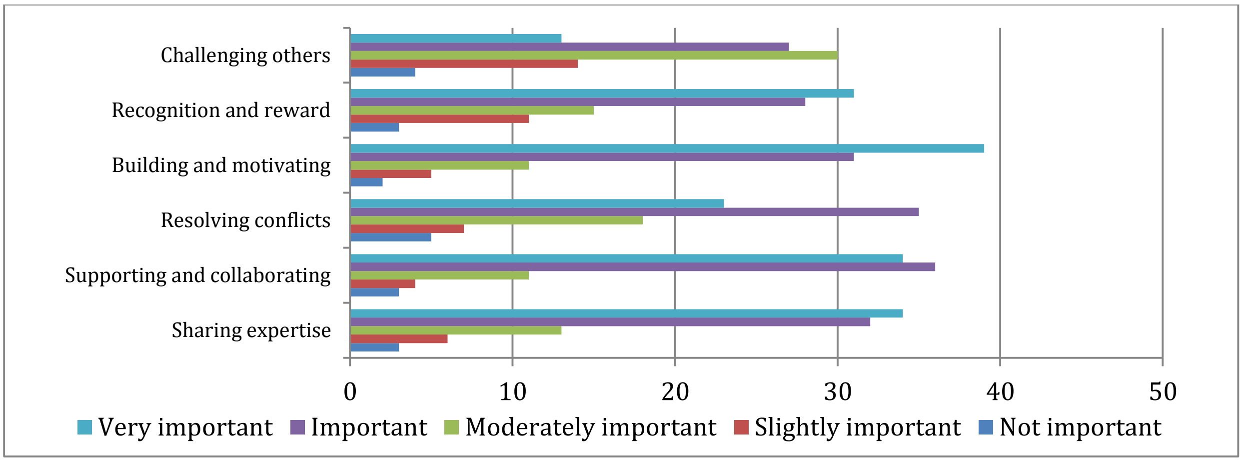

Figure 6.9: Frequencies for project manager innovation teamwork competencies

Innovation can also be effectively implemented when a project team's efforts and energies are put into carrying innovation through considering expected goals, favorable outcomes, and great commitment (Dulaimi, Ling & Bajracharya, 2003). On the other side, if project team members are not convinced that a particular change is fair, it is doubtful they will adopt the change, consider it reasonable, or make effort to guarantee its success (Jiao & Zhao, 2013). However, the bar chart demonstrated in Figure 6.9 shows the frequency scores of each one of the teamwork measurements that are essential for the delivery of successful innovation in projects. The teamwork competencies 1-6 are: sharing expertise; supporting and collaborating; resolving conflicts; building, developing, and motivating; recognition and reward; and challenging others, respectively (refer to Table 4.4). Here, it is observed that all of the items have scored either very important or important, except for teamwork 6, which is frequently challenge others to think and act entrepreneurially (be initiative and take risk). The highest score for this item is moderately important, which means that some of the respondents are not sure if this competency can lead to the required outcome. Still, the amount of respondents who think that teamwork item 6 (challenging others) is important is considerable. Hence, all items in this cluster are important project manager innovation (teamwork) competencies that can lead to delivering successful innovation in projects.

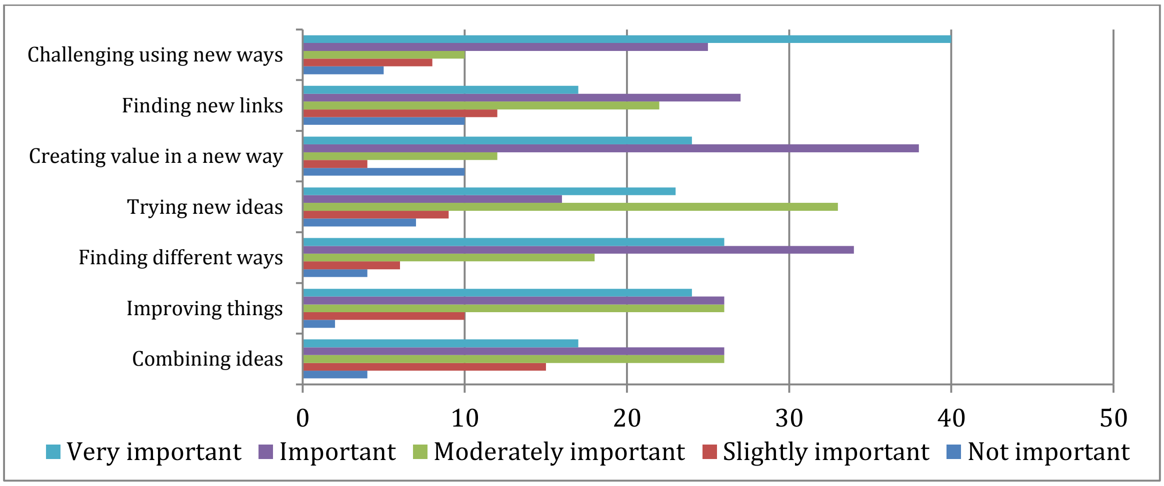

Figure 6.10: Frequencies for project manager innovation creativity competencies

Innovation can be about the creativity of an individual; as the creativity fulfilment of someone is often affected by their natural creative personality and willingness to risk new ideas. Individuals may be urged to use creative thinking strategies to think more creatively and achieve many activities (Tewari, 2011). The bar chart shown in Figure 6.10 represents the frequency scores of each one of the creativity measurements that are essential for the delivery of successful innovation in projects. The creativity competencies 1-7 are combining ideas, improving things, finding different ways, trying new ideas from other fields, creating value in a new ways, finding new links, and approaching challenges in a new way, respectively (refer to Table 4.5). Here, it is observed that most of the respondents have agreed that item 7, which is usually create new ideas by combining existing ideas, is very important for the delivery of successful innovation in projects. On the other side, most of the respondent have rated item 4, which is usually look for new ideas outside of my field and try to apply them, as moderately important. This means that some of the respondents are not sure that this item is important for the delivery of successful innovation in projects. But, at the same time, the amount of respondents who have rated it as very important or important cannot be negligible. Hence, all items of this group are important project manager innovation (creativity) competencies that can lead to delivering successful innovation in projects.

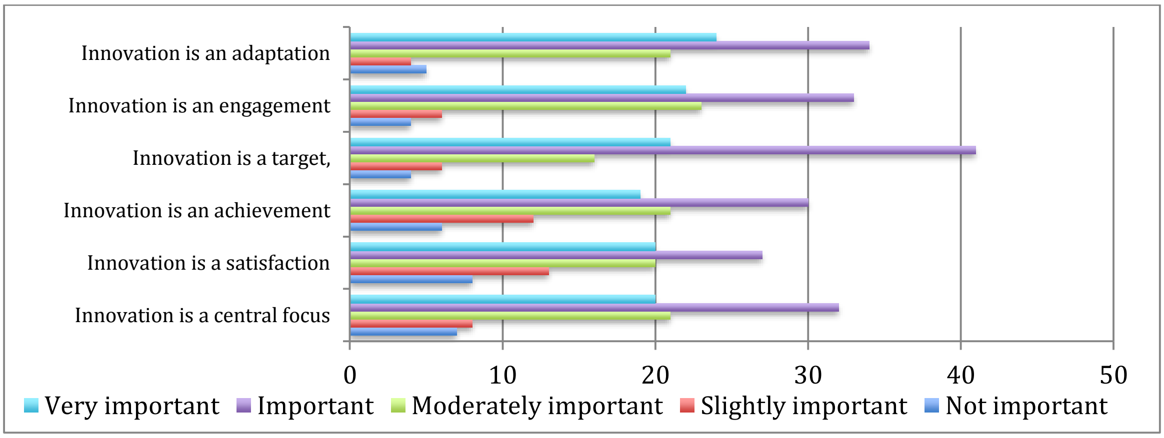

Figure 6.11: Frequencies for project manager innovation commitment competencies

Innovation cannot be started without a strong management's interest and commitment towards it, and positive steps to motivate relevant players (Ling, 2003). The bar chart demonstrated in Figure 6.11 shows that the frequency scores of each one of the commitment measurements that are essential for the delivery of successful innovation in projects. The commitment competencies 1-6 are making innovation a central focus, a satisfaction, an important achievement, a hard work target, an engagement necessity, and getting adapted to it, respectively (refer to Table 4.6). Here, it is observed that all of the respondents have rated these measurements as very important or important. Hence, this indicates that all items of this group are significant project manager innovation (commitment) competencies that can lead to delivering successful innovation in projects.

6.7.3 Project manager innovation personality traits

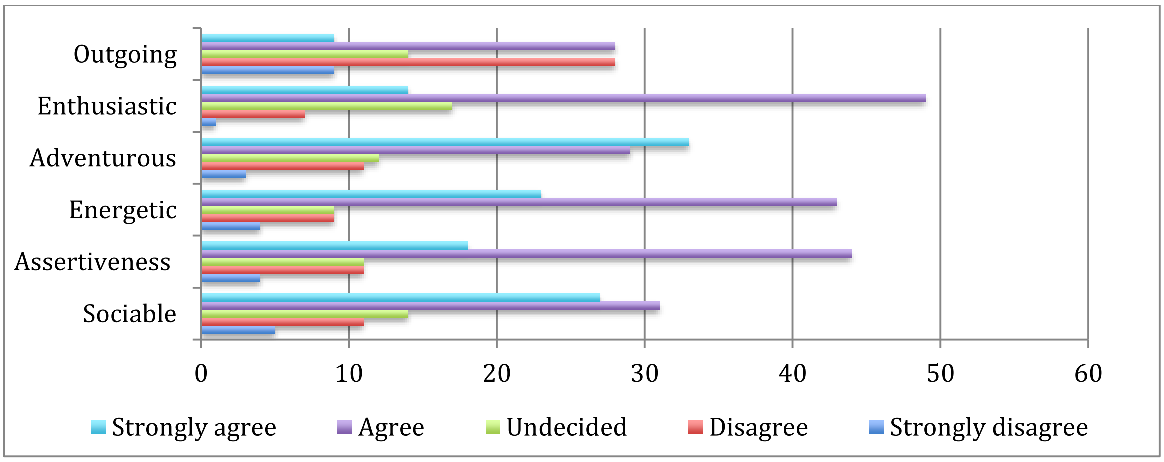

Figure 6.12: Frequencies for project manager innovation extraversion personality traits

As mentioned previously in the literature review, extraversion explains the extent to which project managers are energetic, active, assertive, talkative, enthusiastic, and dominant (Zhao & Seibert, 2006). The bar chart demonstrated in Figure 6.12 illustrates the frequency scores of each one of the extraversion personality trait measurements that are essential for the delivery of successful innovation in projects. The innovation (extraversion) personality traits 1-6 are being sociable, assertive, energetic, adventurous, enthusiastic, and outgoing, respectively (refer to Table 4.8). Here, it is observed that most of the respondents have agreed that these personality traits describe them. Except, for being outgoing, which is taking up new ideas and fighting pressures to turn such ideas into successful innovations. For this measurement, the amount of respondent who strongly agree/ agree is almost equivalent to the amount of respondents who strongly disagree/ disagree that these innovation (extraversion) personality traits describe them. This indicates that being outgoing can be considered as an innovation (extraversion) personality trait, but with lower emphasis.

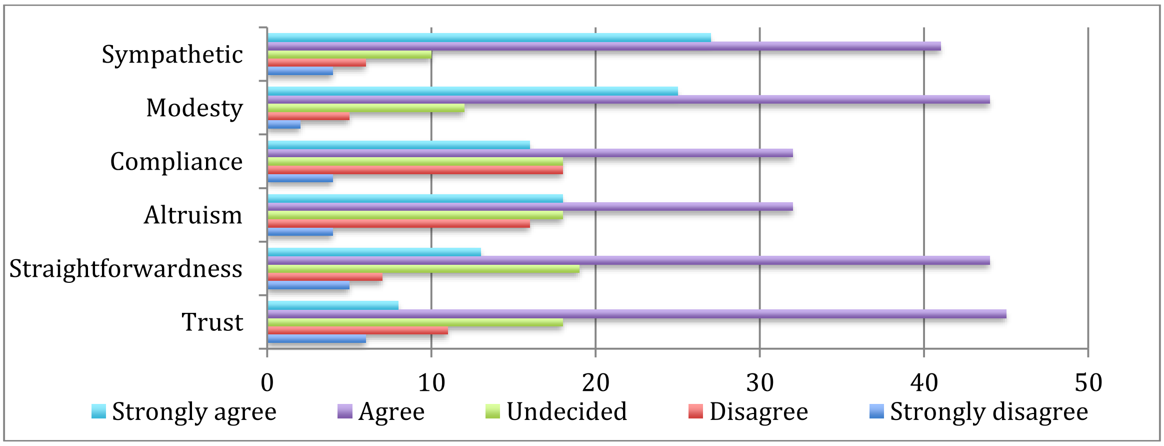

Figure 6.13: Frequencies for project manager innovation agreeableness personality traits

As mentioned previously in the literature review, agreeableness represents an individual's relational orientation, comprising the propensity to prefer cooperation and positive interpersonal relationships (Zhao & Seibert, 2006). The bar chart shown in Figure 6.13 represents the frequency scores of each one of the agreeableness personality trait measurements that are essential for the delivery of successful innovation in projects. The innovation (agreeableness) personality traits 1-6 are being trustworthy, straightforward, altruist, compliant, modest, and sympathetic, respectively (refer to Table 4.8). Here, it is clear that most of the respondents have agreed that these innovation (agreeableness) personality traits describe them.

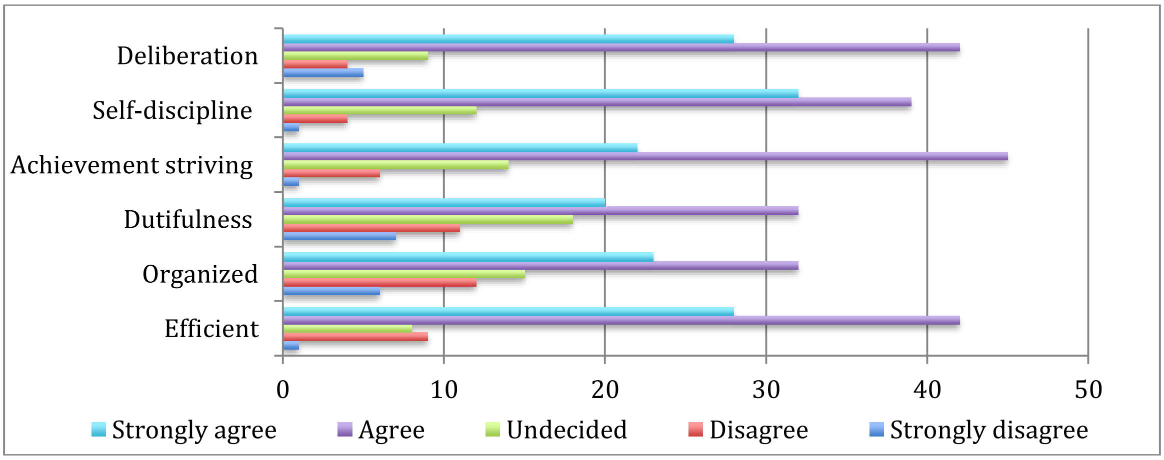

Figure 6.14: Frequencies for project manager innovation conscientiousness personality traits

As mentioned previously in the literature review, conscientiousness represents individual's hard work, persistence, degree of organization, and motivation in the pursuit of target realization (Zhao

& Seibert, 2006). The bar chart illustrated in Figure 6.14 shows the frequency scores of each one of the conscientiousness personality trait measurements that are essential for the delivery of successful innovation in projects. The innovation (conscientiousness) personality traits 1-6 are being efficient, organized, dutiful, achievement striving, self-discipline, and conveying deliberation, respectively (refer to Table 4.8). Here, it is observed that most of the respondents have agreed that these innovation (conscientiousness) personality traits describe them.

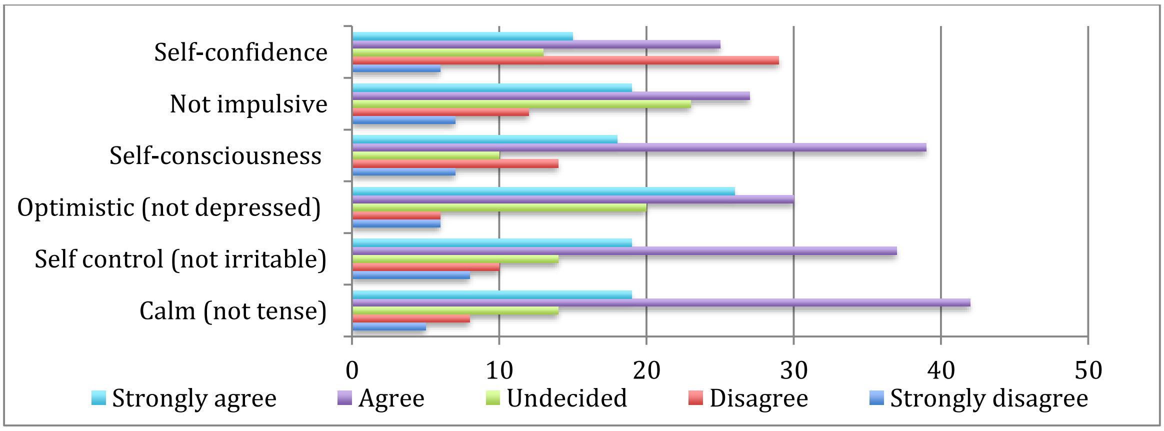

Figure 6.15: Frequencies for project manager innovation neuroticism personality traits

As mentioned previously in the literature review, neuroticism describes the propensity to show poor emotional alteration and experience negative influences, such as insecurity, anxiety, and hostility (Judge et al., 2002). The bar chart shown in Figure 6.15 demonstrates the frequency scores of each one of the emotional stability (opposite of neuroticism) personality trait measurements that are essential for the delivery of successful innovation in projects. The innovation emotional stability personality traits 1-6 are being calm (not tense), self-control (not irritable), optimistic (not depressed), self-consciousness, not impulsive, and self-confident, respectively (refer to Table 4.8). Here, it is observed that most of the respondents have agreed that these personality traits describe them. Except, for being self-confident, the amount of respondent who disagree that this innovation personality traits describe them is relatively high. But, when looking at the overall score of strongly agree/agree, it can be concluded that self-confidence is an important innovation emotional stability personality trait.

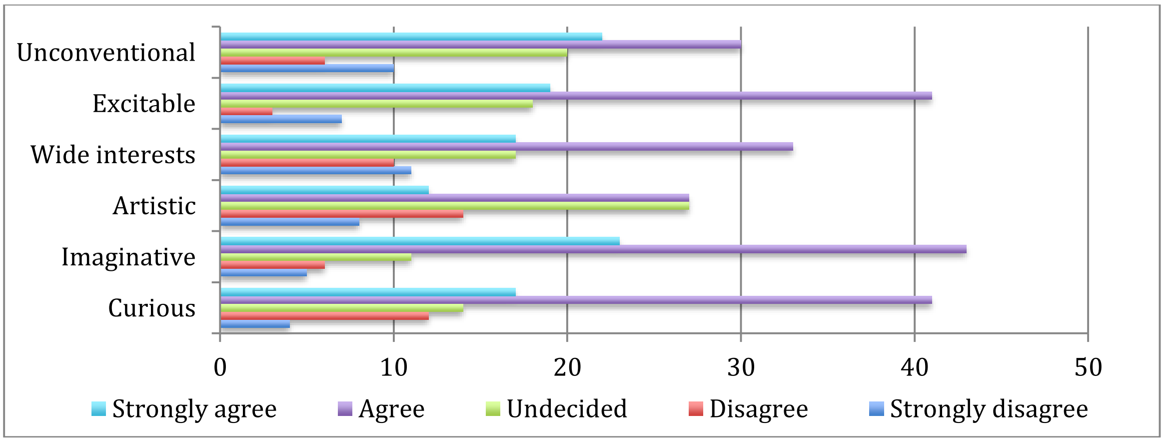

Figure 6.16: Frequencies for project manager innovation openness personality traits

As mentioned previously in the literature review, openness to experience stands for an individual who is intellectually curious, manages to explore novel experiences, and finds out fresh ideas (Zhao & Seibert, 2006). The bar chart illustrated in Figure 6.16 shows the frequency scores of each one of the openness personality trait measurements that are essential for the delivery of successful innovation in projects. The innovation (openness) personality traits 1-6 are being curious, imaginative, artistic, widely interested, excited, and unconventional, respectively (refer to Table 4.8). Here, it is observed that most of the respondents have agreed that these innovation (openness) personality traits describe them.

6.7.4 Project manager environment

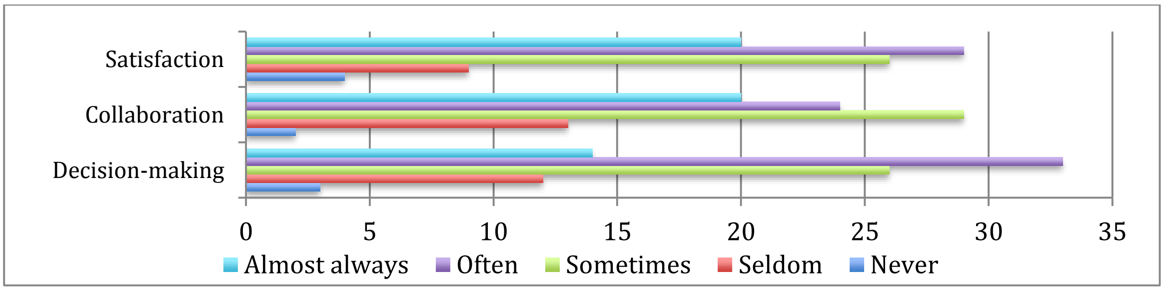

Figure 6.17: Frequencies for project manager innovation environment - stakeholders

The stakeholders express their needs and expectations about projects. This creates a challenge for project team members to evaluate and fulfilled their requirements and expectations (Olander, 2007).

A favourable environment offers sufficient support from main stakeholders, provides suitable resources, generates positive conditions, attains help from management, and presents adequate policies and regulations (Khang & Moe, 2008). The bar chart shown in Figure 6.17 represents the frequency scores of each one of the stakeholder measurements that are essential for the delivery of successful innovation in projects. The PMs' environment measurements of stakeholders 1-3 are decision-making, collaboration, and satisfaction, respectively (refer to Table 4.10). Here, it is observed that all of the items have scored either almost always or often, except for stakeholder item 2 (collaboration), which states that stakeholders work well together to deliver successful innovation. Most of the respondents have rated the frequency of occurrence of this item as sometimes. Still, the amount of participants who have rated the frequency of occurrence of this item, as almost always/ often, is considerable. Hence, all of the stakeholder (environment) measurements can influence the project managers' competencies and the delivery of successful innovation in projects.

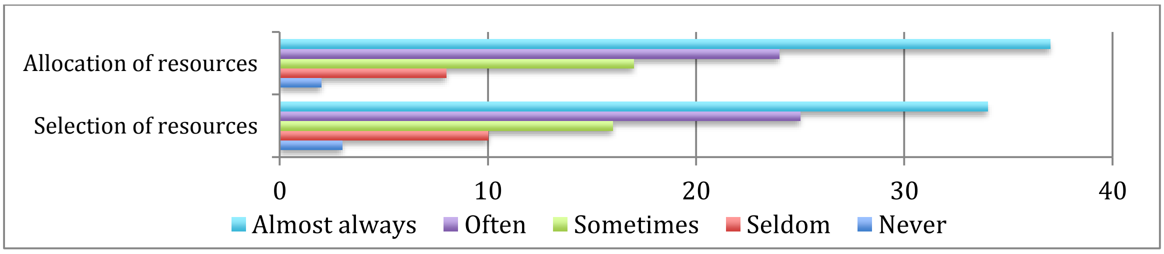

Figure 6.18: Frequencies for project manager innovation environment - resources

Project managers looking for innovation and the success of new products should focus on developing resources within their organizations (Paladino, 2007). Resources have a critical relationship with innovation success, as an effective control of resources can expand an organization's tendency to innovate (Paladino, 2007). The bar chart represented in Figure 6.18 demonstrates the frequency scores of each one of the resource measurements that are essential for the delivery of successful innovation in projects. The PMs' environment measurements of resources 1-2 are selection and allocation of resources, respectively (refer to Table 4.10). Here, it is observed that both items have scored either almost always or often. This indicates that the respondents believe that both of these measurements are significant. Hence, the resources (environment) measurements can influence the project managers’ competencies and the delivery of successful innovation in projects.

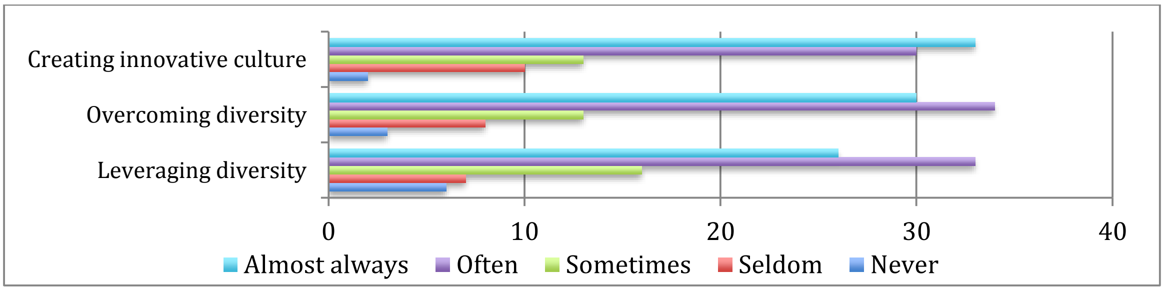

Figure 6.19: Frequencies for project manager innovation environment - culture

Culture has a moderating effect on innovation, as working in diverse cultures will result in having different backgrounds that can affect the success of innovation (Evanschitzky, et al., 2012). West and Bogers (2014) have added that organizational culture has a critical role in the ability and willingness of an organization to effectively gain benefit from various sources of innovation. The bar chart illustrated in Figure 6.19 shows the frequency scores of each one of the culture measurements that are essential for the delivery of successful innovation in projects. The PMs’ environment measurements of culture 1-3 are leveraging diversity, overcoming diversity, and creating an innovative culture, respectively (refer to Table 4.10). Here, it is observed that all of these items have scored either almost always or often. This indicates that the respondents believe that all of these measurements are significant. Hence, the resources (environment) measurements can influence the project managers’ competencies and the delivery of successful innovation in projects.

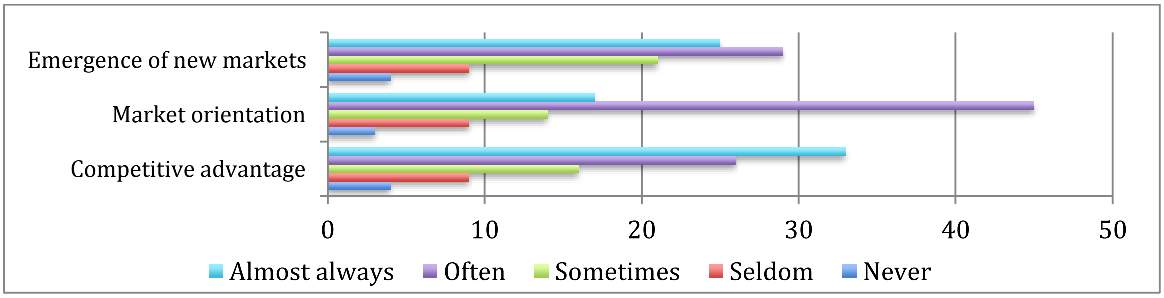

Figure 6.20: Frequencies for project manager innovation environment - market

Innovation is a survival necessity in the present highly competitive and rapidly changing Markets (Sheu & Lee, 2011). It is also a significant gate for organizations trying to grow in the existing markets (Ernst et al., 2015). The bar shown in Figure 6.20 illustrates the frequency scores of each one of the market measurements that are essential for the delivery of successful innovation in projects. The PMs' environment measurements of the market 1-3 are competitive advantage, market orientation, and emergence of new markets, respectively (refer to Table 4.10). Here, it is observed that all of these items have scored either almost always or often. This indicates that the respondents believe that all of these measurements are significant. Hence, the market (environment) measurements can influence the project managers' competencies and the delivery of successful innovation in projects.

6.7.5 Delivery of successful innovation

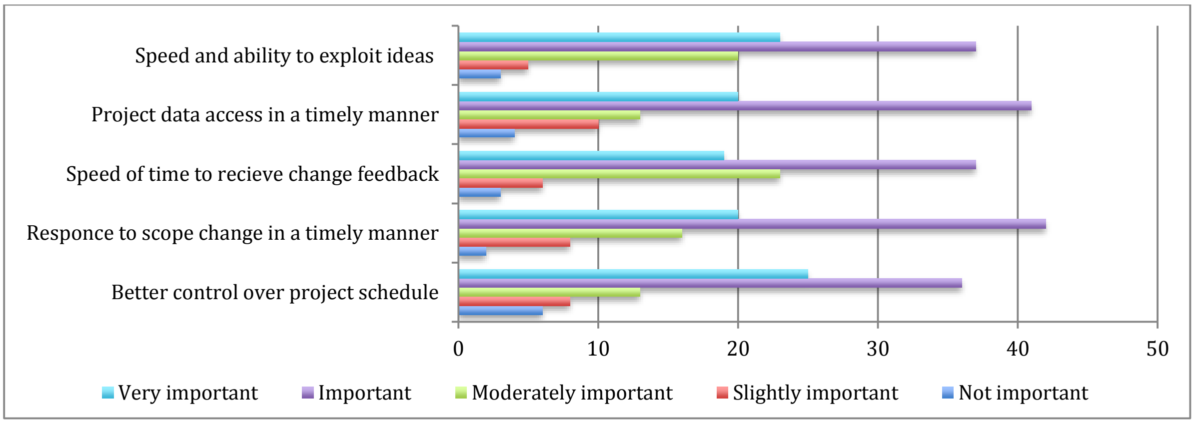

Figure 6.21: Frequencies for delivery of successful innovation time outcome

Time is an integral part of the setting of organizations, specifically as the speed of change in models endures to mirror the rapid evolution of technology. The prominence of time is overstated in the social setting of organizational creativity, as innovation has developed to be the main strategic orientation of organizations trying to accomplish a sustained competitive advantage in the present hypercompetitive and knowledge-rich global environment (Halbesleben et al., 2003). The bar chart shown in Figure 6.21 illustrates the frequency scores of the measurements of the delivery of successful innovation time outcome. The time outcomes 1-5 (refer to Table 4.11) are:

- Time outcome 1: creative ideas resulted in better control over project schedule
- Time outcome 2: ability to respondent to scope change in a timely manner
- Time outcome 3: speed of time from ideas submission to scope change feedback
- Time outcome 4: ability to access project data and knowledge in a timely manner
- Time outcome 5: speed and ability to exploit ideas to improve project success

Here, it is observed that most of the respondents have rated the time outcome items as very important or important. Hence, all of the items in this cluster are significant time outcome measurements for the delivery of successful innovation in projects.

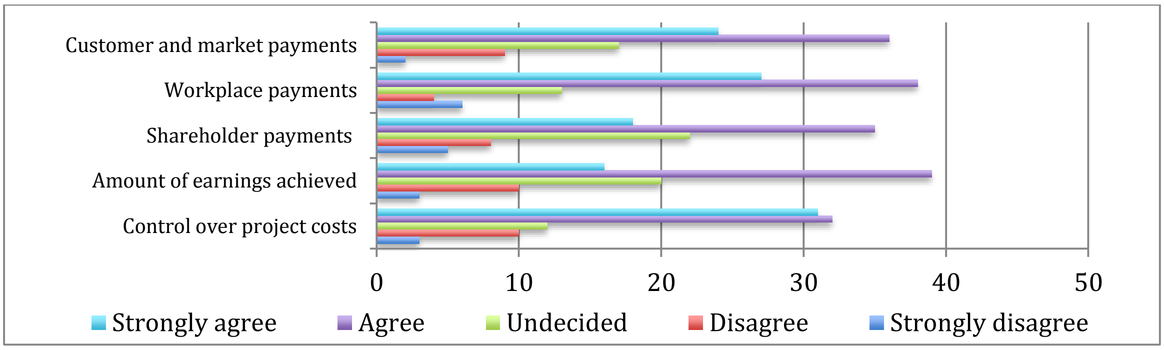

Figure 6.22: Frequencies for delivery of successful innovation cost outcome

It is critical to note that innovation may bring great financial benefits in one case, while it may only develop environmental performance in other cases (Ozorhon, 2013). Innovation can also offer substantial cost reductions (Slater, Mohr & Sengupta, 2013). The bar chart demonstrated in Figure 6.22 represents the frequency scores of the measurements of the delivery of successful innovation cost outcome. The cost outcomes 1-5 (refer to Table 4.11) are:

- Cost outcome 1: creative ideas resulted in better control over project costs
- Cost outcome 2: amount of earnings achieved through innovation relative to objectives, industry competitors, and overall competitive position

- Cost outcome 3: shareholder payments that reflect the growth achieved through applying new ideas
- Cost outcome 4: workplace payments for employee attraction, retention, and motivation
- Cost outcome 5: customer and market payments for market share and customer loyalty

Here, it is observed that most of the respondents have rated the cost outcome items as very important or important. Hence, all of the items in this cluster are significant cost outcome measurements for the delivery of successful innovation in projects.

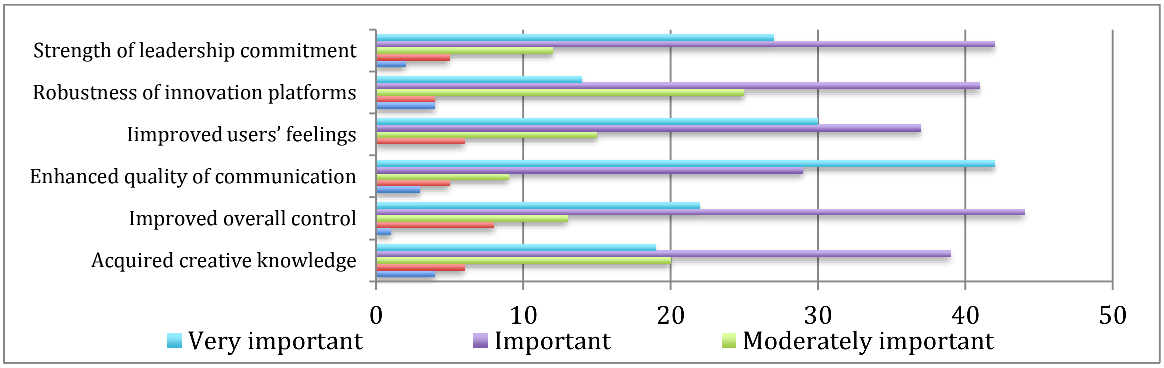

Figure 6.23: Frequencies for delivery of successful innovation quality outcome

Innovation quality outcome can support deliberately the management of innovation. As tools in quality management can create organizational conditions that develop innovations, initiate and supervise innovation process, generate adequate innovation content, and apply innovations successfully in main processes of a specific organization. Quality tools are used indirectly and sometimes directly to manage innovation processes (Bossink, 2002). The bar chart illustrated in Figure 6.23 shows the frequency scores of the measurements of the delivery of successful innovation quality outcome. The quality outcomes 1-6 (refer to Table 4.11) are:

- Quality outcome 1: creative knowledge acquired by the project through the project.
- Quality outcome 2: creative ideas improved overall control exercised over the project.
- Quality outcome 3: enhanced quality of communication between the project members and users.

- Quality outcome 4: creative ideas improved users' feelings regarding participation in the project.
- Quality outcome 5: richness and robustness of existing innovation platforms, groups of ideas, or opportunities chosen and developed.
- Quality outcome 6: strength of present leadership commitment to progress through innovation as mentioned in the strategic initiatives and targets.

Here, it is observed that most of the respondents have rated the quality outcome items as very important or important. Hence, all of the items in this cluster are significant quality outcome measurements for the delivery of successful innovation in projects.

6.8 Assessing statistical normality

Descriptive analysis represents information about the distribution of the obtained responses, specifically, in relation to continuous variables. It is imperative to evaluate normality and to disclose any disruptions of normality assumptions, as this is a substantial factor when assuring that the statistical tests are valid. When assessing normality, skewness and kurtosis are two main assessments that are commonly used to check the assumptions of normality in the study data. The skewness test determines the symmetry of distribution. Values of skewness that are below zero indicate that the scale is left-skewed, while values that are above zero suggests that the scale is right-skewed; values of skewness that are non-zero show that the mean is not in the centre of the distribution.

In order to accurately evaluate how far the values of skewness and kurtosis depart from normality, a rule of thumb advocates that the measured values for skewness and kurtosis should be between ±1 (Aluja et al., 2005). In some cases, if the obtained values of skewness and kurtosis are equal to zero, this indicates that the data are considered to be perfectly normal, which can be an unusual result in the field of social sciences (Pallant, 2011).

Table 6.4 lists all variables with their corresponding skewness and kurtosis values. Evidently, most of the study variables did not interrupt the assumption of normality in accordance with the rule of ±1 statistics threshold (Aluja et al., 2005). The study results explore the scale has the right shape; majority of the values are concentrated on the right side of the mean, with extreme values appearing to the left. This indicates that the study variables are negatively skewed. Yet, although few variables have slightly exceeded the ±1 normality threshold (Aluja et al., 2005), Newsom (2005) have pointed out that the distribution is accepted as normal if the values of skewness are less than or equal to 2, whereas kurtosis demonstrates information about the peak of distribution; the acceptable value of kurtosis has to be less than or equal to 3. Accordingly, normality can be assumed for the study data.

Table 6.4: Skewness and Kurtosis scores

Item code	**Skewness**	**Std. Error**	**Kurtosis**	**Std. Error**	**Item code**	**Skewness**	**Std. Error**	**Kurtosis**	**Std. Error**
LD1	-1.328	0.257	1.056	0.508	PT51	-0.609	0.257	-0.490	0.508
LD2	-1.090	0.257	0.780	0.508	PT52	-0.853	0.257	0.760	0.508
LD3	-0.829	0.257	-0.235	0.508	PT53	-1.019	0.257	1.102	0.508
LD4	-0.958	0.257	0.151	0.508	PT54	-1.328	0.257	1.573	0.508
LD5	-0.396	0.257	0.158	0.508	PT55	-0.932	0.257	0.387	0.508
LD6	-0.953	0.257	0.271	0.508	PT56	-0.751	0.257	-0.330	0.508
LD7	-0.655	0.257	-0.506	0.508	PT57	-0.796	0.257	-0.003	0.508
LD8	-0.891	0.257	0.105	0.508	PT58	-0.695	0.257	-0.531	0.508
LD9	-1.097	0.257	0.231	0.508	PT59	-0.432	0.257	-0.649	0.508
CM10	-0.919	0.257	-0.009	0.508	PT60	0.017	0.257	-1.248	0.508
CM11	-0.991	0.257	0.107	0.508	PT61	-0.743	0.257	-0.121	0.508
CM12	-0.832	0.257	-0.029	0.508	PT62	-1.130	0.257	0.923	0.508
CM13	-0.723	0.257	-0.007	0.508	PT63	-0.300	0.257	-0.622	0.508
CM14	-0.836	0.257	0.072	0.508	PT64	-0.586	0.257	-0.678	0.508
CM15	-0.953	0.257	0.389	0.508	PT65	-1.050	0.257	0.818	0.508
CM16	-0.841	0.257	0.103	0.508	PT66	-0.707	0.257	-0.380	0.508

CM17	-0.691	0.257	-0.308	0.508	TI67	-0.916	0.257	0.103	0.508
TM18	-1.062	0.257	0.640	0.508	TI68	-0.802	0.257	0.386	0.508
TM19	-1.257	0.257	1.498	0.508	TI69	-0.693	0.257	0.345	0.508
TM20	-0.825	0.257	0.159	0.508	TI70	-0.855	0.257	0.147	0.508
TM21	-1.208	0.257	1.114	0.508	TI71	-0.822	0.257	0.553	0.508
TM22	-0.733	0.257	-0.396	0.508	CS72	-0.880	0.257	-0.039	0.508
TM23	-0.221	0.257	-0.487	0.508	CS73	-0.646	0.257	-0.006	0.508
CR24	-0.247	0.257	-0.710	0.508	CS74	-0.679	0.257	0.003	0.508
CR25	-0.373	0.257	-0.621	0.508	CS75	-1.146	0.257	0.894	0.508
CR26	-0.867	0.257	0.330	0.508	CS76	-0.709	0.257	-0.048	0.508
CR27	-0.281	0.257	-0.670	0.508	QL77	-0.831	0.257	-0.501	0.508
CR28	-1.034	0.257	0.198	0.508	QL78	-0.830	0.257	0.429	0.508
CR29	-0.403	0.257	-0.787	0.508	QL79	-1.365	0.257	1.413	0.508
CR30	-1.098	0.257	0.220	0.508	QL80	-0.668	0.257	-0.240	0.508
CT31	-0.671	0.257	-0.237	0.508	QL81	-0.833	0.257	0.933	0.508
CT32	-0.440	0.257	-0.780	0.508	QL82	-1.079	0.257	1.257	0.508
CT33	-0.501	0.257	-0.553	0.508	SK83	-0.391	0.257	-0.344	0.508
CT34	-0.959	0.257	0.708	0.508	SK84	-0.177	0.257	-0.768	0.508
CT35	-0.705	0.257	0.159	0.508	SK85	-0.484	0.257	-0.303	0.508
CT36	-0.876	0.257	0.489	0.508	RS86	-0.764	0.257	-0.370	0.508
PT37	-0.746	0.257	-0.357	0.508	RS87	-0.819	0.257	-0.213	0.508
PT38	-0.885	0.257	0.168	0.508	CU88	-0.871	0.257	0.063	0.508
PT39	-1.036	0.257	0.539	0.508	CU89	-0.939	0.257	0.279	0.508
PT40	-0.843	0.257	-0.240	0.508	CU90	-0.840	0.257	-0.155	0.508
PT41	-0.787	0.257	-0.741	0.508	MK91	-0.808	0.257	-0.238	0.508
PT42	-0.000	0.257	-1.149	0.508	MK92	-0.895	0.257	0.487	0.508
PT43	-0.826	0.257	0.054	0.508	MK93	-0.626	0.257	-0.305	0.508
PT44	-0.909	0.257	0.587	0.508	Job.P.94	0.555	0.257	-1.509	0.508
PT45	-0.423	0.257	-0.729	0.508	Gen. 95	-0.810	0.257	-0.391	0.508
PT46	-0.349	0.257	-0.822	0.508	Edu. 96	-0.665	0.257	-0.366	0.508
PT47	-1.080	0.257	1.355	0.508	Exp. 97	0.471	0.257	-1.132	0.508
PT48	-1.168	0.257	1.067	0.508	Ind.N. 98	0.425	0.257	-1.407	0.508
PT49	-0.998	0.257	0.553	0.508	Org.T.99	-0.546	0.257	-0.935	0.508
PT50	-0.654	0.257	-0.505	0.508					

6.9 Summary

This chapter has concentrated on the relevance of the study data in relation to the conducted data analysis. It describes how the negatively worded items are reversed, the missing values are replaced, the outliers are not found, descriptive statistics are analyzed, and normality tests used for this study are explained in detail. It also identifies the techniques used to test construct reliability using Cronbach alpha. This chapter demonstrates that all of the constructs of this study have measured what they are anticipated to measure.

Chapter 7 Factor analysis and confirmatory factor analysis

7.1 Introduction

The chapter starts with exploratory factor analysis (EFA) to re-categorize the research measurements in according to the obtained loading values. The reliability for each one of the new clusters (Cronbach Apha) is checked. This is followed by an assessment of scales' validity using confirmatory factor analysis (CFA). In particular, the EFA and the CFA (respectively) are performed on the measurements of the project manager innovation competencies, the project manager innovation personality traits, and the delivery of successful innovations. EFA and CFA are conducted on these categories (PMIC, PMIPT, and DSI) as they meet the requirement of minimum five items per cluster, while they are not performed on the project manager innovation environment categorization as their clusters include less that five observations (Hair, Black & Babin, 2010).

7.2 EFA and CFA for the measurements of project manager innovation competencies

Exploratory factor analysis (EFA) is necessary to find out the number of latent variables that can be obtained from the measurement items (DeVellis, 2003). This is critical for verifying whether the adopted measurement questions reflect the study conceptual model. Further, this technique assists in decreasing the measurement questions inventory through eliminating the less significant ones to increase precision (Field, 2009; Hair, Black & Babin, 2010).

In addition, the EFA involves two techniques that are principle component analysis and common factor analysis (Hair, Black & Babin, 2010). Principal component analysis is more applicable for decreasing the number of factors to a smaller number with a more expressive structure, whilst common factor analysis assists in highlighting the factors that measurement items actually represent (Hair, Black & Babin, 2010). This leads to the minimum number of questions that signify the right measurement model. Thus, the researcher has embraced the principle component analysis technique in the current research.

When applying the EFA rotation technique, a researcher can have a much clearer picture of component analysis outcome (Hair, Black & Babin, 2010). Rotation increases the differences between factors and their loaded items, exhibiting a better understanding of the findings (Bryman & Cramer, 2011). Rotation enables researchers to identify questions that are highly loaded on their factors or cross-loaded. It also explains the underlying dimensions or factors, which are regularly signified in the measured questions (Field, 2009; Hair, Black & Babin, 2010; Tabachnick & Fidell, 2007).

More specifically, rotation has two techniques that are the oblique and orthogonal (Hair, Black & Babin, 2010). Oblique rotation enables the obtained factors to associate, whereas orthogonal rotation assumes that there is no correlation between the extracted factors (Field, 2009; Hair, Black & Babin, 2010). In this study orthogonal rotation is adopted, as the underlying factors are not assumed to correlate. Thus, the varimax orthogonal rotation, in the IBM SPSS software, is selected under the principle component analysis to conduct the EFA.

Hair, Black & Babin (2010) have pointed out two rules of thumb to be assured before performing the EFA. First, the minimum number of samples is 50. This rule is met already as the research sample size in 88 respondents, which is above this requirement. Second, having a minimum of five observations per question. Fortunately, none of the items have been removed by the Cronbach alpha analysis. This has helped in maintaining the original number of items. Accordingly, the group of the PM innovation competencies, PM innovation personality traits, and the group of items for the delivery of successful innovation in projects are sufficient to satisfy the five-observations-per-item rule (Hair, Black & Babin, 2010). Yet, the remaining items have less than five observations, and hence have failed to follow this rule.

In particular, the theories adopted that dominate this study are the high performance managerial competency theory and the diffusion of innovation theory. Henceforth, two clusters can appropriately represent the measurement models. One group includes items related to project manager innovation competencies that are: leadership, communication, teamwork, creativity, and commitment competencies. The other group contains items related to the delivery of successful innovation in projects that are innovation for successful: time, cost, and quality outcome. EFA is applied to both of these clusters, plus the cluster of the PM innovation personality traits (moderator) as they successfully follow the five-observations-per-item rule (Hair, Black & Babin, 2010).

The extraction method applied for the EFA is based on with varimax rotation. Fortunately, all questions have loaded successfully (loading > 0.45) (Cua, McKone, & Schroeder, 2001). This implies that the SPSS software has clustered the questions in an order that represents the theoretical factors.

Nevertheless, before conducting the EFA, it is necessary to perform two tests. The Kaiser-Meyer-Olkin (KMO) to test the sample adequacy, and the Bartlett’s test for sphericity. KMO and Bartlett’s test provides acceptable scores above 0.5, and $p < 0.001$, and should be below the threshold ($p = 0.05$), indicating that the correlation matrix is far from the identity matrix (Field, 2009; Hair, Black & Babin, 2010).

This section demonstrates the results of the EFA for the measurements of the PM innovation competencies, as produced from the SPSS software. All of the items are used, since none of them is excluded from the Cronbach alpha analysis. Hence, Table 7.1 demonstrates the results of the KMO and Bartlett's Test, which have provided positive results with a KMO score of 0.906 and a significant Bartlett's Test of Sphericity ($p < 0.001$). There are five factors with eigenvalues greater than one, indicating that the software has recognised five factors from the pool of questions entered in the analysis.

Table 7.1: Number of identified factors by SPSS with their eigenvalues and model fit test for the Project manager innovation competencies

Total Variance Explained			
Factors	**Initial Eigenvalues**		
	Total	**% of Variance**	**Cumulative %**
LD1	19.776	54.934	54.934
LD2	1.558	4.327	59.261
LD3	1.387	3.853	63.114
LD4	1.091	3.032	66.145
LD5	1.055	2.929	69.075

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.906
Bartlett's Test of Sphericity	Chi-Square	2851.532
Degree of Freedom		630
Significance		0.000

The extraction technique used for EFA analysis is based on principle component analysis with varimax rotation. Table 7.2 shows that almost all of the questions have loaded successfully (loading > 0.45) (Cua, McKone, & Schroeder, 2001) on the related factors with no cross loading greater 0.498. This indicates that the SPSS software has categorized the questions in an order, which reflected the theoretical constructs. The only item that has not loaded is CR30, and thus it can be considered as an outlier from the EFA.

Table 7.2: PM innovation competencies loading as a result of the EFA

Measures	Factors				
	1	**2**	**3**	**4**	**5**
LD1	**0.526**		0.477		
LD4	**0.567**				
CM10	**0.513**				
CM11	**0.690**				
CM12	**0.606**				
CM13	**0.463**				
CM14	**0.537**	0.482			
CM15	**0.678**				
CM16	**0.756**				
CM17	**0.708**				
TM18	**0.713**				
TM19	**0.573**				
TM21	**0.477**	0.418			
CT34	**0.703**				
LD2		**0.516**			
LD8		**0.537**			
LD9		**0.720**			
TM20		**0.497**			
CR25		**0.657**			
CR26		**0.675**	0.464		
CR27		**0.568**			
CR28		**0.489**			
CT36		**0.564**			
LD3			**0.691**		
LD6	0.498		**0.536**		
LD7			**0.491**		
TM22			**0.645**		
TM23			**0.697**		
CR24			**0.509**		
CR29				**0.647**	
CT31				**0.647**	
CT32				**0.761**	
CT33				**0.800**	
CT35	0.487	0.454		**0.505**	
LD5					**0.855**
CR30					

The relationships between each variable and the selected components are demonstrated in Table 7.2. The strongest relationship is between LD5 and component # 5, with a loading value of 0.855. However, allocating each variable to the component that has the largest loading leads to the results shown in Table 7.3.

Table 7.3: PMIC new codes as a result of the EFA

Variable Code	Component 1	2	3	4	5	Cronbach Alpha	No. of Questions	New Code	New Description
LD1	0.526					0.958	14	PMIC1	Impact and Influence Competencies
LD4	0.567								
CM10	0.513								
CM11	0.690								
CM12	0.606								
CM13	0.463								
CM14	0.537								
CM15	0.678								
CM16	0.756								
CM17	0.708								
TM18	0.713								
TM19	0.573								
TM21	0.477								
CT34	0.703								
LD2		0.516				0.933	9	PMIC2	Cognitive Competencies
LD8		0.537							
LD9		0.720							
TM20		0.497							
CR25		0.657							
CR26		0.675							
CR27		0.568							
CR28		0.489							
CT36		0.564							
LD3			0.691			0.869	6	PMIC3	Personal Effectiveness Competencies
LD6			0.536						
LD7			0.491						
TM22			0.645						
TM23			0.697						
CR24			0.509						
CR29				0.647		0.846	5	PMIC4	Managerial Competencies
CT31				0.647					
CT32				0.761					
CT33				0.800					
CT35				0.505					
LD5					0.855	0.910	1	PMIC5	Achievement and Action-Oriented Competencies

The findings of the EFA explore four New Latent Clusters of Project Manager Innovation Competencies (PMIC). As demonstrated in Table 7.3, there are 14 items assigned to the first New Latent Cluster coded (PMIC1), 9 items assigned to the second New Latent Cluster coded (PMIC2), 6 items assigned to the third New Latent Cluster coded (PMIC3), 6 items assigned to the fourth New Latent Cluster coded (PMIC4), and 1 item assigned to the fifth New Latent Cluster coded (PMIC5). These New Latent Clusters are elaborated in the following subsections:

PMIC1 – Impact and Influence Competencies

This cluster is a combination of 14 measurements that are shown in Table 7.3. Respectively, these measurements are: (1) inspire others to create ideas and find new opportunities (Seaden et al., 2003); (2) make decisions that help in delivering innovation (Boss, 2000); (3) listen to others without interrupting them (Rojas, 2013); (4) speak using a clear (local or foreign) language that is appropriate to the audience (Rojas, 2013; Vila, Pérez & Coll-Serrano, 2014); (5) write (emails, memos, report, etc.) clearly and concisely using any language (Abu Bakar et al., 2011; Vila, Pérez & Coll-Serrano, 2014); (6) present products, ideas, or reports effectively (Vila, Pérez & Coll-Serrano, 2014); (7) use computers and the Internet efficiently (Vila, Pérez & Coll-Serrano, 2014); (8) communicate in a tone and manner that shows respect (Rojas, 2013); (9) Communicate the importance of innovative solutions systematically and openly (Chen, 2002; Hartmann, 2006); (10) Demonstrate strong awareness about innovation (Wei et al., 2013); (11) share expertise, accountability, and knowledge to strengthen team performance (Bossink, 2002; Tewari, 2011); (12) support and collaborate with team members to solve any problems that may occur (Shieh, 2011); (13) build, develop, and motivate teams to bring forward new ideas (Abu Bakar et al., 2011; Anderson, 1992; Dainty, Cheng & Moore, 2003; Dainty, Cheng & Moore, 2005; Dziekoński, 2017; Guillén & Saris 2013; Liikamaa, 2015; Ríos-Carmenado, Rahoveanu & Gallegos, 2014; Takey & Carvalho, 2015); and (14) willing to put in a great deal of extra effort to support and implement innovation (Dulaimi, Ling & Bajracharya, 2003; Jiao & Zhao, 2013). However, it is clear from these points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of positive interaction that is concerned about positive communication or involvement with individuals (Oxford Dictionary, 2017). This is in line with the argument of Dainty, Mei-I & Moore (2005), who have emphasized the category of ‘‘Impact and Influence-Based Competencies’’. Here, behaviors are related to individuals' interests about the influence they can have on others. ‘‘Impact and influence’’ competencies refer to an individual's capacities to get support for a course of action from others. This is related to a group of process skills relevant to leading or directing a team (Dainty, Mei-I & Moore, 2005). Accordingly, this new cluster can be named ‘‘Impact and Influence Competencies’’.

PMIC2 – Cognitive Competencies

This cluster is a combination of 9 measurements that are shown in Table 7.3. Respectively, these measurements are: (1) proactively take initiative to innovate (Liikamaa, 2015); (2) find practical and creative ways to resolve existing conflicts (Anderson, 1992; Takey & Carvalho, 2015); (3) forming, and developing an effective team that can deliver successful innovation (Abraham et al., 2001); (4) attain constructive resolution of conflict (Anderson, 1992; Takey & Carvalho, 2015); (5) evaluate ideas/ products/ services to see how they can be improved (Tewari, 2011); (6) think about how to do things in a different way (Abu Bakar et al., 2011; Dziekoński, 2017; Ríos-Carmenado, Rahoveanu & Gallegos, 2014); (7) look for new ideas outside of the work field, and try to apply them (Tewari, 2011); (8) look for new methods to create value in capabilities, products, processes, services, and strategies (Tewari, 2011); and (9) have the ability to modify and change any course of action in order to get adapted as needed (Liikamaa, 2015). However, it is obvious from these points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of initiative practices. Initiative practices can be any practice that results in assessing and initiating things independently; having the power or opportunity to act before others do; resolving a difficulty or improving a situation; or more precisely having a fresh approach to something (Oxford Dictionary, 2017). This is in line with the argument of Dainty, Mei-I & Moore (2005), who have emphasized the category of ‘‘Cognitive Competencies’’. Cognitive Competencies are intellectual version of initiative, assisting the PM to understand different tasks, situations, bodies of knowledge, or problems. The ability of individuals to use their intelligence to a work problem demands an appropriate ability and motivation (Dainty, Mei-I & Moore, 2005). Accordingly, this new cluster can be named ‘‘Cognitive Competencies’’.

PMIC3 – Personal Effectiveness Competencies

This cluster is a combination of 6 measurements that are shown in Table 7.3. Respectively, these measurements are: (1) use appropriate influence strategies to get rid or navigate around any obstacles (Howell, Shea & Higgins, 2005); (2) be alerted to new opportunities and can easily get adapted to challenges (Liikamaa, 2015; Takey & Carvalho, 2015); (3) care about building and developing new relationships (Liikamaa, 2015); (4) recognize and award original ideas and ideas for improvement (Abu Bakar et al., 2011); (5) frequently challenge others to be initiative and take risk (Takey & Carvalho, 2015); and (6) create new ideas by combining existing ideas (Tewari, 2011). However, it is clear from these points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of overcoming barriers through overcoming any obstacle that can prevent a movement or an access (Oxford Dictionary, 2017). This is in line with the argument of Dainty, Mei-I & Moore (2005), who have emphasized the category of ‘‘Personal Effectiveness Competencies’’. This cluster of competencies shares a similar theme as they reveal behavioral and intellectual maturity to others and to work (Dainty, Mei-I & Moore, 2005). Accordingly, this new cluster can be named ‘‘Personal Effectiveness Competencies’’.

PMIC4 – Managerial Competencies

This cluster is a combination of 5 measurements that are shown in Table 7.3. Respectively, these measurements are: (1) look for surprising connections between things (Tewari, 2011); (2) consider innovation as a main goal and central focus at work (Howell, Shea & Higgins 2005; Katzenbach &

Smith, 1993); (3) believe that the major satisfaction in life comes from attaining successful innovation (Ling, 2003; Rojas, 2013); (4) believe that the most important achievements that take place involve innovation (Ling, 2003); and (5) Get fully engaged when performing innovation relevant activities (Ríos-Carmenado, Rahoveanu & Gallegos, 2014). However, it is obvious from the above points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of loyalty, which is a strong feeling of support or commitment (Oxford Dictionary, 2017). This is in line with the argument of Dainty, Mei-I & Moore (2005), who have emphasized the category of ‘‘Managerial Competencies’’. This cluster includes project managers’ desire to work cooperatively with their teams; the intention to effectively lead others; and the confidence and appropriate use of positional power to assure that others fulfil a project manager’s wishes (Dainty, Mei-I & Moore, 2005). Accordingly, this new cluster can be named ‘‘Managerial Competencies’’.

PMIC5 – Achievement and Action-Oriented Competencies

This cluster has only one measurement as shown in Table 7.3. The researcher has accepted this measurement to represent the fifth cluster for two main reasons. First, The Cronbach alpha value of this measurement is 0.910, which is relatively high and greater than 0.7. Second, this item has the highest loading value, which 0.855. This indicates that that LD5 and component 5 represent the strongest relationship. This measurement states that it is essential to avoid analysis paralysis when new opportunities are identified through exhibiting a preference towards action (Liikamaa, 2015). The researcher has observed that this argument, which is made by Liikamaa (2015), discusses the idea of being action oriented. Action oriented refers to the ability to become fully oriented to achieving the required aims (Oxford Dictionary, 2017). This is in line with the argument of Dainty, Mei-I & Moore (2005), who have emphasized the category of ‘‘Achievement and Action-Oriented Competencies’’. This cluster focuses on action towards work completion. Achievement orientation refers to working well towards gaining the desired standard of excellence. Action-oriented competency can be similar to being ‘‘initiative’’, as both of these terms are related to a preference for seizing opportunities and taking a proper action (Dainty, Mei-I & Moore, 2005). Accordingly, this new cluster can be named ‘‘achievement and Action-Oriented Competencies’’.

It is imperative to understand the process of CFA for measurement model validation. The first step in CFA is to run the algorithm with the dependent variables identified to describe latent variables. Once the findings are produced, the next step is to examine the estimated values in order to find out whether they meet the definite critical values for each test (Hu and Bentler, 1999, Kline, 2010). Yet, when developing the AMOS 20 to apply confirmatory factor analysis, a condition to separate correlated variables is embraced and identified as ‘modification indices’. Wherever estimated values disturb set criteria it is obligatory to check for and exclude correlated dependent variables. In order to assess the scales used in this study, both Cronbach’s alpha and CFA are used to evaluate the scales and assess their reliability and validity to confirm the scale’s aptitude to create reliable and valid data, which can be trusted on to formulate consistent statistical inferences.
The reliability findings or Cronbach’s alpha results have been demonstrated in the previous section. Yet, scale validity is tested carefully through applying CFA among the study scales separately to specify a confirmatory evaluation of both convergent and discriminant validity (Anderson & Gerbing, 1988). Convergent validity refers to the degree in which scale items correlate to each other and can measure the observed variable, while discriminant validity refers to the extent in which the items assessing the variable are different from other obained variables (Klein, Sollereder & Gierl, 2002). However, as the questionnaire measurements are adapted from the literature review, it is necessary to evaluate its validity and reliability in a UAE context. Another reason to use CFA is to decrease the number of scale variables to a more simply controllable number. CFA examines the scales fitness of the proposed conceptual model with the acquired data. Thus, CFA is the most

suitable technique to explore whether the PMIC, PMIPT, and DSI scales in this research have similar statistical properties to the ones used in preceding studies in other settings. Still, prior to running CFA through AMOS, it has been decided to measure sampling adequacy. The Kaiser-Meyer-Olkin (KMO) index that measures whether the distribution of values is sufficient for CFA, is 0.906, 0.848, 0.921 and for PMIC, PMIPT, and DSI, respectively (refer to Table 7.1, Table 7.5, and Table 7.9, respectively). Hence, the researcher is confident that CFA is a suitable method to use with the sample data of this study. Nevertheless, in this study, CFA uses multiple fit criteria to evaluate the models; these involve CMIN, CMIN/DF, TLI, CFI, and RMSEA. Those measures are descriptive, and have different cut-off values to evaluate the hypothesized model.

It is important to assess the goodness of the model fit between the project manager innovation competencies' measurements and the sample data taken from the study participants. In order to effectively define the fit of a model, it is imperative to use more than one fit index. The reason is that different indices assess different features of a model. Hence, a multiple-index approach provides a more holistic and precise interpretation (Hair et al., 1998). In this study, different fit measures are used to assess the PMIC scale that covers chi-square that measures the relative amount of variance and covariance in a sample through comparing the hypothesised model against the observed data (Byrne, 2013), RMSEA, and CFI that are found through comparing the hypothesised model (initial model) with the independent model (modified model).

The initial model of the PMIC (is the hypothesised model) and it entails 36 items before the elimination of any factors. The results of CFA show that the initial findings of the PMIC scale are unsatisfactory, and modifications of the model are required. Table 7.4 show the chi-square with the degree of freedom (DF), CFI, and RMSEA values for the initial model (before the EFA) and the modified model (using EFA results). The acceptable ranges and cut-off values are: for chi-square (CMIN) the p-value > 0.05 (Joreskog & Sorbom, 1997); CMIN/ DF with a range from 1 to 5

(Schumacker & Lomax, 2004; Ullman, 2001); TLI with a range from 0 to 1 (Hu & Bentler, 1999); CFI ≥ 0.9 (Bentler, 1995); and RMSEA ≤ 0.1 (MacCallum, Browne, & Sugawara, 1996).

Table 7.4: Project manager innovation competencies fit statistics for CFA

	CMIN (p <0.001)	CMIN/ DF	TLI	CFI	RMSEA
Initial Model (The model before EFA)	1087.263	1.862	0.786	0.812	0.095
Modified Model 1 (Using the results of the EFA)	991.839	1.790	0.807	0.830	0.091
Modified Model 2 (Using the results of the EFA, and excluding item LD5)	863.189	1.657	0.863	0.873	0.083
Modified Model 3 (Using modification indices to improve Model2)	770.076	1.498	0.893	0.902	0.072

Based on the findings of the CFA and the measures used to evaluate the PMIC initial model scale [CMIN (p<0.001) = 1087.263; CMIN/DF= 1.862; TLI = 0.786, CFI=0.812; RMSEA=0.095], indicate that the initial Model of the PMIC scale demonstrates an inadequate fit for the data; this means that the PMIC scale factors are not able to explain this data accurately, thus a modified model is suggested. However, the only item in PMIC5 (LD5) is added to the items of PMIC4. Cronbach Alpha of the modified PMIC4 is 0.846, which is an acceptable value. Now, it is time to perform the CFA on the measurements of the project manager innovation competencies. The model fit of the modified model 1 displays model fit values of CMIN (p<0.001) =991.839, CMIN/DF= 1.790; TLI = 0.807, CFI=0.830; RMSEA=0.091. However, the regression line loading for LD5 in the modified PMIC4 has a low loading value of 0.30, and thus it is excluded from the model. The original PMIC4 cluster is used along with the other competency groups (PMIC1, PMIC2, and PMIC3). The modified model 2 shown in Figure 7.1 displays model fit values of CMIN (p<0.001) = 863.189, CMIN/DF= 1.657; TLI = 0.863, CFI=0.873; RMSEA=0.083.

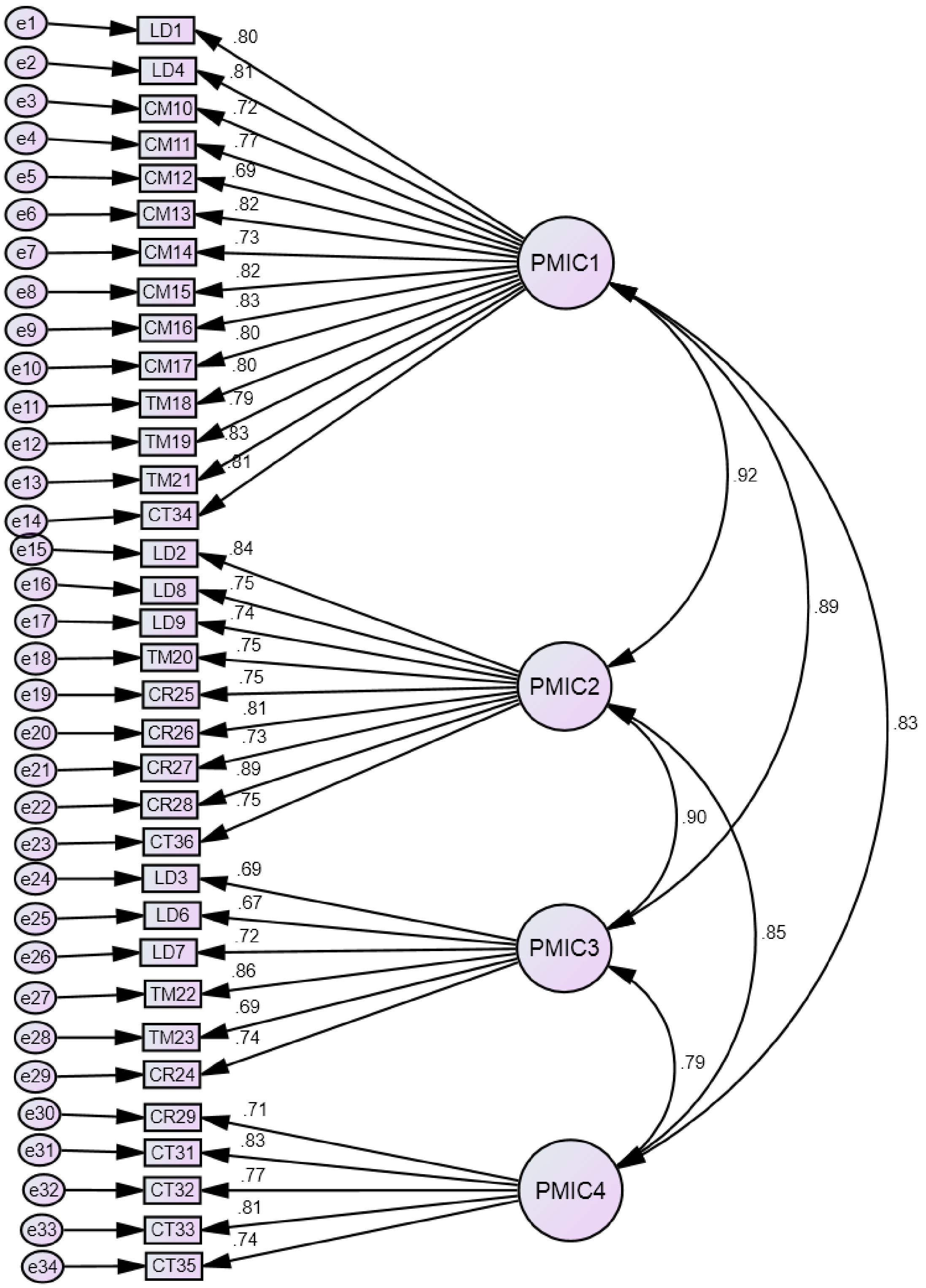

Figure 7.1: CFA for project manager innovation competencies

Yet, the researcher has used modification indices to meet the cut off value as illustrated in Figure 7.2. At this stage the modified model 3 has an improved model fit values of CMIN ($p<0.001$) = 770.076, CMIN/DF= 1.498; TLI =0.893, CFI=0.902; RMSEA=0.072. At this stage, it can be concluded that the model fit of the confirmatory factor analysis for the modified model 3 is acceptable, as it successfully meet the cut-off values. Besides, the model fit of model 3 is better than that of the modified model 2, model 1, or the initial model, for the project manager innovation competencies.

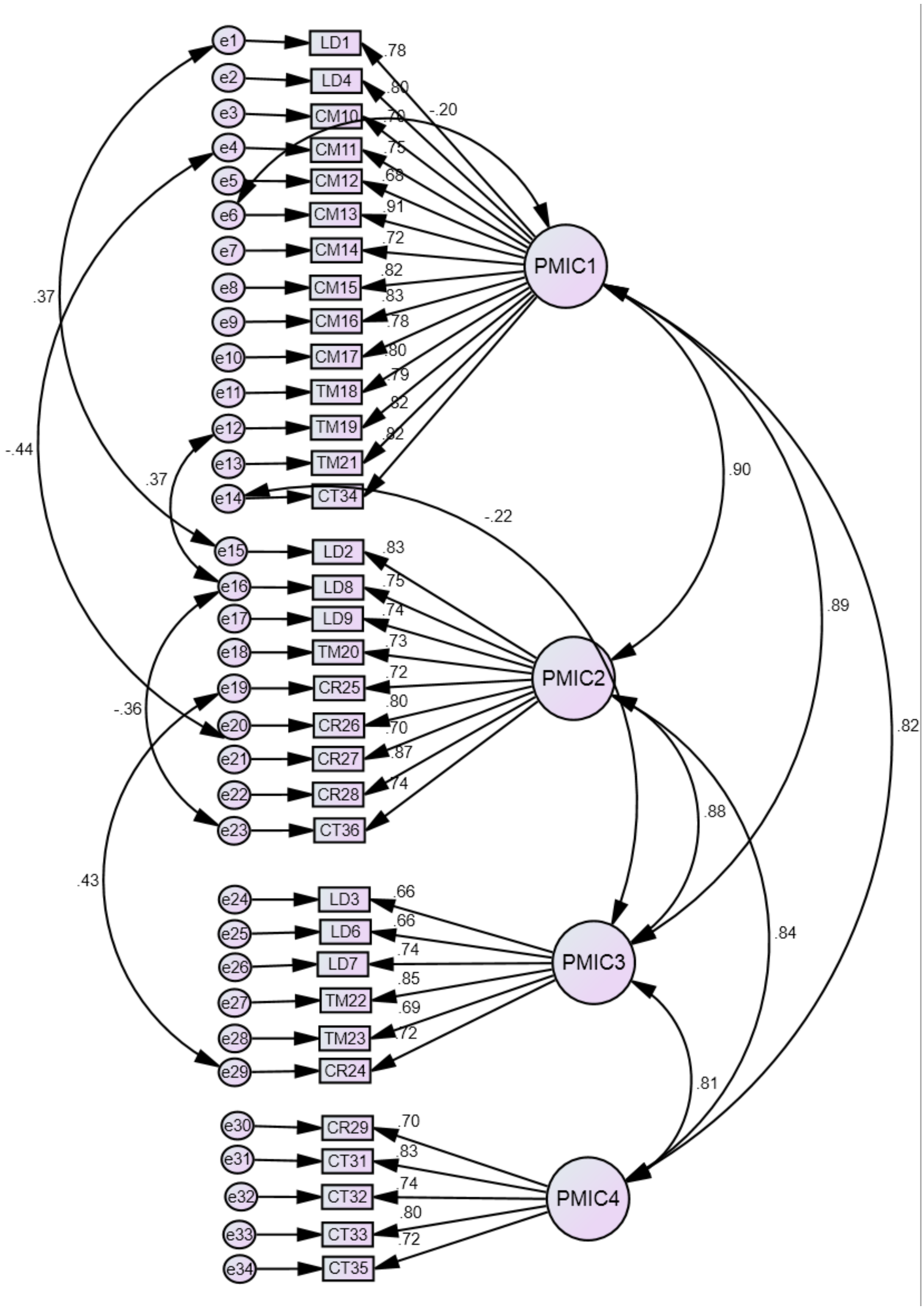

Figure 7.2: Improved CFA for project manager innovation competencies using modification indices

7.3 EFA and CFA for the measurements of project manager innovation personality traits

This section demonstrates the results of the EFA for the measurements of the PM innovation personality traits, as produced from the SPSS software. All of the items are used, since none of them is excluded from the Cronbach alpha analysis. Hence, Table 7.5 demonstrates the results of the KMO and Bartlett's Test, which have provided positive results with a KMO score of 0.848 and a significant Bartlett's Test of Sphericity (p <0.001). There are seven factors with eigenvalues greater than one, representing that the software has recognized seven factors from the pool of questions entered in the analysis.

Table 7.5: Number of identified factors by SPSS with their eigenvalues and model fit test for the Project manager innovation Personality

Total Variance Explained			
Factors	**Initial Eigenvalues**		
	Total	**% of Variance**	**Cumulative %**
PT37	9.310	31.033	31.033
PT38	4.499	14.998	46.031
PT39	1.536	5.120	51.151
PT40	1.356	4.520	55.672
PT41	1.241	4.138	59.810
PT42	1.105	3.684	63.494
PT43	1.034	3.446	66.940

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.848
Bartlett's Test of Sphericity	Chi-Square	1423.558
Degree of Freedom		435
Significance		0.000

The extraction technique used for EFA analysis is based on principle component analysis with varimax rotation. Table 7.6 shows that all of the questions have loaded successfully (loading > 0.45) (Cua, McKone, & Schroeder, 2001) on the related factors with no cross loading greater 0.491.

This indicates that the SPSS software has categorized the questions in an order, which reflected the theoretical constructs (latent variables). The only item that has not loaded is PT37, and thus it can be considered as an outlier from the EFA.

Table 7.6: PM innovation personality traits loading as a result of the EFA

Measures	**Factors**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
PT37							
PT39	**0.605**						
PT40	**0.830**						
PT41	**0.712**						
PT44	**0.614**						
PT47	**0.674**						
PT48	**0.668**						
PT61	**0.594**						
PT62	**0.514**			0.491			
PT50		**0.713**					
PT51		**0.702**					
PT56		**0.771**					
PT57		**0.792**					
PT59		**0.767**					
PT60		**0.732**					
PT38	0.490		**0.521**				
PT49			**0.546**				
PT52			**0.543**				
PT53			**0.653**				
PT54			**0.638**				
PT63				**0.793**			
PT65	0.488			**0.528**			
PT66				**0.723**			
PT43					**0.605**		
PT55					**0.646**		
PT58					**0.741**		
PT45						**0.780**	
PT46		0.487				**0.614**	
PT64						**0.480**	
PT42							**-0.770**

The relationships between each variable and the selected components are demonstrated in Table 7.6. The strongest relationship is between PT40 and component # 1, with a loading value of 0.830. However, assigning each variable to the component that has the largest loading leads to the results shown in Table 7.7.

Table 7.7: Project manager innovation personality traits new codes as a result of the EFA

Vari. Code	Component							Cron. Alpha	No. of Ques.	New Code	New Description
	1	2	3	4	5	6	7				
PT39	0.605							0.897	8	PMIPT1	Alertness and quickness Traits
PT40	0.830										
PT41	0.712										
PT44	0.614										
PT47	0.674										
PT48	0.668										
PT61	0.594										
PT62	0.514										
PT50		0.713						0.854	6	PMIPT2	Self Confidence Traits
PT51		0.702									
PT56		0.771									
PT57		0.792									
PT59		0.767									
PT60		0.732									
PT38			0.521					0.799	5	PMIPT3	Decision-Making Traits
PT49			0.546								
PT52			0.543								
PT53			0.653								
PT54			0.638								
PT63				0.793				0.806	3	PMIPT4	Openness to Innovation Traits
PT65	.			0.528							
PT66				0.723							
PT43					0.605			0.700	3	PMIPT5	Honesty and Integrity Traits
PT55					0.646						
PT58					0.741						
PT45						0.780		0.621	3	PMIPT6	Energy and Toughness Traits
PT46						0.614					
PT64						0.480					
PT42							-0.770	0.881	1	PMIPT7	Outgoing Toward Innovation Traits

The findings of the EFA explore seven New Latent Clusters of Project Manager Innovation Personality Traits (PMIPT). As demonstrated in Table 7.7, there are 8 items assigned to the first New Latent Cluster coded (PMIPT1), 6 items assigned to the second New Latent Cluster coded (PMIPT2), 5 items assigned to the third New Latent Cluster coded (PMIPT3), 3 items assigned to the fourth New Latent Cluster coded (PMIPT4), 3 items assigned to the fifth New Latent Cluster coded (PMIPT5), 3 items assigned to the sixth New Latent Cluster coded (PMIPT6), and 1 item assigned to the seventh New Latent Cluster coded (PMIC7). These New Latent Clusters are elaborated in the following subsections:

PMIPT1 – Alertness and quickness Traits

This cluster is a combination of 8 measurements that are shown in Table 7.7. Respectively, these measurements are: (1) energetic (Howell & Higgins, 1990; Jenssen & Jorgensen, 2004; Lichtenthaler & Ernst, 2009), (2) adventurous (Jenssen & Jorgensen, 2004; Kelley & Lee, 2010; Pinto & Patanakul 2015; Walter et al., 2011), (3) enthusiastic (Howell & Higgins, 1990; Jenssen & Jorgensen, 2004; Lichtenthaler & Ernst, 2009), (4) straightforward (Takey & Carvalho, 2015), (5) modest (Bakker-Pieper & de Vries 2013), (6) sympathetic (Espíritu-Olmos and Sastre-Castillo, 2015; McCrae & Costa, 1987), (7) curious (John & Srivastava, 1999; Rojas, 2013), and (8) imaginative (John & Srivastava, 1999). However, it is obvious from these points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of alertness and quickness. These concepts are important for project managers, as they allow them to be alerted and quick to detect any warning signs that may lead to problems (Othman & Jaafar 2013). This cluster is in line with the argument of Othman and Jaafar (2013), who have emphasized the category of ‘‘Alertness and quickness’’. This category can involve being alerted when problems/conflicts arise, and making quick alternatives to solve project problems (Othman & Jaafar, 2013). Accordingly, this new cluster can be named ‘‘Alertness and Quickness Traits’’.

PMIPT2 – Self Confidence Traits

This cluster is a combination of 6 measurements that are shown in Table 7.7. Respectively, these measurements are: (1) organized (Tewari, 2011), (2) dutifulness (Tewari, 2011), (3) self control (not irritable) (Abu Bakar et al., 2011; Dziekoński, 2017; Vila, Pérez & Coll-Serrano, 2014), (4) optimistic (not depressed) (Howell, Shea & Higgins 2005; Liikamaa, 2015), (5) insightfulness (not impulsive) (Miulescu, 2013), and (6) self confidence (Dziekoński, 2017; Howell, Shea & Higgins 2005; John & Srivastava, 1999; Liikamaa, 2015; Nichols & Cottrell, 2014). However, it is obvious from these points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of self-confidence. The concept ‘‘ self confidence’’ can be effective when project manager are enthusiastic, strong-minded, and willing to lead others (Othman & Jaafar 2013). This cluster is in line with the argument of Othman and Jaafar (2013), who have emphasized the category of ‘‘self confidence’’ (Othman & Jaafar 2013). This category can involve not feeling nervous when communicating with any parties, and not feeling nervous when handling a project (Othman & Jaafar, 2013). Accordingly, this new cluster can be named ‘‘Self Confidence Traits’’.

PMIPT3 – Decision-Making Traits

This cluster is a combination of 5 measurements that are shown in Table 7.7. Respectively, these measurements are: (1) assertiveness (Chong, 2013; Howell, Shea & Higgins 2005; Liikamaa, 2015; Nichols & Cottrell, 2014; Takey & Carvalho, 2015), (2) efficient (Tewari, 2011), (3) achievement striving (Liikamaa, 2015), (4) self-discipline (Howell, Shea & Higgins 2005; Katzenbach & Smith, 1993), and (5) deliberation (Chen, 2002; Rojas, 2013). However, it is obvious from these points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of decision-making. The concept ‘‘decision-making’’ refers to selecting the best option among some given options (Othman & Jaafar 2013). This cluster is in line with the argument of Othman and Jaafar (2013), who have emphasized the category of ‘‘ decision making’’ (Othman & Jaafar 2013). This category can involve making decisions that get good feedback from project members, using the right alternatives to reach project goals, and making fast and right decisions (Othman & Jaafar, 2013). Accordingly, this new cluster can be named ‘‘Decision-Making Traits’’.

PMIPT4 – Openness to Innovation Traits

This cluster is a combination of 3 measurements that are shown in Table 7.7. Respectively, these measurements are: (1) artistic, (2) excitable, and (3) unconventional (John & Srivastava, 1999). However, it is obvious from these points that this is a new combination of measurements, although the measurements have been taken form one source. The researcher has observed that all of these points mainly discuss the idea of being open to innovation. This cluster is in line with the argument of Ríos-Carmenado, Rahoveanu and Gallegos (2014), who have emphasized the category of ‘‘Openess’’ as a necessity for innovative project managers. Accordingly, this new cluster can be named ‘‘Openness to Innovation Traits’’.

PMIPT5 – Honesty and Integrity Traits

This cluster is a combination of 3 measurements that are shown in Table 7.7. Respectively, these measurements are: (1) trustworthy (Liikamaa, 2015; Nichols & Cottrell, 2014), (2) calm (not tense) (Abu Bakar et al., 2011; Dziekoński, 2017; Vila, Pérez & Coll-Serrano, 2014), and (3) self-consciousness (John & Srivastava, 1999). However, it is obvious from these points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of Honesty and Integrity. Honesty is required with project team and clients, and integrity is to stick with agreed actions and keep promises (Othman & Jaafar, 2013). This is in line with the argument of Othman and Jaafar (2013), who have emphasized the category of ‘‘honesty and integrity’’. This category can involve keeping the promise, admitting the mistake, being trustworthy, and encourage all parties to trust their capabilities (Othman & Jaafar, 2013). Accordingly, this new cluster can be named ‘‘Honesty and Integrity Traits’’.

PMIPT6 – Energy and Toughness Traits

This cluster is a combination of 3 measurements that are shown in Table 7.7. Respectively, these measurements are: (1) altruism, (2) compliance, and (3) being with wide interests (John & Srivastava, 1999). However, it is obvious from these points that this is a new combination of measurements, although the measurements have been taken form one source. The researcher has observed that all of these points mainly discuss the idea of being energetic and tough. This cluster is in line with the argument of Othman and Jaafar (2013), who have emphasized the category of ‘‘energy and toughness’’. This category can create a work environment that encourages individuals to deliver their targets, as it can involve not being stressed with work, dealing with a very tight schedule, and working for long hours (Othman & Jaafar, 2013). Accordingly, this new cluster can be named ‘‘Energy and Toughness Traits’’.

PMIC7 – Outgoing Toward Innovation Traits

This cluster has only one measurement as shown in Table 7.7. The researcher has accepted this measurement to represent the fifth cluster for two main reasons. First, The Cronbach alpha value of this measurement is 0.881, which is relatively high and greater than 0.7. Second, the loading value for this measurement is -0.770. This indicates that that PT42 and component 7 represent a strongest relationship. This measurement states that an individual can take up new ideas and fight pressures to turn such ideas into successful innovations (Jenssen & Jorgensen, 2004; Kelley & Lee, 2010; Klerkx & Aarts 2013; Lichtenthaler & Ernst, 2009; Pinto & Patanakul 2015). This measurement discusses the idea of being outgoing. Outgoing refers to being friendly with others and socially confident (Oxford Dictionary, 2017). This cluster is in line with the argument of many authors, who have emphasized the importance of being outgoing towards innovation (Jenssen & Jorgensen, 2004; Kelley & Lee, 2010; Klerkx & Aarts 2013; Lichtenthaler & Ernst, 2009; Pinto & Patanakul, 2015). Accordingly, this new cluster can be named ‘‘Outgoing Toward Innovation Traits’’.

The CFA results for the PMIPT initial model (before EFA) are: CMIN ($p<0.001$) =730.425; CMIN/DF=1.849;TLI =0.660; CFI=0.712; and RMSEA=0.094. These findings indicate that the initial Model provides an inadequate fit to the data as demonstrated in the Table 7.8. Hence, the CFA is performed on the EFA results for the PMIPT (shown in Table 7.8).

Table 7.8: Fit statistics for CFA for PMIPT scale

	CMIN (p <0.001)	CMIN/DF	TLI	CFI	RMSEA
Initial Model (The model before EFA)	730.425	1.849	0.660	0.712	0.094
Modified Model 1 (Using the results of the EFA)	503.704	1.391	0.847	0.873	0.064
Modified Model 2 (Using the results of the EFA, and excluding PT42)	454.186	1.356	0.900	0.911	0.061

However, the only item in PMIPT7 (PT42) is added to the items of PMIPT6. Cronbach Alpha of modified PMIPT6 cluster is 0.552, which is not acceptable value. Instead, the item of PMIPT7 (PT42) is added to the items of PMIPT4 to provide an acceptable Cronbach alpha value that is 0.602. In justification, the item of PMIPT7 (about the PM outgoing toward innovation traits) can match with PMIPT6 (about PM energy and toughness traits) or PMIPT4 (about PM openness to innovation traits). But, the item of PMIPT7 does not match with the items of PMIPT5 (about PM honesty and integrity traits), as it does not include the same concept. Now, it is time to perform the CFA on the measurements of the project manager innovation personality traits using AMOS software. The model fit of the modified model 1 (including PT42) demonstrates model fit value of CMIN ($p<0.001$) = 503.704, CMIN/DF= 1.391; TLI = 0.847, CFI=0.873; RMSEA=0.064. Yet, the regression line loading for PT42 in the modified PMIPT4 has a low loading value of -0.10, and thus it is excluded from the model. Alternatively, the original PMIPT4 cluster is used along with the other PM innovation personality trait groups (PMIPT1, PMIPT2, PMIPT3, PMIPT5and PMIPT6). The modified model 2 shown in Figure 7.3 displays model fit values of CMIN ($p<0.001$) = 454.186, CMIN/DF= 1.356; TLI = 0.900, CFI=0.911; RMSEA=0.061. Yet, it can be concluded that the model fit of the confirmatory factor analysis for the PMIPT modified model 2 is acceptable, as it successfully meet the cut-off values. Besides, it can be observed that the model fit for model 2 is better than that of the modified model 1 or the initial model, for the project manager innovation personality traits.

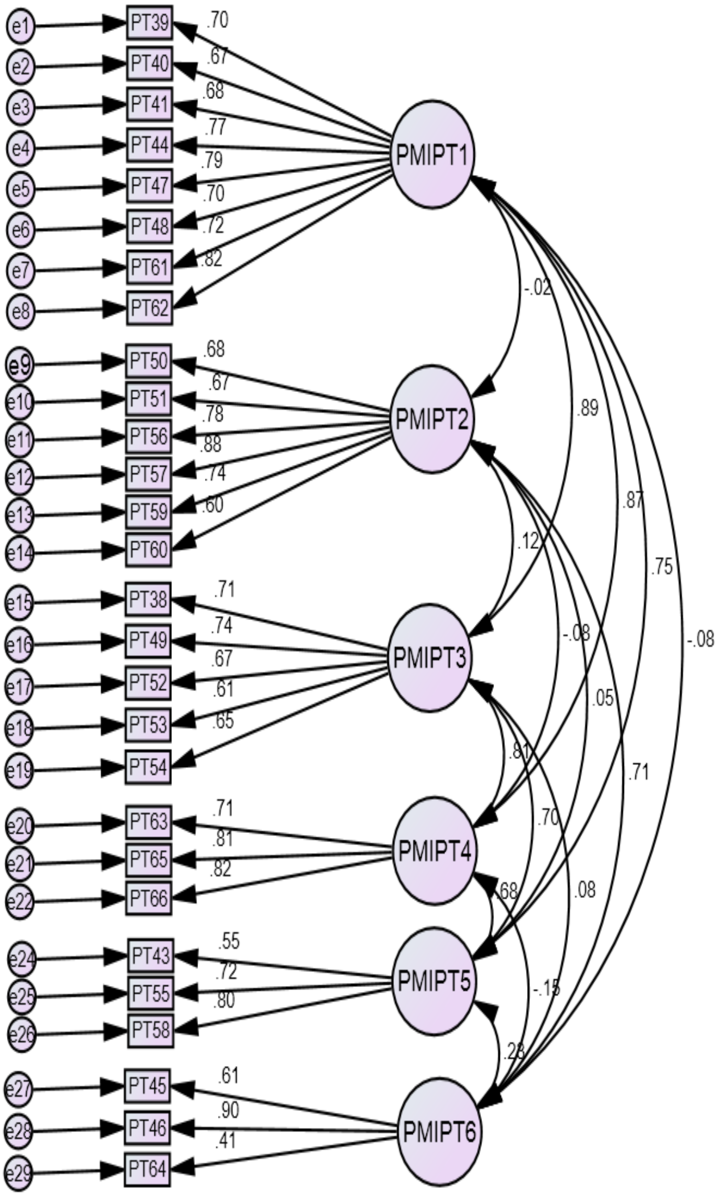

Figure 7.3 CFA for project manager innovation personality traits

7.4 EFA and CFA for the measurements of the delivery of successful innovation in projects

This section demonstrates the results of the EFA for the measurements of the delivery of successful innovation in projects as produced from the SPSS software. All of the items are used, since none of them is excluded from the Cronbach alpha analysis. Table 7.9 illustrates the results of the KMO and Bartlett's Test have provided positive results with a KMO score of 0.921 and a significant Bartlett's Test of Sphericity ($p < 0.001$). There are two factors with eigenvalues greater than one, indicating that the software has recognized two factors from the pool of questions entered in the analysis.

Table 7.9: Number of identified factors by SPSS with their eigenvalues and model fit test of the delivery of successful innovation in projects

Total Variance Explained			
Factors	**Initial Eigenvalues**		
	Total	**% of Variance**	**Cumulative %**
TI1	9.419	58.866	58.866
TI2	1.108	6.923	65.789

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.921
Bartlett's Test of Sphericity	Chi-Square	1036.241
Degree of Freedom		120
Significance		.000

The extraction technique used for EFA analysis is based on principle component analysis with varimax rotation. As shown in Table 7.10, all questions have loaded successfully (loading > 0.45) (Cua, McKone, & Schroeder, 2001) on the related factors with no cross loading greater 0.568. This indicates that the SPSS software has categorized the questions in an order, which reflected the theoretical constructs (latent variables).

Table 7.10: Items for the DSI in projects loading as a result of the EFA

Measures	Factors	
	1	**2**
TI70	**0.592**	0.537
TI71	**0.549**	0.533
CS72	**0.599**	0.568
CS73	**0.690**	
CS74	**0.798**	
CS75	**0.816**	
CS76	**0.819**	
QL77	**0.774**	
QL78	**0.693**	0.455
QL79	**0.689**	0.459
QL80	**0.702**	
QL81	**0.573**	0.488
QL82	**0.625**	0.465
TI67		**0.866**
TI68		**0.813**
TI69		**0.620**

The relationships between each variable and the selected components are demonstrated in Table 7.11. The strongest relationship is between TI67 and component # 2, with a loading value of 0.866. However, assigning each variable to the component that has the largest loading leads to the results shown in Table 7.11.

Table 7.11: New codes as a result of the EFA

Variable Code	Component		Cronbach Alpha	No. of Questions	New Code	New Description
	1	**2**				
TI70	0.592		0.950	13	DSI2	Control of New Scope
TI71	0.549					
CS72	0.599					
CS73	0.690					
CS74	0.798					
CS75	0.816					
CS76	0.819					
QL77	0.774					
QL78	0.693					
QL79	0.689					
QL80	0.702					
QL81	0.573					
QL82	0.625					
TI67		0.866	0.794	3	DSI1	Response to scope change
TI68		0.813				
TI69		0.620				

The results of the EFA explore two new latent clusters for the delivery of successful innovation

(DSI) in projects. As presented in Table 7.11, there are 13 items assigned to the first new latent cluster coded (DSI1), and 3 items assigned to the second new latent cluster coded (DSI2). These new latent clusters are explained in the following subsections:

DSI1 – Control of New Scope

This cluster is a combination of 13 measurements that are demonstrated in Table 7.11. Respectively, these measurements are: (1) Ability to access project data and knowledge in a timely manner; (2) Speed and ability to exploit ideas to improve project success; (3) Creative ideas resulted in better control over project costs; (4) Amount of earnings achieved through innovation relative to objectives, industry competitors, and overall competitive position; (5) Shareholder payments that reflect the growth achieved through applying new ideas; (6) Workplace payments for employee attraction, retention, and motivation; (7) Customer and market payments for market share and customer loyalty; (8) Creative knowledge acquired by the project through the project; (9) Creative ideas improved overall control exercised over the project; (10) Enhanced quality of communication between the project members and users; (11) Creative ideas improved users' feelings regarding participation in the project; (12) Richness and robustness of existing innovation platforms, groups of ideas, or opportunities chosen and developed; and (13) Strength of present leadership commitment to progress through innovation as mentioned in the strategic initiatives and targets (Bossink, 2002; Chason et al., 2013; Dainty, Cheng & Moore, 2003; Gambatese & Hallowell, 2011; Hartmann, 2006; Jayaram, Oke & Prajogo, 2014; Malinoski & Perry, 2000; Slater, Mohr & Sengupta, 2013).

However, it is obvious from these points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of ''Controlling the New Scope''. In general, a project manager is responsible for the success of a project and is accountable for its planning, directing, allocating, and controlling functions (Bakar, et al., 2011). Ling (2003) has pointed out that innovation can only be successful if project team members are greatly interested in it, during initiation and implementation phases, while project managers are expected to control and manage the significant factors affecting the implementation of innovation. Considering innovation, the role of project managers to deliver successful innovation in projects can involve; adopting and carrying innovation in a unique manner, controlling time, cost, quality, safety and environmental matters, promoting innovative ideas openly, making thoughtful strategic decisions, communicating the prominence of innovative solutions systematically, generating a favourable environment for embracing innovation, inspiring others through adhering high ethical standards, and facilitating innovation on site (Dulaimi, Nepal & Park, 2005; Hartmann, 2006; Hills et. al, 2008). Besides, controlling financial and physical resources can bring projects to a successful conclusion in terms of time, cost, and stakeholder satisfaction (Hills et al., 2008). This indicates that control is a major role of project managers that can allow them to meet the main targets of cost, time, and quality. Yet, project team members can be satisfied only if their necessities are tackled through making them feel unique and needed, have influence, security, and control (Tanner, 2008). O'Connor and Rice (2013) have mentioned that in order to withstand competitive advantage over a long term, mature organizations can advance their innovations to act as a base for building and controlling basically new markets. Paladino (2007) have added that the reason is that resources have a critical relationship with innovation success, as an effective control of resources can expand an organization's tendency to innovate. Accordingly, this new cluster can be named ‘‘Control of the New Scope’’.

DSI2 – Response to Scope Change

This cluster is a combination of 3 measurements that are demonstrated in Table 7.11. Respectively, these measurements are: (1) Creative ideas resulted in better control over project schedule; (2) Ability to respondent to scope change in a timely manner: (3) Speed of time from ideas submission

to scope change feedback (Chason et al., 2013; Dainty, Cheng & Moore, 2003; Chuang, Jason & Morgan, 2011; Halbesleben et al., 2003; Hartmann, 2006; Ozorhon, 2013; Rogers, 2003).
However, it is clear from these points that this is a new combination of measurements, which have been taken from different scholars. The researcher has observed that all of these points mainly discuss the idea of ‘‘Responses to Scope Change’’. As mentioned earlier in the literature review, a project is defined as an attempt to organize human material and financial resources in a new way, to address a unique scope of work of provided specification, within well known constraints of time and cost, so as to attain unitary, useful change, throughout the delivery of the aimed quantitative and qualitative objectives (Turner, 1993). Hence, the project scope is critical to judge whether a project is successful or not (Zhang, Du & Zhang, 2014). Collyer & Warren (2009) have argued that the dynamic nature of projects can cause many problems such as finding difficulty in planning, having short time frames, planning for uncertain results, balancing decision required quality against decision actual speed, and providing proper timing scope freeze during any rapid change. Yet, the project manager primarily manages the project through identifying all project requirements; establishing well-defined and attainable objectives; balancing the challenging demands for scope, time, cost, and quality; adjusting plans and methods to the different expectations and interests of the different stakeholders; and managing projects carefully in response to all uncertainties that may occur (PMBOK® Guide, 2008). Accordingly, this new cluster can be named ‘‘Response to Scope Change’’.
The CFA results for the delivery of successful innovation initial model (before EFA) are: CMIN ($p<0.001$) = 188.591; CMIN/DF =1.867; TLI =0.880; CFI=0.911; and RMSEA=0.095. These findings suggest that the initial model provides an adequate fit as shown in the Table 7.12.
However, EFA has been performed successfully to the measurements of the DSI and lead to new clusters. The CFA results of the new clusters established from the EFA (shown in Table 7.12) are

acceptable (CMIN ($p<0.001$) = 193.824; CMIN/DF =1.882; TLI = 0.878; CFI=0.907; and RMSEA=0.096) as shown in Table 7.12.

Table 7.12: Fit statistics for CFA for DSI scale

	CMIN (p <0.001)	CMIN/DF	TLI	CFI	RMSEA
Initial Model (The model before EFA)	188.591	1.867	0.880	0.911	0.095
Modified Model (Using the results of the EFA)	193.824	1.882	0.878	0.907	0.096

After the deletion of the low loading items in the EFA stage, the CFI has dropped down from 0.911 to 0.907, except it is still considered to be a satisfactory value. Besides, Figure 7.4 shows the regression line loadings of the modified model, which are in the acceptable range. Hence, the DSI modified model meets the acceptable cut-off values, and thus it is considered to be a valid instrument for measuring the DSI in projects.

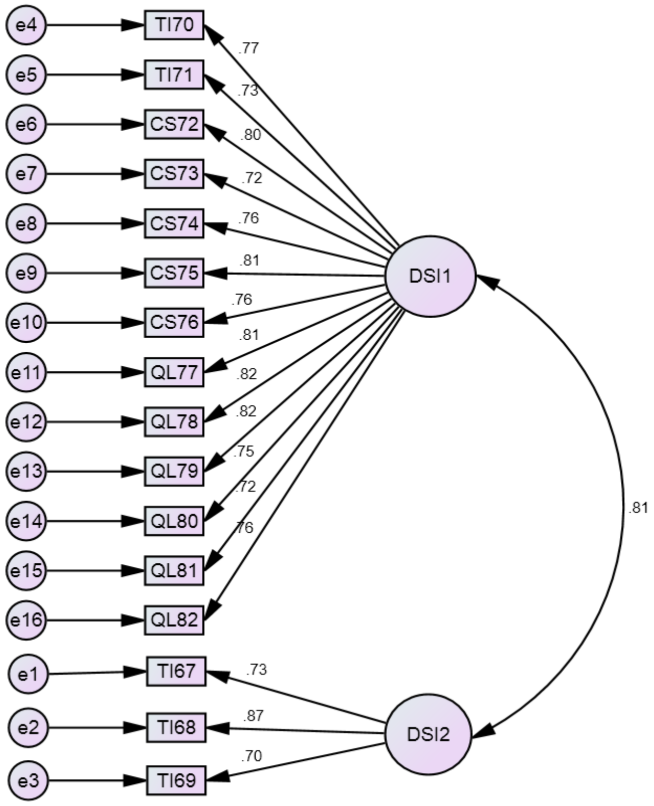

Figure 7.4: CFA for the successful delivery of innovation in projects

7.5 Summary

This chapter has demonstrated that the results of Cronbach alpha test for each cluster confirms that the scales have performed well. It has also been worthwhile to evaluate their validity in other ways, to establish a solid judgement on whether these scales can be effective in the data analysis or not. Thus, the CFA has been used to test the validity of the measurements used to gather data. It has also been performed to assess interrelationships and covariance among all latent variables through estimating population covariance matrix for the hypothesized model compared with observed covariance matrix, to attain smallest difference between estimated and observed matrices.

Chapter 8 Analysis of the findings

8.1 Introduction

This chapter represents the direct path analysis for the relationship between the project manager innovation competencies and the delivery of successful innovation. It also analyzes the mediation effect of the project manager innovation personality traits and the project manager innovation environment of the delivery of successful innovation in projects.

In clarification, Chapter 7 has included the factor analysis, which has two main parts. First, the Exploratory Factor Analysis has been performed. It has re-categorized the project manager innovation competencies, the project manager innovation personality traits, and the delivery of successful innovation in projects, into new clusters. While, the project manager innovation environment is excluded from the EFA as each one of its variables include less than five observations. Second, the Confirmatory Factor Analysis is established to assess the conceptual integrity of the constructs used in the study structural model (Arbuckle & Wothke 1999). In the current study, the CFA has produced separate model fits for the project manager innovation competencies, the project manager innovation personality traits, and the delivery of successful innovation in projects (that are obtained from the EFA). The results of the CFA provide evidence for viability, when the constructs are combined together in a particular model. The findings of the modified structural models indicate that they can progressively present acceptable model fit for the data of the current study. With such evidence, the researcher has more confidence in the results obtained from the hypothesized model, as all measurements show sufficient construct reliability to be used in the analysis.

Nonetheless, the analysis of the findings continues in this chapter, and it covers three main parts that are performed using Structural Equation Modeling (AMOS 20 software). The first part includes the structural model assessment of the direct path between the project manager innovation competencies and the delivery of successful innovation in projects, along with an assessment to validate the direct relationship hypotheses. The second part covers the structural model assessment of the project manager innovation personality traits mediation effect on the relationship between the project manager innovation competencies and the delivery of successful innovation in projects, as well as an assessment to validate the PMIPT mediation hypotheses. The third part presents the structural model assessment of the project manager innovation environment mediation effect on the relationship between the project manager innovation competencies and the delivery of successful innovation in projects, along with an assessment to validate the PMIE mediation hypotheses. Yet, this is a comprehensive strategy to test hypotheses relationships among the study independent and dependent variables, besides it is essential to test the structural model fit before making any interpretations about theoretical assumptions (Joreskog & Sorbom, 1997).

8.2 Path Analysis between PMIC and DSI

8.2.1 Structural model assessment: direct path between PMIC and DSI

The structural models are applied to the measurement of this study using AMOS 20.The structural models includes direct structural paths from the project manager innovation competencies (impact and influence competencies, PMIC1, cognitive competencies, PMIC2, personal effectiveness competencies, PMIC3, and managerial competencies, PMIC4) and the dependent variables for the delivery of successful innovation in projects (control of new scope, DSI1 and response to scope change, DSI2).

Objective 1 of this study aims to investigate the relationship between PMIC and the DSI in projects. Hypotheses H1-1 and H1-8 are proposed to achieve this objective. Hence, Figure 8.1 demonstrates the structural model for the relationship between PM impact and influence competencies and the delivery of successful innovation in projects.

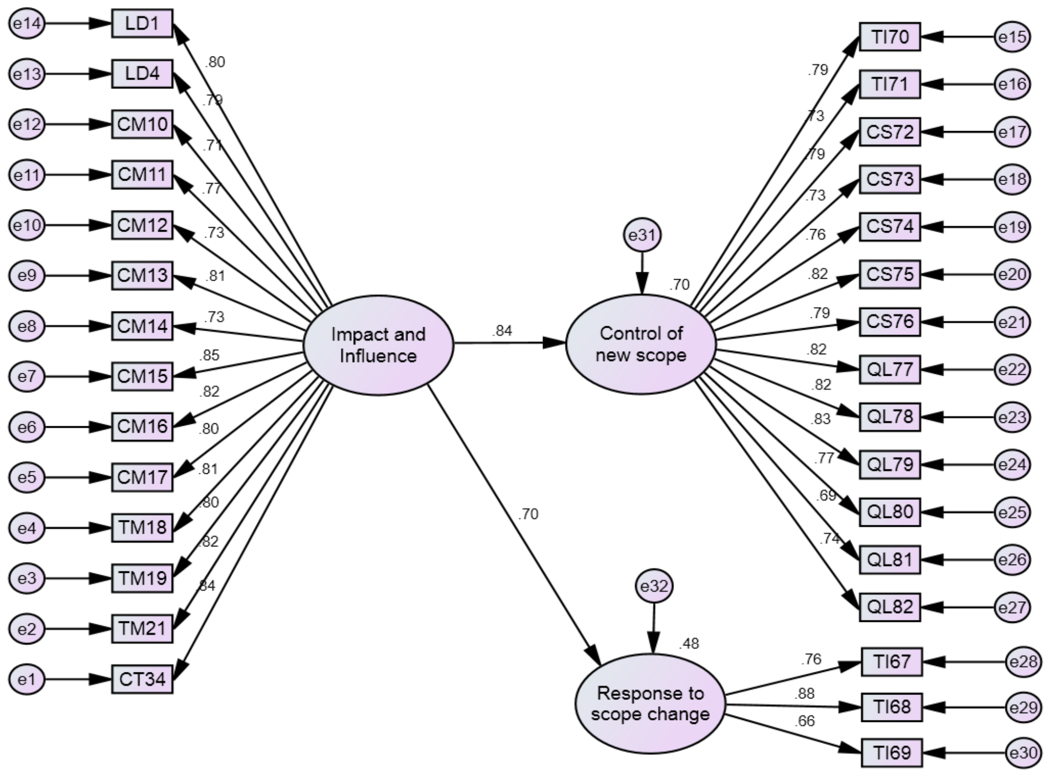

Figure 8.1: Path between impact and influence competencies and the delivery of successful innovation

Similar models are prepared to study the path between the remaining clusters of competencies and the delivery of successful innovation. The structural model fit results for the project manager innovation competencies and the delivery of successful innovation are summarized in Table 8.1.The acceptable ranges and cut-off values are: for chi-square (CMIN) the p-value > 0.05 (Joreskog & Sorbom, 1997); CMIN/ DF with a range from 1 to 5 (Schumacker & Lomax, 2004; Ullman, 2001); SRMR ≤ 0.08 (Bentler, 1995); GFI ≥ 0.90 (Tabachnick & Fidell, 2007); TLI with a range from 0 to 1 (Hu & Bentler, 1999); CFI ≥ 0.9(Bentler, 1995); and RMSEA ≤ 0.1 (MacCallum, Browne, & Sugawara, 1996).

Table 8.1: Model fit statistics for PMIC and DSI model

Base model	CMIN	CMIN/DF	SRMR	GFI	TLI	CFI	RMSEA
PMIC1 and DSI	631.995	1.568	.072	.706	.895	.903	.077
PMIC2 and DSI	420.852	1.542	.074	.751	.908	.916	.075
PMIC3 and DSI	344.856	1.674	.097	.767	.889	.901	.084
PMIC4 and DSI	300.078	1.613	.081	.788	.907	.918	.080

The findings of the above table are within the acceptable cut-off values, and thus confirm that these models display an acceptable model fit for the project manager innovation competencies and the delivery of successful innovation in projects.

8.2.2 Direct-relationship hypothesis between PMIC and DSI in projects

This section identifies the direct path relationship between project manager innovation competencies and the delivery of successful innovation in projects. Table 8.2 summarized the t-value and p-value results of the path analysis between PMIC and the DSI in projects. Considering that the probability of a t-value equal to or greater than actual t-value in a two-tailed test indicates significance of coefficient under the null hypothesis that has a true value is zero.

Table 8.2: Hypotheses testing for the direct path between PMIC and DSI

Path analysis	**Sign**	**P-value**	**t-value**
Control of new scope <-- Impact and influence competencies	+	***	7.846
Response to scope change <-- Impact and influence competencies	+	***	5.875
Control of new scope <-- Cognitive competencies	+	***	6.974
Response to scope change <-- Cognitive competencies	+	***	5.725
Control of new scope <-- Personal effectiveness competencies	+	***	6.116
Response to scope change <-- Personal effectiveness competencies	+	***	4.676
Control of new scope <-- Managerial competencies	+	***	6.289
Response to scope change <-- Managerial competencies	+	***	5.366

* $p < 0.01$, ** $p < 0.005$, *** $p < 0.001$.

Using the results of the above table, the confirmed hypotheses are:

Hypothesis (H1-1) proposed that: there is a positive *relationship between the project manager impact and influence competencies and the control of new scope in projects*. Empirical testing supports this hypothesis, as the path coefficient is statistically significant (t-value =7.846, p<0.001) and the relationship has a positive sign.

Hypothesis (H1-2) proposed that: *there is a positive relationship between the project manager impact and influence competencies and the response to scope change in projects*. Empirical testing supports this hypothesis, as the path coefficient is statistically significant (t-value =5.875, p<0.001) and the relationship has a positive sign.

Hypothesis (H1-3) proposed that: *there is a positive relationship between the project manager cognitive competencies and the control of new scope in projects*. Empirical testing supports this hypothesis, as the path coefficient is statistically significant (t-value =6.974, p<0.001) and the relationship has a positive sign.

Hypothesis (H1-4) proposed that: *there is a positive relationship between the project manager cognitive competencies and the response to scope change in projects*. Empirical testing supports this hypothesis, as the path coefficient is statistically significant (t-value =5.725, p<0.001) and the relationship has a positive sign.

Hypothesis (H1-5) proposed that: *there is a positive relationship between the project manager personal effectiveness competencies and the control of new scope in projects.* Empirical testing supports this hypothesis, as the path coefficient is statistically significant (t-value =6.116, p<0.001) and the relationship has a positive sign.

Hypothesis (H1-6) proposed that: *there is a positive relationship between the project manager personal effectiveness competencies and the response to scope change in projects.* Empirical testing supports this hypothesis, as the path coefficient is statistically significant (t-value =4.676, p<0.001) and the relationship has a positive sign.

Hypothesis (H1-7) proposed that: *there is a positive relationship between the project manager managerial competencies and the control of new scope in projects.* Empirical testing supports this hypothesis, as the path coefficient is statistically significant (t-value =6.289, p<0.001) and the relationship has a positive sign.

Hypothesis (H1-8) proposed that: *there is a positive relationship between the project manager managerial competencies and the response to scope change in projects.* Empirical testing supports this hypothesis, as the path coefficient is statistically significant (t-value =5.366, $p<0.001$) and the relationship has a positive sign.

Table 8.3 summarized the results of the hypotheses tests using the direct path analysis technique between the project manager innovation competencies and the delivery of successful innovation. These confirmed hypotheses correspond to the aim of the study, provide answer to the first research question, and satisfy the research objectives 1, 2 and 3. Yet, the findings of the current study confirm that all of the studied project manager innovation competencies have a positive direct relationship with the delivery of successful innovation in projects.

Table 8.3: Summary of confirmed hypotheses for the direct path between PMIC and DSI1

No.	Hypothesis Assumption	Sign	t-value	P-value	Result
H1-1	There is a positive relationship between the PM impact and influence competencies and the control of new scope in projects.	+	7.846	P<0.001	Supported
H1-2	There is a positive relationship between the PM impact and influence competencies and the response to scope change in projects	+	5.875	p<0.001	Supported
H1-3	There is a positive relationship between the PM cognitive competencies and the control of new scope in projects.	+	6.974	P<0.001	Supported
H1-4	There is a positive relationship between the PM cognitive competencies and the response to scope change in projects	+	5.725	p<0.001	Supported
H1-5	There is a positive relationship between the PM personal effectiveness competencies and the control of new scope in projects	+	6.116	P<0.001	Supported
H1-6	There is a positive relationship between the PM personal effectiveness competencies and the response to scope change in projects	+	4.676	p<0.001	Supported
H1-7	There is a positive relationship between the PM managerial competencies and the control of new scope in projects	+	6.289	P<0.001	Supported
H1-8	There is a positive relationship between the PM managerial competencies and the response to scope change in projects.	+	5.366	p<0.001	Supported

8.3 PMIPT Mediation Analysis

8.3.1 Structural model assessment: PMIPT mediation

The mediation relationship describes how or why two particular variables are associated, where the mediating variable is intermediating in the relationship between dependent and independent variables. Hence, a cause and effect relationship can be assumed in this study. In support to this assumption, most of the scholars have agreed that personality traits have an effect on individuals' behaviours and attitudes (Meindl, 1995; Hetland & Sandal, 2003; Yammarino & Atwater, 1993; Felfe & Schyns, 2006; Emery, Calvard & Pierce, 2013). This study proposes that the positive and negative traits perform as a director of such relationships, which in turn can cause positive or negative insights toward the relationship between PMIC and the DSI in projects.

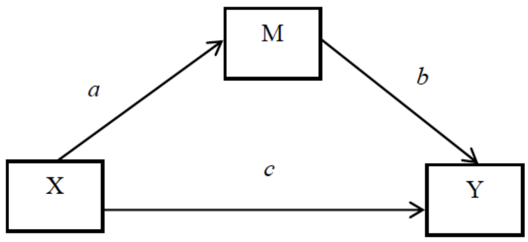

Figure 8.2: Mediation model

As demonstrated in Figure 8.2, in this study, the independent variable ''X'' is the ''project manager innovation competencies'', the mediator ''M'' is the project manager innovation personality traits, and the dependent variable ''Y'' is the delivery of successful innovation in projects. X is postulated to have an affect on the mediator M, thus path *a* is the direct effect of X on M, characterized by the coefficient for X on M. X is also postulated to have a direct effect on Y characterized by the coefficients on an outcome variable Y, hence path *c* is the overall effect of the independent variable X on the final outcome Y. While, path *b* is considered to be the direct effect of mediating variable M on the final outcome Y characterized by the coefficients of M on Y. The mediation effect, in which X leads to Y through M, is known as the indirect effect c'. The product of *a* and *b* counts the indirect effect of X on Y through M (Hayes, 2009). Accordingly, in this study, Figure 8.3 illustrates the independent variable (PMIC), the mediator (PMIPT), and dependent variable (DSI), as shown in Figure 8.3.

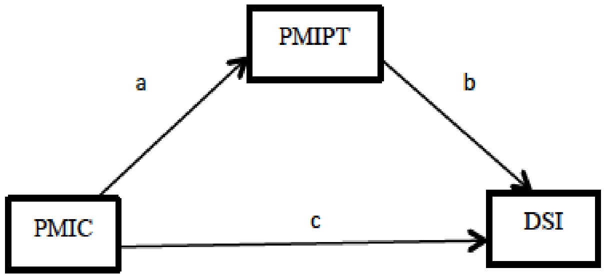

Figure 8.3: Mediation model for the effect of PMIPT on PMIC and DSI in projects

Objective 4 of this study aims to investigate the influence of PMIPT on the relationship between PMIC and the DSI in projects. Hypotheses H2-1 and H2-8 are proposed to achieve this objective where PMIPT mediate the relationship between PMIC and the DSI in projects. In addition, Figure 8.4 demonstrates the structural mediation of project manager innovation personality traits on the relationship between PM impact and influence competencies and the delivery of successful innovation in projects.

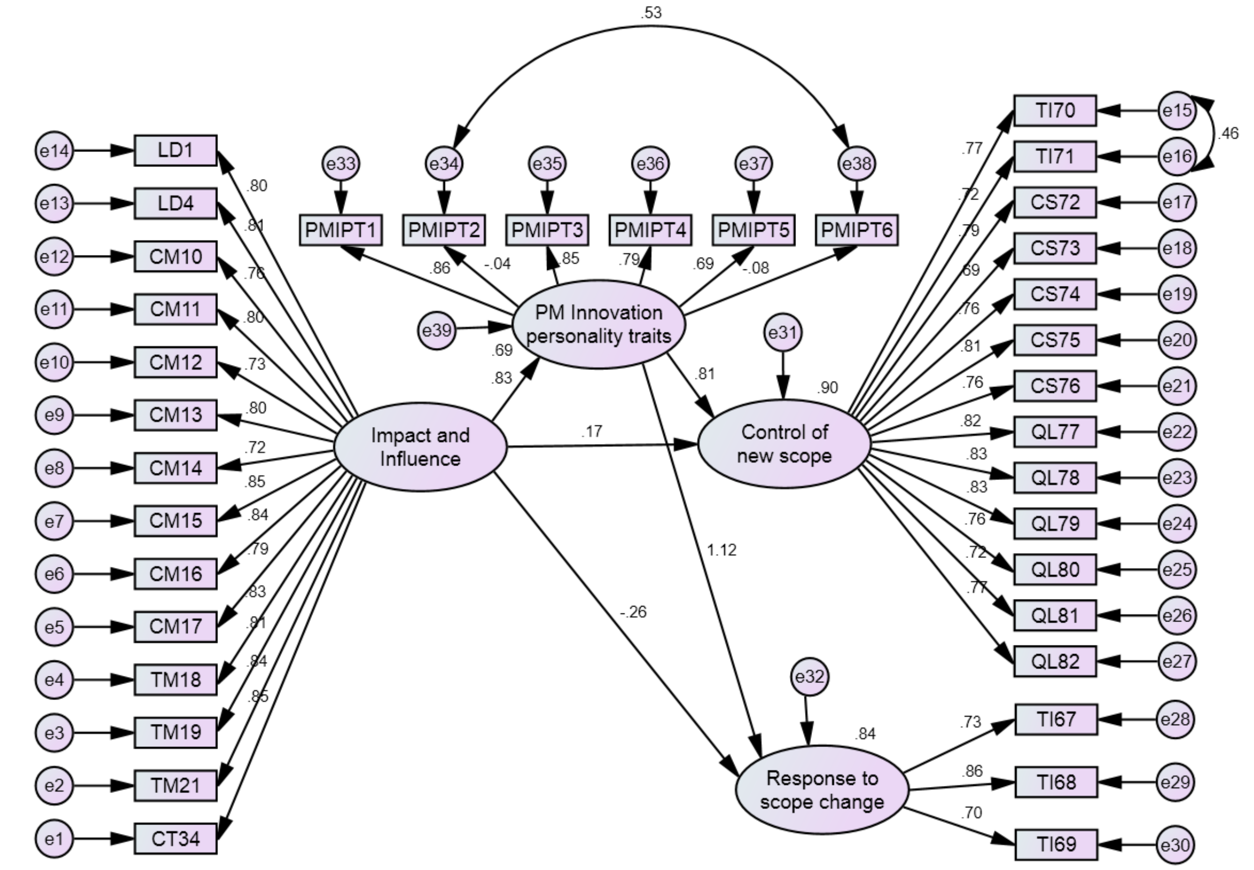

Figure 8.4: Mediation of PMIPT on the relationship between PMIC1 and DSI

Similar models are prepared to study the mediation of the PMIPT on the remaining clusters of competencies and the delivery of successful innovation. More specifically, in this research, the mediation analysis process and results (for PMIPT) are depicted through assessing how well the observed pattern of covariance between the study variables fits the observed data, as summarized in Table 8.4. This does not only help in determining which variable can be considered as a mediator between independent and dependent variables, but also obtaining which mediation model performs well with the research data.

Table 8.4: Model fit statistics for PMIPT meditational model

Mediator model	CMIN	CMIN/DF	RMR	GFI	TLI	CFI	RMSEA
PMIC1 PMIPT DSI	824.233	1.404	.185	.690	.910	.916	.065
PMIC2 PMIPT DSI	605.904	1.412	.343	.732	.912	.919	.066
PMIC3 PMIPT DSI	473.395	1.376	.405	.748	.922	.929	.063
PMIC4 PMIPT DSI	492.619	1.549	.403	.752	.893	.903	.076

The findings of the above table are within the acceptable cut-off values, and hence confirm that these models display an acceptable model fit for the mediation effect of the project manager innovation personality traits on the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

8.3.2 Verifying the mediation hypotheses of PMIPT

The study anticipates that the project manager innovation personality traits may have a mediating role on the relationship between PMIC and the DSI in projects. Hence, the most popular approach for mediation analysis is the causal steps procedure established by Baron and Kenny (1986) (Zhao, Lynch & Chen 2010). This method covers the following set of regression equations that are related to the independent variable, mediator variable, and dependent variable (Zhao, Lynch & Chen 2010):

$Y = i_1 + cX + e_1$ (1)

$M = i_2 + aX + e_2$ (2)

$Y = i_3 + bM + c'X + e_3$ (3)

Where, the intercept for each equation is i; the corresponding residual for each equation is e; the mediator is M; independent variable is X, the dependent variable is Y, indirect bath between X, M, and Y is c'. Bath a, b, and c are illustrated in Figure 8.2.

However, the results obtained from these equations are used to assess the following conditions for M as a mediator of the relationship between X and Y, as follows (Zhao, Lynch & Chen 2010):

1. The independent variable should relate to the dependent variable (c in Equation 1 is significant). This condition is used to determine that there is a relationship between X and Y to be mediated.
2. The independent variable should relate to the mediator (a in Equation 2 is significant). This condition determines the first phase of the mediation effect.
3. The mediator should relate to the dependent variable (b in Equation 3 is significant). This

condition determines the second phase of the mediation effect.

4. The independent variable should no longer relate to the dependent variable, particularly after the mediator variable is controlled (c' in Equation 3 is not significant). This condition indicates that the relationship between X and Y tested under the first condition disappears when the mediation effect conveyed through M is taken into account.

Satisfying all of the above four conditions provides evidence for full mediation, while satisfying the first three conditions suggests partial mediation (Zhao, Lynch & Chen 2010). Yet, in this research, and considering the above equations, the mediation relationship is assessed using the path sign, t-value, and p-value (significance level), as demonstrated in Table 8.5.

Table 8.5: Mediation results for project manager innovation personality traits

	PMIPT Mediation			Mediation Type
Mediation Path	**Sign**	**P-value**	**t-value**	
PMIC1, PMIPT, and DSI1				
PM innovation personality traits <-- PM impact and influence competencies	+	***	8.634	Full mediation
Control of new scope <-- PM innovation personality traits	+	***	6.150	
Control of new scope <-- PM impact and influence (before mediation)	+	***	7.846	
Control of new scope <-- PM impact and influence (after mediation)	+	.111	1.594	
PMIC1, PMIPT, and DSI2				
PM innovation personality traits <-- PM impact and influence competencies	+	***	8.634	Full mediation
Response to scope change <-- PM innovation personality traits	+	***	5.649	
Response to scope change <-- PM impact and influence (before mediation)	+	***	5.875	
Response to scope change <-- PM impact and influence (after mediation)	-	.099	1.650	
PMIC2, PMIPT, and DSI1				
PM innovation personality traits <-- PM cognitive competencies	+	***	7.808	Full mediation
Control of new scope <-- PM innovation personality traits	+	***	5.490	
Control of new scope <-- PM cognitive competencies (before mediation)	+	***	6.974	
Control of new scope <-- PM cognitive competencies (after mediation)	+	.660	0.440	
PMIC2, PMIPT, and DSI2				
PM innovation personality traits <-- PM cognitive competencies	+	***	7.808	Full mediation
Response to scope change <-- PM innovation personality traits	+	***	4.911	
Response to scope change <-- PM cognitive competencies (before mediation)	+	***	5.725	
Response to scope change <-- PM cognitive competencies (after mediation)	-	.135	1.497	
PMIC3, PMIPT, and DSI1				
PM innovation personality traits <-- PM personal effectiveness competencies	+	***	6.415	Full mediation
Control of new scope <-- PM innovation personality traits	+	***	6.476	
Control of new scope <-- PM personal effectiveness (before mediation)	+	***	6.116	
Control of new scope <-- PM personal effectiveness (after mediation)	+	.447	0.761	
PMIC3, PMIPT, and DSI2				
PM innovation personality traits <-- PM personal effectiveness competencies	+	***	6.415	Partial mediation
Response to scope change <-- PM innovation personality traits	+	***	5.893	
Response to scope change <-- PM personal effectiveness (before mediation)	+	***	4.676	
Response to scope change <-- PM personal effectiveness (after mediation)	-	.007*	2.698	
PMIC4, PMIPT, and DSI1				
PM innovation personality traits <-- PM managerial competencies	+	***	6.495	Full mediation
Control of new scope <-- PM innovation personality traits	+	***	6.261	
Control of new scope <-- PM managerial competencies (before mediation)	+	***	6.289	
Control of new scope <-- PM managerial competencies (after mediation)	+	.498	0.677	
PMIC4, PMIPT, and DSI2				
PM innovation personality traits <-- PM managerial competencies	+	***	6.495	Full mediation
Response to scope change <-- PM innovation personality traits	+	***	5.106	
Response to scope change <-- PM managerial competencies (before mediation)	+	***	5.366	
Response to scope change <-- PM managerial competencies (after mediation)	-	.793	0.262	

* p < 0.01, ** p < 0.005, *** p < 0.001.

The results represented in Table 8.6 are used to test the hypotheses, which are established to examine the PMIPT mediation on the relationship between PMIC and DSI, as follows:

Hypothesis (H2-1) proposed that: *the project manager innovation personality traits mediate the* *relationship between project manager impact and influence competencies and the control of new scope in projects.* Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficient of PMIC1→PMIPT is significant (t-value =8.634, p<0.001), PMIPT→DSI1 is significant (t-value = 6.150, p<0.001), PMIC1→DSI1 before mediation is significant (t-value =7.846, p<0.001), and PMIC1→DSI1 after mediation is not significant (t-value =1.594, p=0.111).

Hypothesis (H2-2) proposed that: *the project manager innovation personality traits mediate the relationship between project manager impact and influence competencies and the response to scope change in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficient of PMIC1→PMIPT is significant (t-value =8.634, p<0.001), PMIPT→DSI2 is significant (t-value =5.649, p<0.001), PMIC1→DSI2 before mediation is significant (t-value =5.875, p<0.001), and PMIC1→DSI2 after mediation is not significant (t-value = -1.650, p=0.099).

Hypothesis (H2-3) proposed that: *the project manager innovation personality traits mediate the relationship between project manager cognitive competencies and the control of new scope in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficient of PMIC2→PMIPT is significant (t-value =7.808, p<0.001), PMIPT→DSI1 is significant (t-value = 5.490, p<0.001), PMIC2→DSI1 before mediation is significant (t-value =6.974, p<0.001), and PMIC2→DSI1 after mediation is not significant (t-value =0.440, p=0.660).

Hypothesis (H2-4) proposed that: *the project manager innovation personality traits mediate the relationship between project manager cognitive competencies and the response to scope change in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficient of PMIC2→PMIPT is significant (t-value =7.808, p<0.001), PMIPT→DSI2 is significant (t-value = 4.911, p<0.001), PMIC2→DSI2 before mediation is significant (t-value

=5.725, p<0.001), and PMIC2→DSI2 after mediation is not significant (t-value =1.497, p=0.135).

Hypothesis (H2-5) proposed that: *the project manager innovation personality traits mediate the relationship between project manager personal effectiveness competencies and the control of new scope in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficient of PMIC3→PMIPT is significant (t-value =6.415, p<0.001), PMIPT→DSI1 is significant (t-value =6.476, p<0.001), PMIC3→DSI1 before mediation is significant (t-value =6.116, p<0.001), and PMIC3→DSI1 after mediation is not significant (t-value =0.761, p=0.447).

Hypothesis (H2-6) proposed that: *the project manager innovation personality traits mediate the relationship between project manager personal effectiveness competencies and the response to scope change in projects*. Empirical testing supports this hypothesis with partial mediation results, as the mediation path coefficient of PMIC3→PMIPT is significant (t-value =6.415, p<0.001), PMIPT→DSI2 is significant (t-value = 5.893, p<0.001), PMIC3→DSI2 before mediation is significant (t-value =4.676, p<0.001), and PMIC3→DSI2 after mediation is significant (t-value = -2.698, p=0.007).

Hypothesis (H2-7) proposed that: *the project manager innovation personality traits mediate the relationship between project manager managerial competencies and the control of new scope in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficient of PMIC4→PMIPT is significant (t-value =6.495, p<0.001), PMIPT→DSI1 is significant (t-value = 6.261, p<0.001), PMIC4→DSI1 before mediation is significant (t-value =6.289, p<0.001), and PMIC4→DSI1 after mediation is not significant (t-value=0.677, p=0.498).

Hypothesis (H2-8) proposed that: *the project manager innovation personality traits mediate the relationship between project manager managerial competencies and the response to scope change in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficient of PMIC4→PMIPT is significant (t-value =6.495, p<0.001), PMIPT→DSI2 is significant (t-value = 5.106, p<0.001), PMIC4→DSI2 before mediation is significant (t-value =5.366, p<0.001), and PMIC4→DSI2 after mediation is not significant (t-value =-0.262, p=0.793). Table 8.6 summarized the results of the hypotheses tests using the mediation analysis technique. These confirmed hypotheses provide answer to the second research question, and correspond to the research the fourth research objectives. In particular, the mediation of PMIPT is full for all relationships, except that it is partial for mediation of PMIPT on the relationship between project manager personal effectiveness competencies cluster and the response to scope change in projects. Yet, the findings of the current study confirm that the project manager innovation personality traits have a mediation effect on the relationship between the project manager innovation competencies and the delivery of successful innovation in projects.

Table 8.6: Summary of confirmed PMIPT mediation hypotheses

No.	Mediation hypothesis assumption	Mediation type	Results
H2-1	The project manager innovation personality traits mediate the relationship between project manager impact and influence competencies and the control of new scope in projects	Full mediation	Supported
H2-2	The project manager innovation personality traits mediate the relationship between project manager impact and influence competencies and the response to scope change in projects	Full mediation	Supported
H2-3	The project manager innovation personality traits mediate the relationship between project manager cognitive competencies and the control of new scope in projects.	Full mediation	Supported
H2-4	The project manager innovation personality traits mediate the relationship between project manager cognitive competencies and the response to scope change in projects	Full mediation	Supported
H2-5	The project manager innovation personality traits mediate the relationship between project manager personal effectiveness competencies and the control of new scope in projects	Full mediation	Supported
H2-6	The project manager innovation personality traits mediate the relationship between project manager personal effectiveness competencies and the response to scope change in projects	Partial mediation	Supported
H2-7	The project manager innovation personality traits mediate the relationship between project manager managerial competencies and the control of new scope in projects	Full mediation	Supported
H2-8	The project manager innovation personality traits mediate the relationship between project manager managerial competencies and the response to scope change in projects	Full mediation	Supported

8.4 PMIE Mediation Analysis

8.4.1 Structural model assessment: PMIE mediation

The mediation relationship describes how or why two particular variables are related, where the mediating variable is intermediating in the relationship between dependent and independent variables. Thus, a cause and effect relationship can be assumed in this study. In support to this assumption, most of the scholars agree that the project manager environment have an influence on individuals' behaviours and attitudes (Dulaimi, Nepal & Park, 2005; Gambatese & Hallowell, 2011, Wei et al., 2013). This study proposes that the positive and negative PM innovation environment perform as a director of such relationships, which in turn can cause positive or negative perceptions toward the PMIC and the DSI in projects. The review of literature of this study demonstrates that PMs' innovation environment can determine their innovation competencies and their ability to deliver innovation in projects.

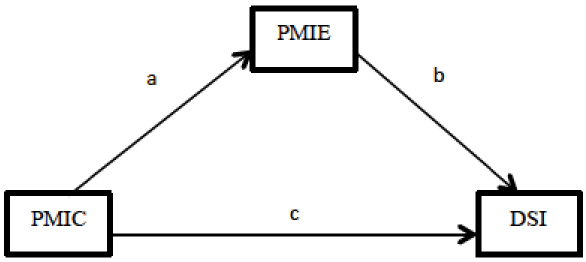

Figure 8.5: Mediation model for the effect of PMIE on PMIC and DSI in projects

Figure 8.5 illustrates the independent variable (PMIC), the mediator (PMIE), and dependent variable (DSI). PMIC is assumed to exert an influence on the mediator PMIE, as a result path a is the direct effect of PMIC on PMIE, signified by the coefficient for PMIC on PMIE. PMIC is also assumed to utilize a direct effect on DSI, characterized by the coefficients on variable DSI, so path c is the overall influence of the independent variable PMIC on the outcome DSI. While, path b is the direct influence of mediating variable PMIE on the outcome DSI signified by the coefficients of PMIE on DSI in projects. The mediator effect, in which PMIC leads to DSI through PMIE, is called indirect influence c'. The product of a and b quantifies the indirect influence of PMIC on DSI through PMIE (Hayes, 2009).

Objective 3 of this study aims to examine the influence of PMIE on the relationship between PMICs and the DSI in projects. Hypotheses H3-1 and H3-8 are proposed to achieve this objective where PMIE mediate the relationship between PMICs and the DSI in projects. In addition, Figure 8.6 demonstrates the structural mediation of project manager innovation environment on the relationship between PM impact and influence competencies and the delivery of successful innovation in projects.

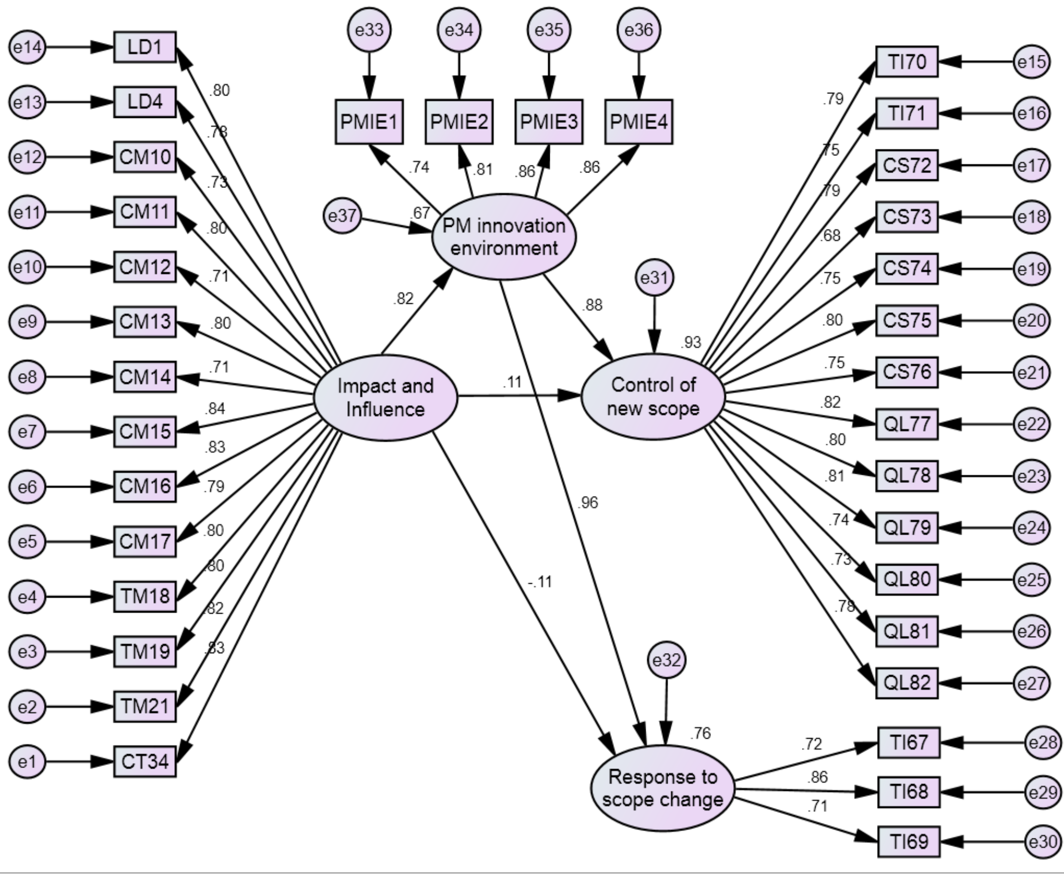

Figure 8.6: Mediation of PMIE on the relationship between PMIC1 and DSI

Similar models are prepared to study the mediation of the PMIE on the remaining clusters of competencies and the delivery of successful innovation. In this research, the mediation analysis process and results (for PMIE) are described through assessing how well the observed pattern of covariance between the study variables fit the observed data, as summarized in Table 8.7. This does not only help in determining which variable can be considered as a mediator between independent and dependent variables, but also obtaining which mediation model performs well with the research data.

Table 8.7: Model fit statistics for PMIE meditational model

Mediator model	CMIN	CMIN/DF	RMR	GFI	TLI	CFI	RMSEA
PMIE 1 PMIPT DSI	787.357	1.508	.093	.684	.896	.903	.073
PMIE 2 PMIPT DSI	585.359	1.574	.104	.725	.897	.905	.077
PMIE 3 PMIPT DSI	429.030	1.464	.105	.759	.922	.930	.070
PMIE 4 PMIPT DSI	433.927	1.613	.112	.759	.905	.915	.080

The findings of the above table are within the acceptable cut-off values, and thus confirm that these models display an acceptable model fit for the mediation effect of the project manager innovation environment on the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

8.4.2 Verifying the mediation hypotheses of PMIE

The study anticipates that the project manager innovation environment may have a mediating role on the relationship between PMIC and the DSI in projects. Following the four steps to analyze mediation that are mentioned in section 8.3.2, the PMIE mediation relationship is assesses using the path sign, t-value, and p-value (significance level), as demonstrated in Table 8.8.

Table 8.8 Meditation results for project manager innovation environment

Mediation Path	PMIPT Mediation			Mediation Type
	Sign	P-value	t-value	
PMIC1, PMIE, and DSI1				
PM innovation environment <-- PM impact and influence competencies	+	***	7.011	Full mediation
Control of new scope <-- PM innovation environment	+	***	6.101	
Control of new scope <-- PM impact and influence competencies	+	***	7.846	
Control of new scope <-- PM impact and influence competencies (after mediation)	+	.274	1.094	
PMIC1, PMIE, and DSI2				
PM innovation environment <-- PM impact and influence competencies	+	***	7.011	Full mediation
Response to scope change <-- PM innovation environment	+	***	4.856	
Response to scope change <-- PM impact and influence competencies	+	***	5.875	
Response to scope change <-- PM impact and influence competencies (after mediation)	-	.463	0.735	
PMIC2, PMIE, and DSI1				
PM innovation environment <-- PM cognitive competencies	+	***	6.182	Full mediation
Control of new scope <-- PM innovation environment	+	***	6.365	
Control of new scope <-- PM cognitive competencies	+	***	6.974	
Control of new scope <-- PM cognitive competencies (after mediation)	+	.042	2.035	
PMIC2, PMIE, and DSI2				
PM innovation environment <-- PM cognitive competencies	+	***	6.182	Full mediation
Response to scope change <-- PM innovation environment	+	***	5.061	
Response to scope change <-- PM cognitive competencies	+	***	5.725	
Response to scope change <-- PM cognitive competencies (after mediation)	-	.919	0.102	
PMIC3, PMIE, and DSI1				
PM innovation environment <-- PM personal effectiveness competencies	+	***	5.987	Full mediation
Control of new scope <-- PM innovation environment	+	***	6.286	
Control of new scope <-- PM personal effectiveness competencies	+	***	6.116	
Control of new scope <-- PM personal effectiveness competencies (after mediation)	+	.560	0.582	
PMIC3, PMIE, and DSI2				
PM innovation environment <-- PM personal effectiveness competencies	+	***	5.987	Partial mediation
Response to scope change <-- PM innovation environment	+	***	5.406	
Response to scope change <-- PM personal effectiveness competencies	+	***	4.676	
Response to scope change <-- PM personal effectiveness competencies (after mediation)	-	.008*	2.657	
PMIC4, PMIE, and DSI1				
PM innovation environment <-- PM managerial competencies	+	***	5.856	Full mediation
Control of new scope <-- PM innovation environment	+	***	6.519	
Control of new scope <-- PM managerial competencies	+	***	6.289	
Control of new scope <-- PM managerial competencies (after mediation)	+	.033	2.127	
PMIC4, PMIE, and DSI2				
PM innovation environment <-- PM managerial competencies	+	***	5.856	Full mediation
Response to scope change <-- PM innovation environment	+	***	4.771	
Response to scope change <-- PM managerial competencies	+	***	5.366	
Response to scope change <-- PM managerial competencies (after mediation)	+	.364	0.907	

* p < 0.01, ** p < 0.005, *** p < 0.001.

The results represented in Table 8.6 helps in testing the hypotheses, as follows:

Hypothesis (H3-1) proposed that: *the project manager innovation environment mediates the* *relationship between project manager impact and influence competencies and the control of new scope in projects.* Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficients of PMIC1→PMIE is significant (t-value =7.011, p<0.001), PMIE→DSI1 is significant (t-value =6.101, p<0.001), PMIC1→DSI1 before mediation is significant (t-value =7.846, p<0.001), and PMIC1→DSI1 after mediation is not significant (t-value =1.094, p=0.274).

Hypothesis (H3-2) proposed that: *the project manager innovation environment mediates the relationship between project manager impact and influence competencies and the response to scope change in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficients of PMIC1→PMIE is significant (t-value =7.011, p<0.001), PMIE→DSI2 is significant (t-value =4.856, p<0.001), PMIC1→DSI2 before mediation is significant (t-value =5.875, p<0.001), and PMIC1→DSI2 after mediation is not significant (t-value =-0.735, p=0.463).

Hypothesis (H3-3) proposed that: *the project manager innovation environment mediates the relationship between project manager cognitive competencies and the control of new scope in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficients of PMIC2→PMIE is significant (t-value =6.182, p<0.001), PMIE→DSI1 is significant (t-value =6.365, p<0.001), PMIC2→DSI1 before mediation is significant (t-value =6.974, p<0.001), and PMIC2→DSI1 after mediation is not significant (t-value =2.035, p=0.042).

Hypothesis (H3-4) proposed that: *the project manager innovation environment mediates the relationship between project manager cognitive competencies and the response to scope change in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficients of PMIC2→PMIE is significant (t-value =6.182, p<0.001), PMIE→DSI2 is significant (t-value =5.061, p<0.001), PMIC2→DSI2 before mediation is significant (t-value

=5.725, p<0.001), and PMIC2→DSI2 after mediation is not significant (t-value =0.102, p=0.919).

Hypothesis (H3-5) proposed that: *the project manager innovation environment mediates the relationship between project manager personal effectiveness competencies and the control of new scope in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficients of PMIC3→PMIE is significant (t-value =5.987, p<0.001), PMIE→DSI1 is significant (t-value =6.286, p<0.001), PMIC3→DSI1 before mediation is significant (t-value =6.116, p<0.001), and PMIC3→DSI1 after mediation is not significant (t-value =0.582, p=0.560).

Hypothesis (H3-6) proposed that: *the project manager innovation environment mediates the relationship between project manager personal effectiveness competencies and the response to scope change in projects*. Empirical testing supports this hypothesis with partial mediation results, as the mediation path coefficients of PMIC3→PMIE is significant (t-value =5.987, p<0.001), PMIE→DSI2 is significant (t-value =5.406, p<0.001), PMIC3→DSI2 before mediation is significant (t-value =4.676, p<0.001), and PMIC3→DSI2 after mediation is significant (t-value =2.657, p=0.008) at P<0.01.

Hypothesis (H3-7) proposed that: *the project manager innovation environment mediates the relationship between project manager managerial competencies and the control of new scope in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficients of PMIC4→PMIE is significant (t-value =5.856, p<0.001), PMIE→DSI1 is significant (t-value =6.519, p<0.001), PMIC4→DSI1 before mediation is significant (t-value =6.289, p<0.001), and PMIC41→DSI1 after mediation is not significant (t-value=2.127, p=0.033).

Hypothesis (H3-8) proposed that: *the project manager innovation environment mediates the relationship between project manager managerial competencies and the response to scope change in projects*. Empirical testing supports this hypothesis with full mediation results, as the mediation path coefficients of PMIC4→PMIE is significant (t-value =5.856, p<0.001), PMIE→DSI2 is significant (t-value =4.771, p<0.001), PMIC4→DSI2 before mediation is significant (t-value =5.366, p<0.001), and PMIC4→DSI2 after mediation is not significant (t-value =0.907, p=0.364). Table 8.9 summarized the results of the hypotheses tests using the mediation analysis technique. These confirmed hypotheses provide answer to the third research question, and correspond to the research the fifth research objectives. In particular, the mediation of PMIE is full for all relationships, except that it is partial for mediation of PMIE on the relationship between project manager personal effectiveness competencies cluster and the response to scope change in projects. Yet, the findings of the current study confirm that the project manager innovation environment has a mediation effect on the relationship between the project manager innovation competencies and the delivery of successful innovation in projects.

Table 8.9: Summary of confirmed mediation hypotheses for PMIE

No.	Mediation hypothesis assumption	Mediation type	Results
H3-1	The project manager innovation environment mediates the relationship between project manager impact and influence competencies and the control of new scope in projects	Full mediation	Supported
H3-2	The project manager innovation environment mediates the relationship between project manager impact and influence competencies and the response to scope change in projects	Full mediation	Supported
H3-3	The project manager innovation environment mediates the relationship between project manager cognitive competencies and the control of new scope in projects.	Full mediation	Supported
H3-4	The project manager innovation environment mediates the relationship between project manager cognitive competencies and the response to scope change in projects	Full mediation	Supported
H3-5	The project manager innovation environment mediates the relationship between project manager personal effectiveness competencies and the control of new scope in projects	Full mediation	Supported
H3-6	The project manager innovation environment mediates the relationship between project manager personal effectiveness competencies and the response to scope change in projects	Partial mediation	Supported
H3-7	The project manager innovation environment mediates the relationship between project manager managerial competencies and the control of new scope in projects	Full mediation	Supported
H3-8	The project manager innovation environment mediates the relationship between project manager managerial competencies and the response to scope change in projects	Full mediation	Supported

8.5 Summary

This chapter does not only describe the data analysis for the hypothesized relationships, but also identifies the proposed meditational hypothesized relationship. The findings reveal that all clusters of project manager innovation competencies have a positive direct relationship with the delivery of successful innovation in projects. At the same time, the results confirm that the project manager innovation personality traits have a mediation effect on the relationship between the project manager innovation competencies and the delivery of successful innovation. The results also confirm that the project manager innovation environment has a mediation effect on the relationship between project manager innovation competencies and the delivery of successful innovation.

Chapter 9 Discussion

9.1 Introduction

This chapter integrates the key findings and represents a detailed discussion of the results. The chapter start by discussing the main concepts of this research that are the project manager innovation competencies, the delivery of successful innovation in projects, and the mediation factors influencing the main concepts of the current study. Then, it moves forward to demonstrate the results obtained from the confirmatory factor analysis, which has been performed on the study measurements. This chapter also includes a detailed description about the direct and mediation modelling that is performed to test the research hypotheses. It concludes with a discussion of the study overall model.

9.2 Discussion of the research main concepts

9.2.1 The concept of delivering successful innovation in projects

This section discusses the concept of the delivery of successful innovation in projects using the findings obtained from the literature review and the analysis of primary data. In Chapters 2, the researcher has explained the importance of identifying main criteria that lead to delivering successful innovation. Using the comprehensive literature review of this study, the criteria for the delivery of successful innovation in projects have been classified into three clusters that are: time, cost, and quality (Bossink, 2002; Chuang, Jason & Morgan, 2011; Halbesleben et al., 2003; Hartmann, 2006; Jayaram, Oke & Prajogo, 2014; Kelley & Lee, 2010; Ozorhon, 2013; Slater, Mohr & Sengupta, 2013). Time resumes to mirror the quick evolution of technology. The prominence of time is amplified in creativity, as innovation has become the main strategic orientation of organizations trying to accomplish a sustained competitive advantage in the existing knowledge-rich environment (Halbesleben et al., 2003). Innovation can also bring financial benefits to organization, and innovative solutions often offer substantial cost reductions (Slater, Mohr & Sengupta, 2013). Quality is important in forming organizational conditions in which innovations can be advanced through managing and introducing innovation process, creating proper innovation content, and applying innovations in the main processes of organizations (Bossink, 2002). Hence, the literature has indicated that these clusters have an influence on the delivery of innovation. Thus, the researcher has recognized the importance of studying these clusters and testing them analytically. At this stage, the following research gaps have been addressed:

1. The difference between delivering projects and delivering successful innovation in projects.
2. The project criteria important to deliver successful innovation in projects.
3. A model that illustrates the project criteria that leads to delivering successful innovation in projects.

The findings obtained from the theoretical background of this study indicate that the project manager competencies are the main influencing factor for the delivery of successful innovation in projects (Chatenier et al., 2010; Racela, 2014; Vila, Perez & Coll-Serrano, 2014). In support to this finding, Tai Tsou (2012) has pointed out that it is essential to facilitate a link between competencies and innovation, as project managers can recognize the significance of knowledge integration, and utilize their competencies to cultivate it, which, in turn, can result in favorable innovation outcomes, as discussed in the following section.

9.2.2 The concept of project manager innovation competencies

This section discusses the concept of project manager innovation competencies using the findings obtained from the literature review and the analysis of primary data. In Chapters 3, the researcher has explained the importance of identifying those project manager innovation competencies that can lead to delivering successful innovation in projects. Using the thorough literature review of this study, these project manager innovation competencies have been classified into five clusters that are: leadership, communication, teamwork, creativity, and commitment competencies. In support to this selection, Bossink (2002) have mentioned that project managers' leadership competencies that are relevant to innovation are based on their: knowledge, responsibility for the degree to which innovations can be advanced, passion and interest, or accountability for an enhancement of innovation. Rogers (2003) has added communication competencies are very important for the success of innovation, as the second dimension of the innovation diffusion theory is ''communication channels''. He has looked at communication as a process in which the participating members create and share the information they have with one another to reach a mutual understanding of innovation. Lloréns Montes, Ruiz Moreno and García Morales (2005) have pointed out the importance of teamwork for the success of innovation. They have argued that project managers must support and encourage innovation, individual initiative, through the construction of competencies that are centered on the creation of unity in teamwork. Song, et al. (2015) has emphasized that creativity is an essential competency for the success of innovation. They have mentioned that creativity offers project team members as well as other external users with the means to produce, choose, and improve new ideas. While, Ling (2003) have clarified that project management commitment towards innovation is imperative, as innovation cannot be started without a strong interest and commitment towards it, and positive steps to motivate relevant players. Hence, the literature has indicated that these five clusters have an influence on the delivery of innovation. Thus, the researcher has recognized the importance of studying these clusters and testing them analytically. During this step, the following research gaps have been addressed:

1. Lack of link between project manager competencies and innovation competencies.
2. Lack of association between project manager innovation competencies and the delivery of innovation.

3. A model that demonstrates the influence of project manager innovation competencies on the delivery of successful in projects.

The findings obtained from the theoretical background of this study indicate that there is a relationship between PM innovation competencies and the delivery of successful innovation in projects (Afsar, Badir & Khan, 2015; Crant, 2000; Montani, Odoardi & Battistelli, 2014; Vila, Pérez & Coll-Serrano, 2014). In line with this, Vila, Pérez and Coll-Serrano (2014) have argued that project manager competencies can increase the probability of delivering successful innovation. Besides, project managers' multifaceted role in innovation has a considerable influence in achieving project targets and objectives in order to develop innovative practices on site. Such a significant role should be complemented by project managers' competencies (Dulaimi, Nepal & Park, 2005)

9.2.3 The concept of project manager innovation personality traits

This section discusses the concept of project manager innovation personality traits using the findings obtained from the literature review and the analysis of primary data. In Chapters 3, the researcher has explained the importance of identifying the project manager personality traits, and found an association between them and both project manager innovation competencies and the delivery of innovation in projects. Using the comprehensive literature review of this study, these personality traits are the ''Big Five'' that include extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. In justification, a high degree of openness to experience implies that an individual is creative, curious, imaginative, and untraditional towards accepting and implementing innovative ideas (George & Zhou, 2001; McCrae & Costa, 1985). An extravert individual prefers being with others and enjoys social activities, which can positively influence innovation (LePine & Van Dyne, 2001; Lucas et al., 2000). Individuals with high conscientiousness show motivation to accomplish goals, self-discipline, dependability, and preference for planned and systematic behaviors, which enhances the delivery of successful innovation (Barrick, Mount, Judge, 2001). Agreeable individuals are compliant, trusting, forgiving, modest, tolerant, softhearted, and have higher quality interpersonal interactions that helps them achieve innovation (Barrick & Mount, 1991). Ultimately, individuals with emotional stability (opposite of neuroticism) tend to be adjusted, calm, patient, and secure towards innovation (Feist, 1998; McCrae & Costa, 1987). Hence, the literature has indicated that these five clusters have an association with the project manger competencies and the delivery of successful innovation in projects (Bakker-Pieper & de Vries 2013; Dvir & Malach-Pines, 2006; Nichols & Cottrell, 2014). Thus, the researcher has recognized the importance of studying these clusters and testing them analytically. At this stage, the following research gaps have been addressed:

1. A link between project manager personality traits and project manager innovation competencies.
2. A link between project manager personality traits and innovation.
3. The project manager personality traits as a mediator for the relationship between project manager innovation competencies and the delivery of successful innovation in projects.
4. A model that demonstrates the influence of project manager innovation competencies on the delivery of successful in projects, considering the mediation effect of the PM personality traits.

The findings obtained from the theoretical background of this study indicate that the project manager innovation personality traits can mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects (Creasy & Anantatmula, 2013; Gehring, 2007; Hyvari, 2006; Skulmoski & Hartman, 2010; Stock, von Hippel & Gillert, 2016). In support to this, Gehring (2007) have pointed out that project managers must understand their competencies that are required as well as the personality traits that compliment or compete these competencies. Other scholars have also argued that project managers' personality traits can be associated to their competencies (Creasy & Anantatmula, 2013; Skulmoski & Hartman, 2010; Hyvari, 2006). At the same time, personality traits can impact the delivery of successful innovation at all stages starting from idea generation, prototyping, diffusion, and up to the successful delivery of innovation (Stock, von Hippel & Gillert, 2016).

9.2.4 The concept of project manager innovation environment

This section discusses the concept of project manager innovation environment using the findings obtained from the literature review and the analysis of primary data. In Chapters 2 and Chapter 3, the researcher has explained the importance of identifying the project manager innovation environment, and found an association between them and both project manager innovation competencies and the delivery of innovation in projects. Using the thorough literature review of this study, the project manager innovation environment has been classified into four clusters that are: stakeholders, resources, culture, and market. Stakeholders are important for project managers who deal carefully with them in order to deliver successful innovative. Project managers express ideas for them in a persuasive way, apply multiple influence tactics strategically and proficiently, and gain support and overcome resistance of key stakeholders (Howell, Shea & Higgins, 2005). Resources have a critical relationship with innovation success, as an effective control of resources can expand project managers' tendency to adopt and implement innovation (Paladino, 2007). Culture has a moderating effect on innovation, as working in diverse cultures will result in having different backgrounds that can influence the success of innovation (Evanschitzky, et al., 2012). The market can enhance the ability of project managers to deliver successful innovation (Paladino, 2007). Hence, the literature has indicated that these four clusters have an association with the project manger competencies and the delivery of innovation. Thus, the researcher has recognized the importance of studying these clusters and testing them analytically. At this stage, the following research gaps have been addressed:

1. A link between project manager environment and project manager innovation competencies.
2. A link between project manager environment and innovation.
3. The project manager environment as a mediator for the relationship between project manager innovation competencies and the delivery of innovation.
4. A model that demonstrates the influence of project manager innovation competencies on the delivery of successful in projects, considering the mediation effect of the PM innovation environment.

The findings obtained from the theoretical background of this study indicate that the project manager innovation environment can mediate the relationship between PM innovation competencies and the delivery of successful innovation in projects (Cunha, et al. 2014; Dulaimi, Nepal & Park, 2005; Gambatese & Hallowell, 2011). In line with this, Dulaimi, Nepal & Park (2005) have clarified that an innovation supportive environment can help project managers use their competencies effectively to deliver successful innovation in projects. In contrast, Cunha, et al. (2014) have explained that a poor innovation environment discourages innovation, as it has many problems such as lack of experienced resources, lack of control on innovation initiatives, and unwillingness to pay the required costs for innovation.

9.3 Confirmatory factor analysis discussion

9.3.1 CFA for project manager innovation competencies

In order to examine the validity of the study measures, confirmatory factor analysis is performed as clarified in Chapter 7. It is crucially imperative to evaluate the validity in the UAE context, as the study survey used has been constructed using a thorough literature review.

CFA is performed to explain the correlation patterns between a set of the observed variables and the scale factors. Evaluations about exclusion or inclusion of scale items have been based on the following criteria: items loading with a value less than 0.45 are excluded from any additional analysis as they are considered to be weak (Hair, Black, Babin, & Anderson, 2010). For the CFA of the current study, items with a loading value less than 0.45 are excluded, and items with Cronbach's Alpha of 0.60 and above are considered to be acceptable.

In the current study, the CFA of the project manager innovation competencies have provided adequate results. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (that decides whether the distribution of values is adequate for CFA) is 0.906. Bartlett's test of sphericity is significant (CMIN = 2851.532, $p < 0.000$). Hence, the researcher is confident that factor analysis is an appropriate method for this study (refer to Table 7.1). A number of model fit measures (CMIN, CMIN/DF, TLI, CFI, and RMSEA) are used to assess how well the model fits the obtained data. Before CFA, project manager innovation competencies have covered PM: leadership, communication, teamwork, creativity and commitment competencies. After the CFA, the PMIC are re-categorized into five new clusters that are PM: impact and influence, cognitive, personal effectiveness, managerial, achievement and action-oriented competencies. PMIC5 (achievement and action-oriented competencies) has been excluded from this study, as the only item (LD5) in this cluster has a CFA loading value of 0.30, which is below the acceptable cut-off value. Yet, the results of the CFA indicate that the remaining four clusters of PMIC (PMIC1, PMIC2, PMIC3, and PMIC4) show a good model fit with the observed data.

9.3.2 CFA for project manager innovation personality traits

In the current study, the CFA of the project manager innovation personality traits have provided adequate results. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (that decides whether the distribution of values is adequate for CFA) is 0.848. Bartlett's test of sphericity is significant (CMIN = 1423.558, $p < 0.000$). Hence, the researcher is confident that factor analysis is an appropriate method for this study (refer to Table 7.5). A number of model fit measures (CMIN,

CMIN/DF, TLI, CFI, and RMSEA) are used to assess how well the model fits the obtained data. Before the CFA, project manager innovation personality traits have included the ‘‘Big Five’’ personality traits that are PM: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience traits. After the CFA, the PMIPT are re-categorized into five new clusters that are PM: alertness and quickness, self-confidence, decision-making, openness to innovation, honesty and integrity, energy and toughness, and outgoing toward innovation traits. Cluster PMIPT7 (outgoing toward innovation traits) has been excluded from this study, as the only item (PT42) in this cluster has a CFA loading value of -0.10, which is below the acceptable cut-off value. Yet, the results of the CFA indicate that the remaining six clusters of PMIPT (PMIPT1, PMIPT2, PMIPT3, PMIC4, PMIC5, and PMIC6) show a good model fit with the observed data.

9.3.3 CFA for project manager innovation environment

Using the comprehensive literature review of this study, the project manager innovation environment has four clusters that are stakeholder, resources, culture, and market. Neither the EFA nor the CFA have been performed on them. The reason is that each cluster includes less than five observed variables as have been explained previously in Chapter 7.

9.3.4 CFA for delivering successful innovation in projects

In the current study, the CFA of the delivery of successful innovation in projects have provided adequate results. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (that decides whether the distribution of values is adequate for CFA) is 0.921. Bartlett’s test of sphericity is significant (CMIN = 1036.241, p <0.000). Hence, the researcher is confident that factor analysis is an appropriate method for this study (refer to Table 7.9). A number of model fit measures (CMIN, CMIN/DF, TLI, CFI, and RMSEA) are used to assess how well the model fits the obtained data. Before the CFA, the delivery of successful innovation has included: innovation for successful time outcome, innovation for successful cost outcome, and innovation for successful quality outcome.

After the CFA, the delivery of successful innovation is re-categorized into two new clusters that are: control of new scope and response to scope change (DSI1 and DSI2, respectively). Yet, the results of the CFA indicate that the new clusters of DSI show a good model fit with the observed data.

9.4 Modelling direct and mediation relationships

9.4.1 Direct path analysis discussion

The first aim of the study and its main objective (Chapter One, section 1.4) is to investigate the relationship between the project manager innovation competencies and the delivery of successful innovation in projects among UAE employees. The analysis is performed using SPSS 22 and AMOS 20 computer software based on principal components factoring technique, with varimax rotation on correlations of the study observed variables.

After a thorough review of relevant studies about project manager competencies and innovation literature, it is found out that there is a gap of knowledge in regards the relationship between the project manager innovation competencies and the delivery of successful innovation in projects. In this study the project manager competency models (refer to Section 3.4) are used to form a more inclusive and broader perspective. Whereas some studies have been performed in the UAE, there is not a single study that has statistically examined the relationship between the project manager innovation competencies and the delivery of successful innovation in projects. Thus, it is deemed critical to statistically test this model in a different setting such as the UAE.

The obtained sample data have revealed results that are consistent with many scholars; For example, Siguaw, Simpson and Enz (2006, p. 563) have mentioned that ‘‘*possessing strong innovation orientations encourage the acquisition of competencies that facilitate innovation. The deliberate managerial actions, processes, procedures, and practices are honed to a set of innovation competencies because of the overarching innovation orientation that unifies and guides* *action*''. Similarly, Turner and Muller (2006) have pointed out that a project manager's success at managing projects dependents on his or her competence. All of these arguments are in line with the study findings that suggest a positive direct relationship between PMIC and the DSI in projects, as detailed in the following section. Arditi, Gluch & Holmdahl (2013) have added that competencies are fundamental elements that allow project managers to accomplish their targets, advance them, and improve their outcomes. Later, Vila, Pérez & Coll-Serrano (2014) have explained that project managers are progressively expected to satisfy their potential for innovation at work, and to challenge and develop their professional competencies. Their contribution in innovative activities has become an essential element in organizations' strategies to retain and attract human talent in order to foster success in business.

In general, the regression weights obtained for the current study are demonstrated in Appendix E. In particular, the standardized regression weight between the project manager innovation competencies and the control of new scope are shown in Figure 9.1. As observed, the strength of the standardized regression weights is very high (above 80%) for all relationships. This indicates that each cluster of project manager innovation competencies has a strong, positive, and direct relationship with the control of new scope in projects. In support to this result, innovation can only be successful if project managers are able to control and manage the significant factors affecting the delivery of successful innovation (Ling, 2003). These factors involve controlling time, cost, quality, safety and environmental matters (Dulaimi, Nepal & Park, 2005; Hartmann, 2006; Hills et. al, 2008). Also, Hills et. al (2008) have pointed out that there is a relationship between project managers' competencies and what they regularly do to manage projects. They have also added that having the right competencies enables them not only to control the various requirements of projects, but also motivate others through their effectual behaviors.

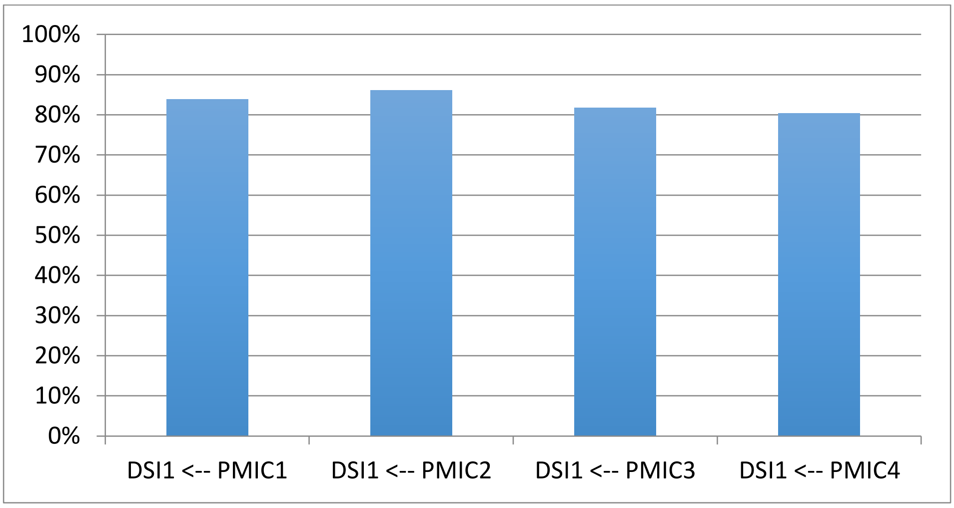

Figure 9.1: Standardized regression weights between PMIC and control of new scope

Further, in this study, the standardized regression weights between the project manager innovation competencies and the response of scope are illustrated in Figure 9.2. As seen, the strength of the standardized regression weights is high (above 60%) for all relationships. This signifies that each cluster of project manager innovation competencies has a strong, positive, and direct relationship with the response to scope change in projects. In line with this finding, some scholars have pointed out that in order to tackle scope changes, project managers need to develop their competencies (Lloréns Montes, Ruiz Moreno & García Morales, 2005). Ahsan, Ho and Khan (2013) have added that depending on the scope and the changes that may take place on it, the competencies of a project manager can vary in depth and breadth. Yet, Jiao and Zhao (2013) have argued that project managers should cope with or be committed to change, although sometimes they may be thinking whether that change is fair or justified. If project managers could not convince themselves that a particular change is fair, it is doubtful they will adopt the change, consider it reasonable, or make effort to guarantee its success. In addition, Liikamaa (2015) have stated that there is a relationship between the project managers' ability to adapt to scope changes and their competencies, which in return helps in delivering successful innovation in projects.

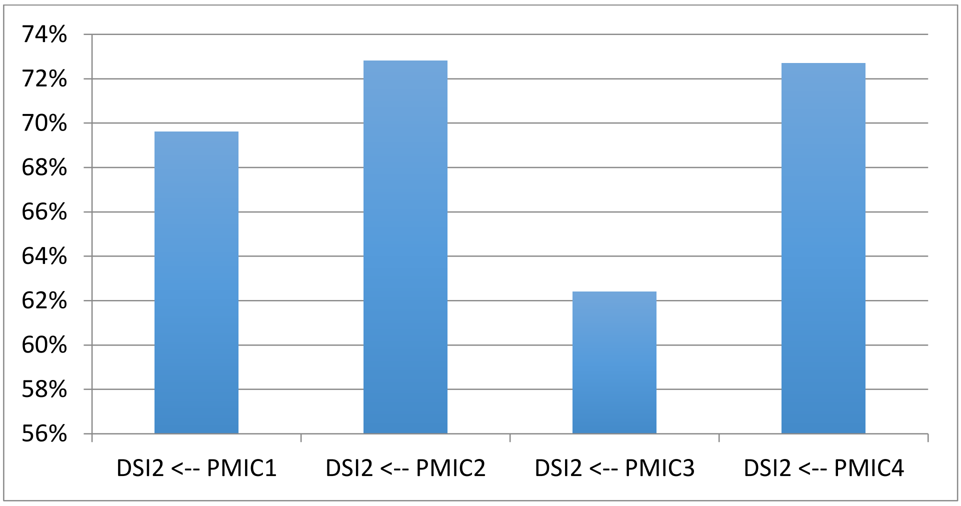

Figure 9.2: Standardized regression weights between PMIC and response to scope change

In short, there is a positive direct relationship between project manager innovation competencies and the delivery of successful innovation in projects (including both control of new scope and response to scope change).

9.4.2 PMIPT Mediation analysis discussion

The literature has highlighted the significant relationship between personality traits and innovation. For example, a high degree of openness to experience indicates that an individual is creative, curious, imaginative, and untraditional (George & Zhou, 2001; McCrae & Costa, 1985). While, a low openness to experience implies that an individual is narrow in interests, unadventurous, un-analytical, and traditional (McCrae & Costa, 1987). An extravert individual prefers being with others and enjoys social activities, while introvert individuals show low social engagement (LePine & Van Dyne, 2001; Lucas et al., 2000). Individuals with high conscientiousness show motivation to achieve goals, dependability, self-discipline, and preference for planned and systematic behaviors (Barrick, Mount, Judge, 2001). Agreeable individuals are compliant, forgiving, trusting, modest, softhearted, tolerant, and have higher quality interpersonal interactions (Barrick & Mount, 1991). Individuals with high neuroticism tend to be anxious and regularly show negative attitudes, and interact less with others in social situations (LePine & Van Dyne, 2001). While, individuals with emotional stability (The opposite of neuroticism) tend to be adjusted, calm, patient, and secure (Feist, 1998; McCrae & Costa, 1987).

In this study, the PMIPT mediation requirements are met in six clusters that are project manager: alertness and quickness, self-confidence, decision-making, openness to innovation, honesty and integrity, and energy and toughness traits. Using these traits, it is argued that the project manager innovation personality traits can influence the project manager innovation competencies, which in return, can affect the delivery of successful innovation in projects. In other words, the present study contributes to a more integrative view of the PMIPT as a mediator variable on the relationship between the independent (PMIC) and dependent (DSI) variables. Thus, project manager innovation personality traits are examined as a mediator for the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

It is imperative to observe the difference before and after adding the PMIPT mediator to the relationship between the project manager innovation competencies and the successful delivery of innovation (control of new scope and response to scope change) in projects. Hence, the standardized regression weight of the PMIC and DSI direct relationship, and the standardized indirect effect when adding the mediator are compared, as follows:

The histogram shown in Figure 9.3 demonstrates that the relationship between the project manager innovation competencies and control of new scope is strong in spite of the existence of the mediator, as the regression weights before and after adding the mediator are considered to be high (above 60%). In addition, when adding the PMIPT mediator for the relationship between the independent and dependent variable, the standardized regression weights for PMIC1, PMIC2, PMIC3, and PMIC4 have dropped down by 16.7%, 7.8%, 9.6%, and 9.8%, respectively. This indicates that the PMIPT mediator influences the relationship between PMIC and the DSI2 negatively, or in other words, it disturbs this relationship. On the other side, the histogram illustrated in Figure 9.4 shows that the relationship between the project manager innovation competencies and response to new scope is strong in spite of the existence of the mediator, as the regression weights before and after adding the mediator are considered to be high (above 60%). In addition, when adding the PMIPT mediator for the relationship between the independent and dependent variable, the standardized regression weights for PMIC1, PMIC2, PMIC3, and PMIC4 have increased by 23.6%, 29.6%, 43.8%, and 1.6%, respectively. This indicates that the PMIPT mediator influences the relationship between PMIC and the DSI2 positively, or in other words, it strengthens this relationship. Here, it is clear that the PMIPT mediator has different effects. It has weakened the relationship between PMIC and the DSI1, and strengthened the relationship between PMIC and DSI2. In support to this result, the literation has indicated that there is an association between the project manager innovation: personality traits, competencies, and the delivery of successful innovation. In particular, Gehring (2007) have argued that in order to increase the probability of innovation success, project managers should understand the competencies that are required and what personality traits they have that compliment or compete with these competencies. Thal and Bedingfield (2010) have emphasized that there are associations between personality traits and the success of a project manager. Later, Stock, von Hippel and Gillert (2016) have argued that the personality traits are associated with the successful completion of each stage in the innovation process.

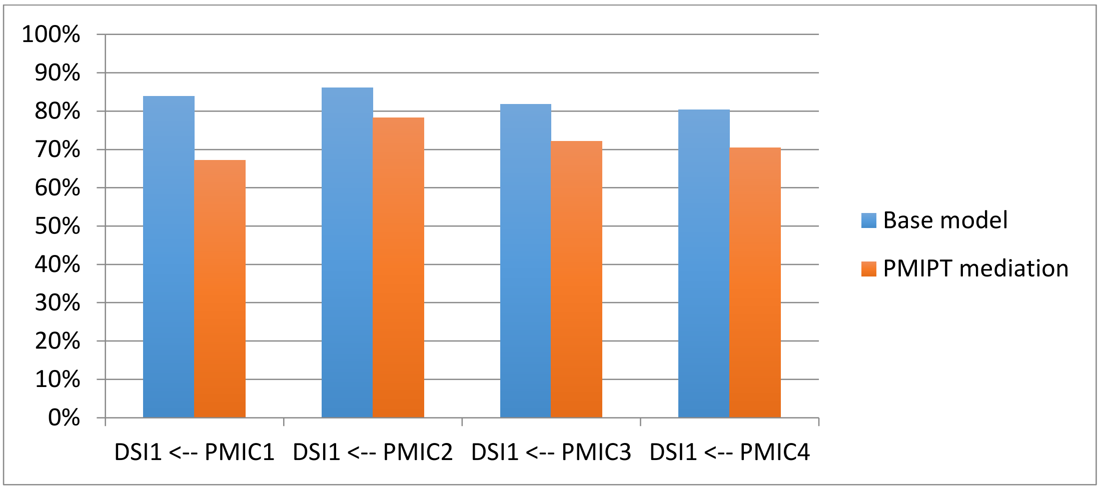

Figure 9.3: PMIPT mediation impact on the relationship between PMIC and DSI1

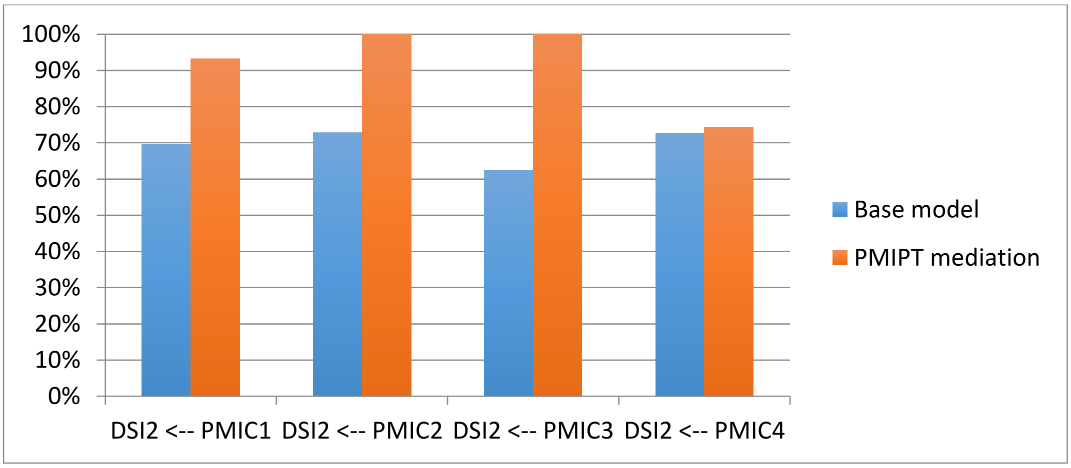

Figure 9.4: PMIPT mediation impact on the relationship between PMIC and DSI2

In short, the PMIPT mediates the relationship between project manager innovation competencies and the delivery of successful innovation in projects (including both control of new scope and response to scope change). However, PMIPT mediator disturbs the relationship between PMIC and control of new scope, while it strengthens the relationship between PMIC and response to scope change.

9.4.3 PMIE Mediation analysis discussion

The literature has pointed out the significant relationship between the environment and innovation. For example, Dulaimi, Nepal and Park (2005) have argued that innovation environment foster expectations for implementing innovation and accomplishing potential results. Wei et al. (2013) have added that innovative environment does not only generate positive outcomes at individual employee level, but also demonstrates the role of project managers' attitudes, perceptions, and cognitions. While Dul and Ceylan (2014) have clarified that a supporting environment helps organizations become more advanced in terms of innovation development.

In this study, the PMIE mediation requirements are met in four clusters that are stakeholders, resources, culture, and market. Using these environment criteria, it is argued that the project manager innovation environment can influence the relationship between the project manager innovation competencies, which in return, can affect the delivery of successful innovation in projects. In other words, the present study contributes to a more integrative view of the PMIE as a mediator variable on the relationship between the independent (PMIC) and dependent (DSI) variables. Thus, the project manager innovation environment is examined as a mediator between the project manager innovation competencies and the delivery of successful innovation in projects.

It is important to observe the difference before and after adding the PMIE mediator to the relationship between the project manager innovation competencies and the delivery of successful innovation (control of new scope and response to scope change) in projects. Thus, the standardized regression weight of the PMIC and DSI direct relationship, and the standardized indirect effect when adding the mediator are compared, as follows:

The histogram shown in Figure 9.5 demonstrates that the relationship between the project manager innovation competencies and control of new scope is strong in spite of the existence of the mediator, as the regression weights before and after adding the mediator are considered to be high (above 60%). In addition, when adding the PMIE mediator for the relationship between the independent and dependent variable, the standardized regression weights for PMIC1, PMIC2, PMIC3, and PMIC3 have dropped down by 12.5%, 21.4%, 7.5%, and 17.8%, respectively. This indicates the PMIE mediator influences the relationships between PMIC and DSI1 negatively, or in other words, it disturbs this relationship. On the other hand, the histogram shown in Figure 9.6 demonstrates that the relationship between the project manager innovation competencies and response to scope change is strong in spite of the existence of the mediator, as the regression weights before and after adding the mediator are considered to be high (above 60%). In addition, when adding the PMIE mediator for the relationship between the independent and dependent variable, the standardized regression weights for PMIC1 and PMIC3 have increased by 8.4% and 36.6%, respectively. This indicates the PMIE mediator influences the relationships between PMIC1 and DSI2 and PMIC3 and DSI2 positively. Whereas, the standardized regression weights for PMIC2 and PMIC4 have dropped down by 2.9% and 15.8%, respectively. This implies the PMIE mediator influences the relationships between PMIC2 and DSI2 and PMIC4 and DSI2 negatively. In line with this finding, Ling (2003) have pointed out that one of the main factors that can considerably affect the extent to which innovation will be successful is the work environment. Seaden et al. (2003) have agreed with this argument, as they have mentioned that there is a strong linkage between the project managers' perception of the environment and their innovative practices. Hartmann (2006) have clarified that when considering diversity and challenging environment situations can differ from one organization to the other. The reason is that organizations operate in diverse countries or regions, have distinctive histories, offer dissimilar services, present different cultures, etc. in particular, in a poor-innovation environment can suppress innovation (Cunha, et al. 2014), while a favorable-innovation environment positively influences innovation (Jayaram, Oke & Prajogo, 2014), and maximizes project managers' competencies (i.e. collaborations and decisions making abilities) (Lloyd-walker, Mills & Walker, 2014). This indicates the project managers' environment is associated with their competencies as well as the delivery of successful innovation in projects.

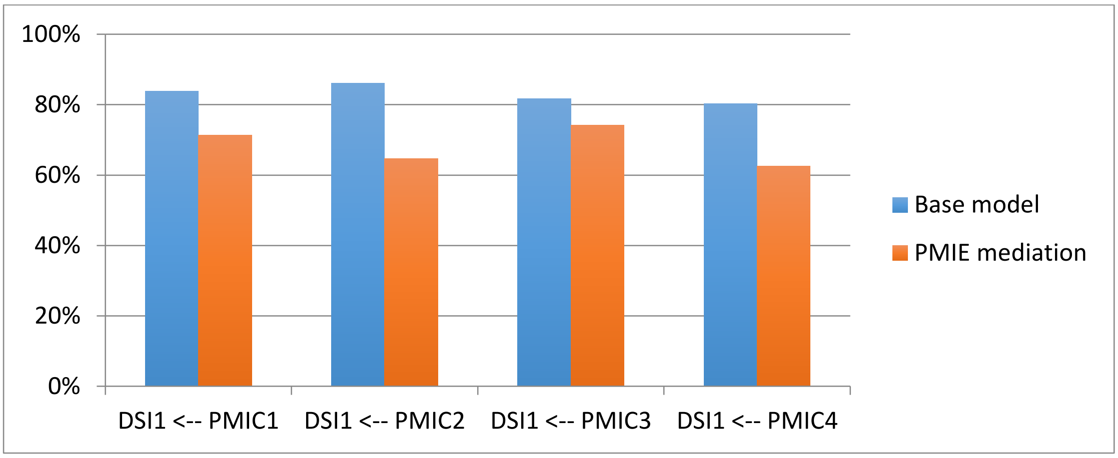

Figure 9.5: PMIE mediation impact on the relationship between PMIC and DSI1

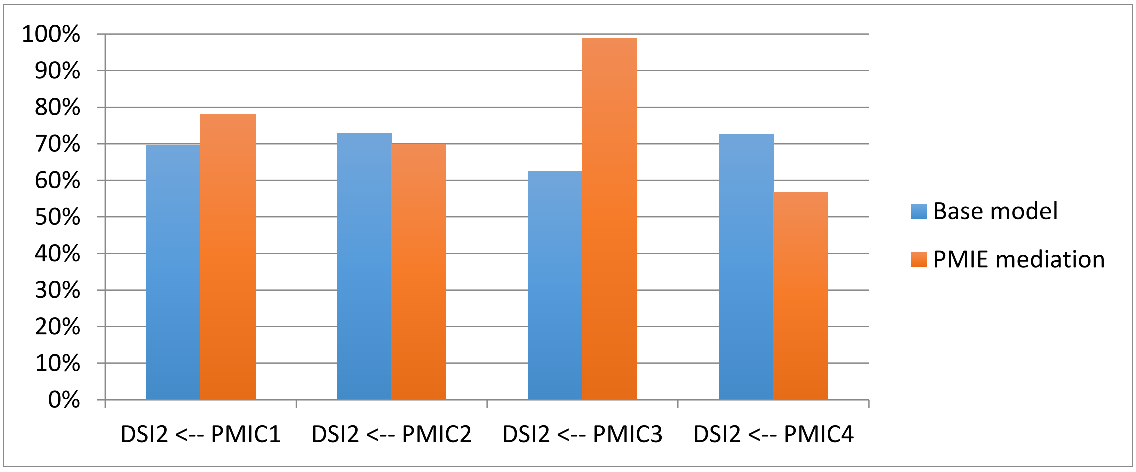

Figure 9.6: PMIE mediation impact on the relationship between PMIC and DSI2

In short, the PMIE mediates the relationship between project manager innovation competencies and the delivery of successful innovation in projects (including both control of new scope and response to scope change). However, PMIE mediator disturbs the relationship between PMIC and control of new scope in projects, while it has different effect on the relationship between PMIC and response to scope changer in projects. In particular, this mediator strengthens the relationship between PMIC1 and DSI2, and PMIC3 and DSI2, whereas it disturbs the relationship between PMIC2 and DSI2, and PMIC4 and DSI2.

9.5 The study overall model discussion

The study overall model is shown in Figure 9.7. However, it is clear that when combining all variables together, the model does not provide accurate result. The reason is that when having two mediators the indirect effect will not be measured accurately (Lowry & gaskin, 2014).

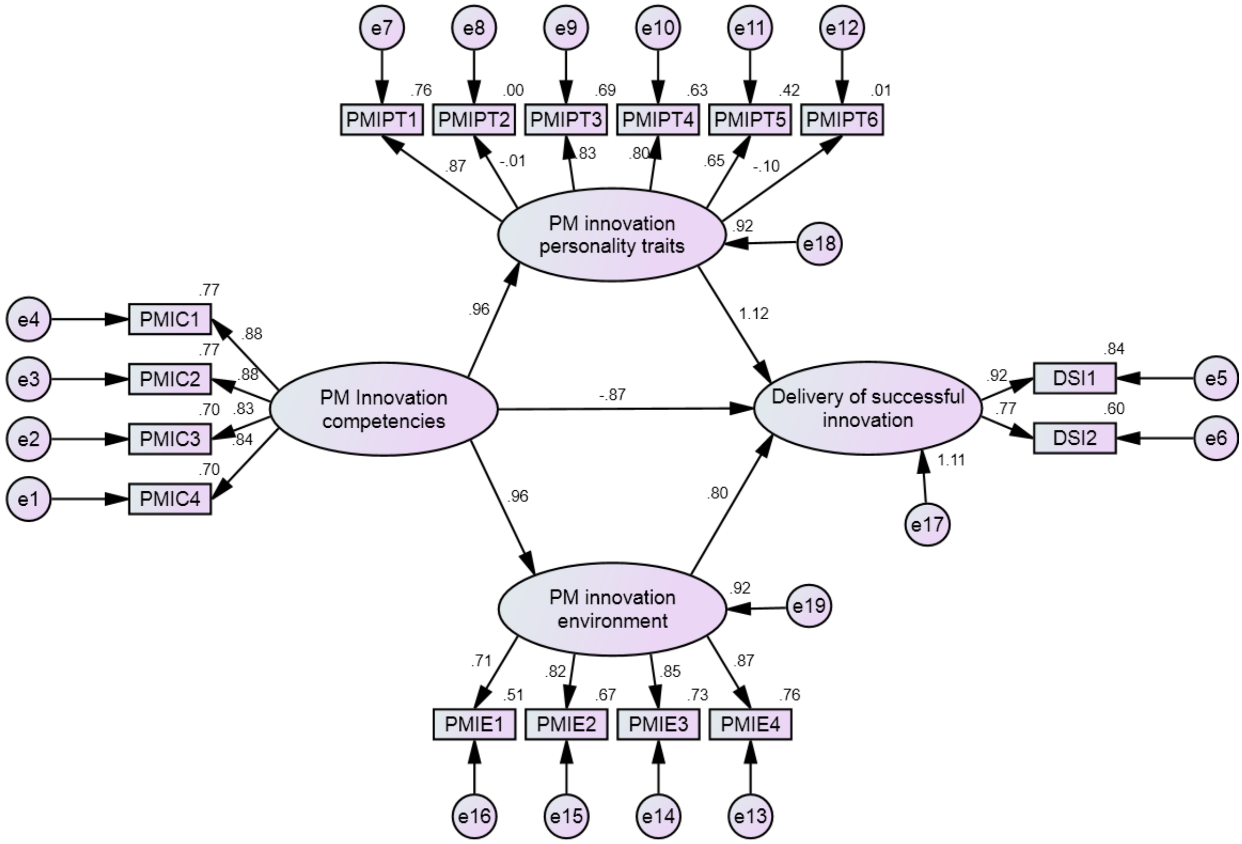

Figure 9.7: The study model before mediation

Thus, this model is broken down to three models that are:

- The first model demonstrates the positive direct relationship between the project manager innovation competencies and the delivery of successful innovation in projects, as shown in Figure 9.8.

- The second model illustrates the project manager innovation personality traits as a mediator to the relationship between the project manager innovation competencies and the delivery of successful innovation in projects, as shown in Figure 9.9.
- The third model represents the project manager innovation environment as a mediator to the relationship between the project manager innovation competencies and the delivery of successful innovation in projects, as shown in Figure 9.10.

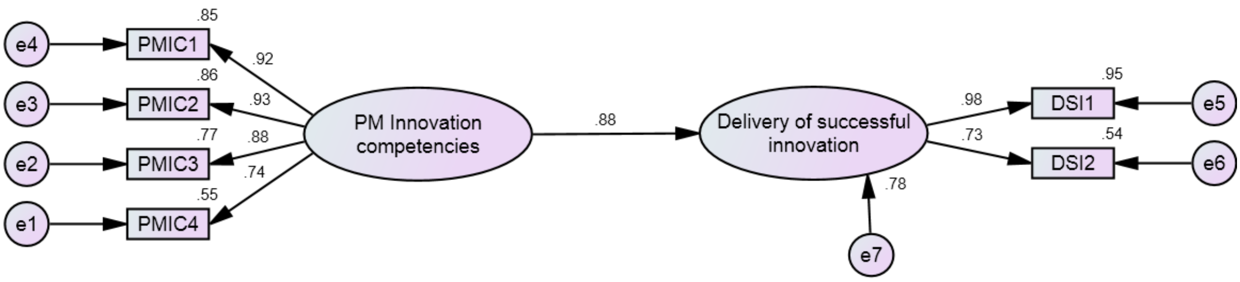

Figure 9.8: The study model before mediation

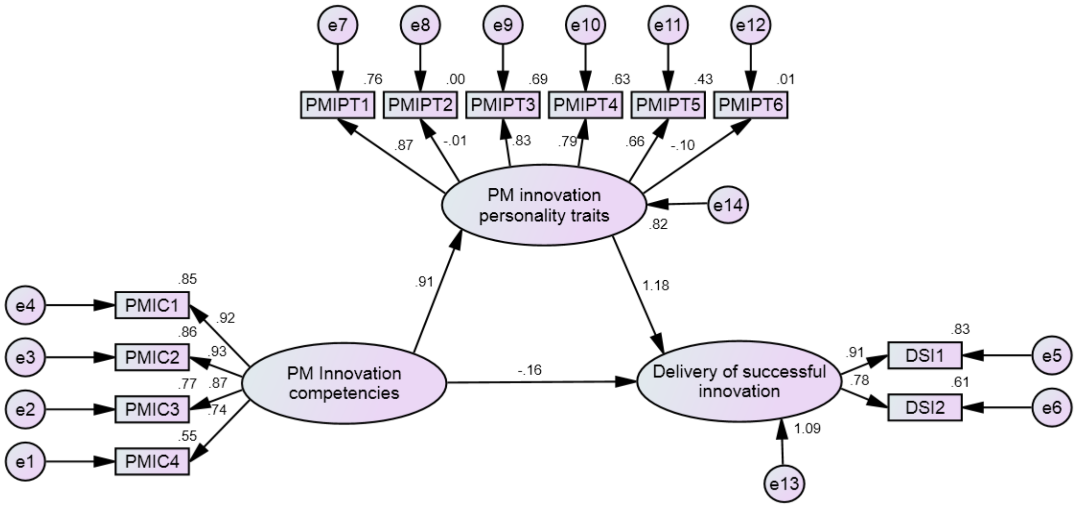

Figure 9.9: The study model with PMIPT mediation

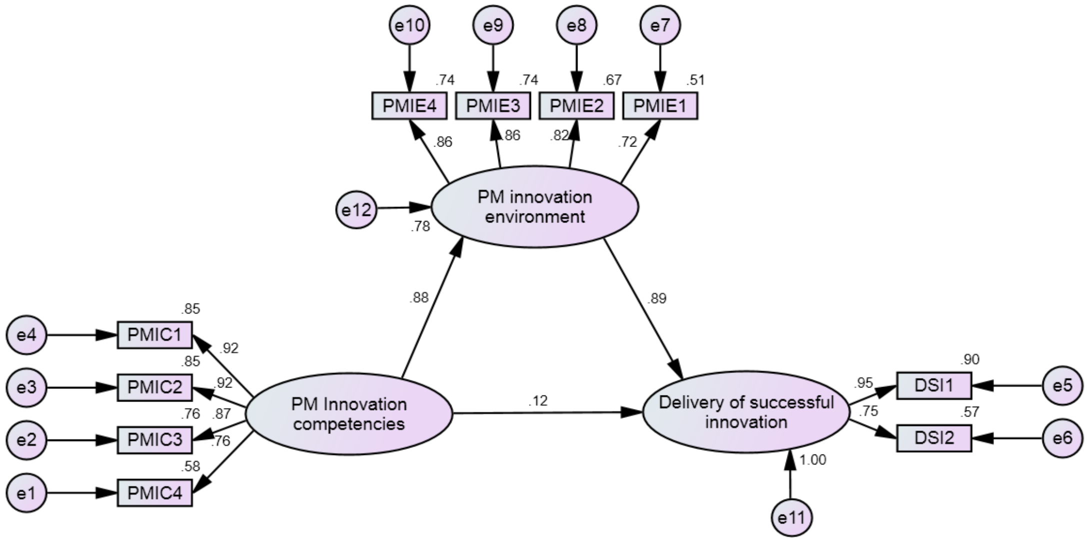

Figure 9.10: The study model with PMIE mediation

Using the result obtained from the models shown in Figure 9.8, 9.9, and 9.10, the overall findings are summarized in Table 9.1. The obtained values in Table 9.1 lead to three main findings. First, there is a significant positive direct relationship between the project manager innovation competencies and the delivery of successful innovation in projects. Several scholars have indicated that there can be a relationship between project manager innovation competencies and the delivery of successful innovation (Afsar, Badir & Khan, 2015; Crant, 2000; Montani, Odoardi & Battistelli, 2014; Vila, Pérez & Coll-Serrano, 2014). Second, the project manager personality traits mediate the relationship between the project manager personality traits and the delivery of successful innovation in projects. The relationship between PMIC and DSI before mediation is significant. Whereas, after mediation, the relationship between: PMIPT and PMIC is significant, PMIPT and DSI is significant, and PMIC and DSI after mediation is insignificant. This result indicates full mediation relationship between PMIPT and the relationship between PMIC and the DSI in projects. Numerous scholars have implied that the project manager personality traits can mediate the relationship between project manager innovation competencies and the delivery of successful innovation (Gehring, 2007; George & Zhou, 2001; Judge et al., 2002, LePine & Van Dyne, 2001; Lucas et al., 2000; Stock, von Hippel & Gillert, 2016). Third, the project manager environment mediates the relationship between the project manager competencies and the delivery of successful innovation in projects. The relationship between PMIC and DSI before mediation is significant. Whereas, after mediation, the relationship between: PMIE and PMIC is significant, PMIE and DSI is significant, and PMIC and DSI after mediation is insignificant. This result indicates full mediation relationship between PMIE and the relationship between PMIC and the DSI in projects. Various scholars have indicated that the project manager environment can mediate the relationship between project manager innovation competencies and the delivery of successful innovation (Cunha, et al. 2014;

Dulaimi, Nepal & Park, 2005; Gambatese & Hallowell, 2011; Khang & Moe, 2008; Wei et al., 2013).

Table 9.1: The overall results obtained from the SEM

	Sign	Estimate	t-value	p-value	Result
Direct relationship between PMIC and DSI					
DSI <-- PMIC (before mediation)	+	0.88	8.432	***	Significant (direct relationship)
PMIPT mediation on the relationship between PMIC and DSI					
PMIPT <-- PMIC	+	0.91	7.695	***	Significant (full mediation)
DSI <-- PMIPT	+	1.18	5.225	***	
DSI <-- PMIC (before mediation)	+	0.88	8.432	***	
DSI <-- PMIC (after mediation)	-	0.16	0.747	.455	
PMIE mediation on the relationship between PMIC and DSI					
PMIE <-- PMIC	+	0.88	7.627	***	Significant (full mediation)
DSI <-- PMIE	+	0.89	5.779	***	
DSI <-- PMIC (before mediation)	+	0.88	8.432	***	
DSI <-- PMIC (after mediation)	+	0.12	.825	.409	

Nevertheless, at this stage, the conceptual model shown in Figure 4.1, can be modified in accordance to the findings of the current study. Thus, the modified study model is illustrated in Figure 9.11. In comparison, in the conceptual model, the project manager innovation competencies (form the literature view) have been five clusters that are project manager: leadership, communication, teamwork, creativity, and commitment competencies. In the current study model, there are four clusters of project manager innovation competencies that are: impact and influence, cognitive, personal effectiveness, and managerial competencies. Similarly, the project manager innovation personality traits (from the literature review) have been five clusters (Big five) project manager innovation personality traits that are: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. In the current study model, there are six clusters of project manager personality traits that are alertness and quickness, self-confidence, decision-making, openness to innovation, honesty and integrity, and energy and toughness traits. At the same time, the delivery of successful innovation in projects (from the literature review) has included three clusters that are innovation for successful: time, cost, and quality outcome. In the current study model, there are two clusters for the delivery of successful innovation in projects that are control of new scope and response to scope change. Yet, the project manager innovation environment (from the literature review) has covered four clusters that are stakeholders, resources, culture, and market. In the current study model, the clusters for the project manager innovation environment remain the same.

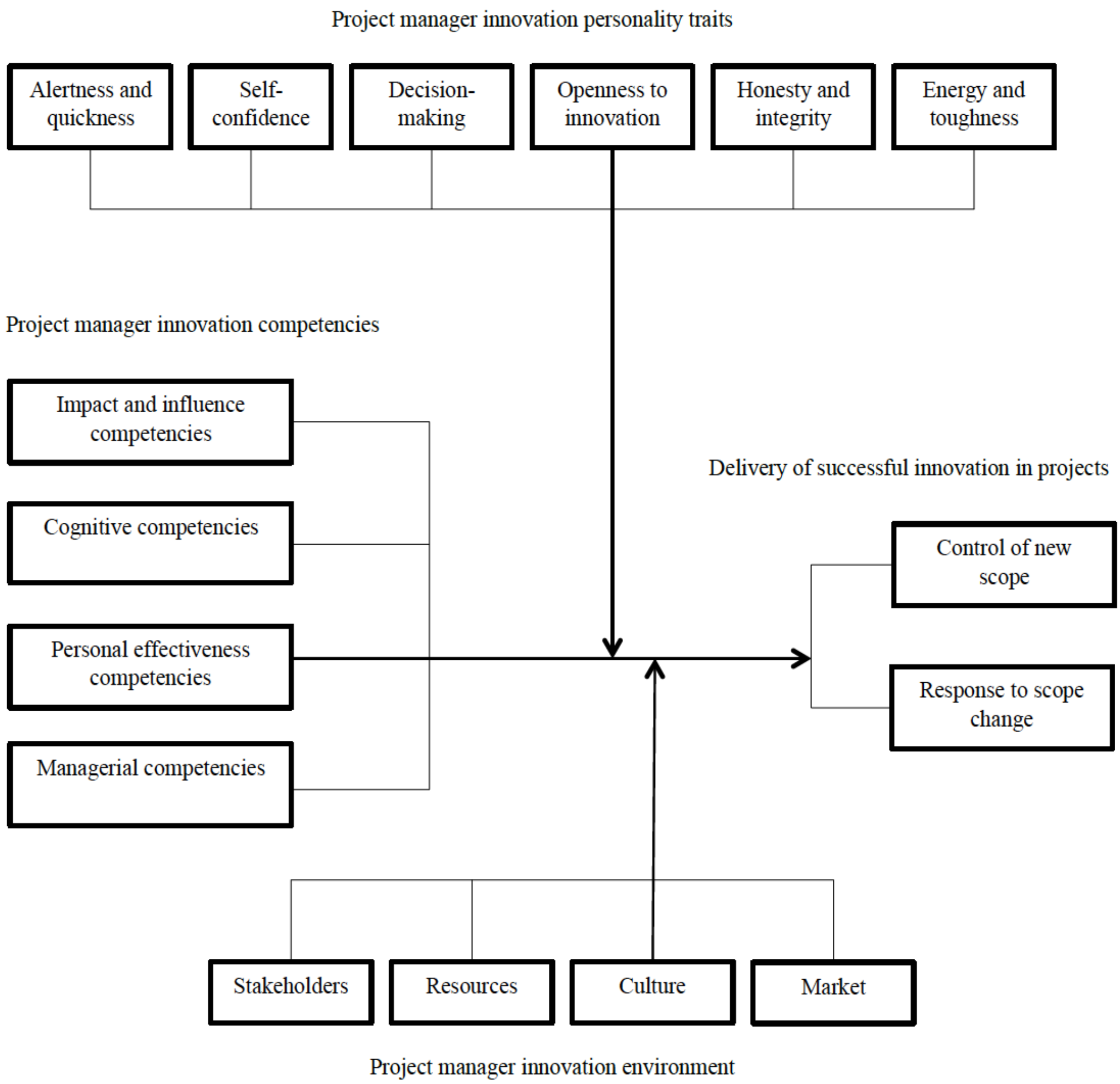

Figure 9.11: The study model

9.6 Summary

This chapter have included a detailed discussion about the research main concepts and knowledge gaps that are relevant to the delivery of successful innovation in projects, and project manager innovation: competencies, personality traits, and environment. It has also summarized the results of the confirmatory factor analysis for each one of these concepts. Then, it has covered a thourough discussion about the direct and mediation relationships of the current study. It has also included in detail a discussion about the positive direct relationship between project manager innovation competencies and the delivery of successful oinnovation in projects. Further, this chapter has explained that the project manager innovation personality traits and the project manager innovation environment mediate the relationship betwenn project manager innovation competencies and the delivery of successful innovation in projects. It has concluded with a discussion about the study overall model.

Chapter 10 Conclusion and Recommendations

10.1 Introduction

This Chapter explains the robustness of the methodology used to achieve the aims and objectives of this study. It also represents in detail how each objective have been accomplished. The research academic and practical implications are covered in this chapter. At the same time, the study limitation and future research recommendations are listed. This Chapter concludes with important remarks that summarize the main findings and link them with existing literature.

10.2 Robustness of the methodology

The research methodology adopted to achieve the current study aims and objectives has been thoroughly explained in Chapter Four. The research is based on an in-depth qualitative review of the existing literature about project managers' innovation: competencies, personality traits, and environment; and their influence on the delivery of successful innovation in projects. The knowledge gaps of this study that have been used to develop the research question are summarized in Section 9.2 in the previous Chapter. Using the comprehensive literature review, the study questionnaire has been developed and validated by five experts to get their professional feedback and assure that the questions are clear and easy to understand. Then, the questionnaires have been distributed electronically to collect data from practitioners working in organizations located in the United Arab Emirates. Adequate number of responses has been collected. At this stage, the negatively worded questions are adjusted, the missing values are replaced, data are coded, and the reliability of data is tested using Cronbach Alpha. Appropriate statistical tools have been adopted to analyse the survey results. Descriptive statistics are used to study the variation in the participants' responses. Exploratory factor analysis that is followed by a confirmatory factor analysis has been used to assess the validity of the scale measurements. Ultimately, structural equation modelling has been applied to test the research hypotheses.

10.3 Accomplishing the research objectives

This section describes in detail how each one of the current research objectives has been accomplished, as follows:

The first objective of this research is *to critically review and extract PM innovation competencies*. This objective is achieved through performing a comprehensive literature review that is narrowed down gradually. The review starts with management competencies, project management competencies, and (more specifically) project manager competencies. Then, this is narrowed down to find out the project manager competencies that are associated with innovation (project manager innovation competencies). These competencies are leadership, communication, teamwork, creativity, and commitment competencies. Each one of these competencies has numerous measurements that are extracted from literature as shown in Chapter Four.

The second objective of this research is *to critically review and extract the measures for successful innovation in projects*. This objective is achieved through performing a comprehensive literature review that is narrowed down gradually. The review starts with the delivery of successful projects, the antecedents and challenged of innovation in projects, and (more specifically) the delivery of successful innovation in projects. Then, this is narrowed down to find out the measurements including the delivery of successful innovation in projects. These measurements are innovation for successful: time, cost, and quality outcome. Each one of these measurements has numerous items that are extracted from literature as demonstrated in Chapter Four.

The third objective of this research is *to critically investigate the relationship between project manager innovation competencies and the delivery of successful innovation in projects*.

A survey has been prepared to investigate this relationship. The collected data have passed through an exploratory factor analysis that is followed by a confirmatory factor analysis. At this stage, the new clusters of project manager innovation competencies (including impact and influence competencies, cognitive competencies, personal effectiveness competencies, and managerial competencies) and the delivery of successful innovation (control of new scope, and response to scope change) are assessed. The results of the structural equation modeling confirm that there is a positive direct relationship between project manager innovation competencies and the delivery of successful innovation in projects.

The fourth objective of this research is *to examine the mediating impact of the project manager innovation personality traits on the relationship between project manager innovation competencies and the delivery of successful innovation in projects*. This objective is achieved using the survey findings. The ‘‘Big Five’’ personality traits have passed through an exploratory factor analysis that is followed by a confirmatory factor analysis. At this stage, the new clusters of project manager innovation personality traits (including alertness and quickness, self-confidence, decision-making, openness to innovation, honesty and integrity, and energy and toughness traits.) are assessed for mediation. The results of the structural equation modeling confirm that project manager innovation personality traits mediate the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

Ultimately, the fifth objective of this research is *to investigate the mediating effect of the project manager innovation environment on the relationship between project manager innovation competencies and the delivery of successful innovation in projects*. This objective is achieved using the survey findings. None of the exploratory factor analysis or the confirmatory factor analysis has been applied because the measurements have less than five observations. The project manager innovation environment (stakeholders, resources, culture, and market) clusters, which are obtained from the literature review, are used. The results of the structural equation modeling confirm that project manager innovation environment mediates the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

10.4 Key research implications

10.4.1 Academic implications

This research has numerous important implications for the project manager competencies and innovation literature. Whilst many empirical studies are carried out in the areas of project manager innovation competencies (impact and influence competencies, cognitive competencies, personal effectiveness competencies, and managerial competencies) and the delivery of successful innovation (control of new scope and response to scope change) in projects, this study investigates a holistic view of the influence of project manager innovation competencies on the delivery of innovation in projects. At the same time, this study examines the mediational role of project manager innovation personality traits (alertness and quickness, self confidence, decision-making, openness to innovation, honesty and integrity, and energy and toughness traits) on the relationship between project manager innovation competencies and the delivery of successful innovation in projects. The study also investigates the mediational role of project manager innovation environment (stakeholders, resources, culture, and market) on the relationship between project manager innovation competencies and the delivery of successful innovation in projects. This study satisfies an important need in project manager competencies and innovation literature with findings of reliable and valid measurements of project manager innovation competencies, innovation personality traits, and innovation environment that can help in delivering successful in projects.

The results of this thesis confirm that project managers' innovation competencies positively influence the delivery of successful innovation in projects. Given that there is a lack of studies that have examined the relationship between the complete set of dimensions of the project manager innovation competencies model and the delivery of successful innovation in UAE project, this study and its contribution to the expansion of knowledge in the fields of competencies and innovation is significant.

Chapter Eight describes the mediation hypotheses proposed in this thesis. Mediational tests are used to confirm the mediational hypotheses. Project manager innovation personality traits are a mediator variable in this study, which affects the relationship between project manager innovation competencies and the delivery of successful innovation in projects. Also, project manager innovation environment is a mediator variable in the current study, which affects the relationship between project manager innovation competencies and the delivery of successful innovation in projects. However, these findings add to the body of innovation, competencies, and personality traits' literature through providing a more integrative view of PMIPT and PMIE as mediator variables for the relationship between PMIC and the DSI in projects.

10.4.2 Practical implications

The results reported in this study have several practical implications for UAE organizations in particular, and for regional organisations in general. Through empirically testing the influence of the project manager innovation competencies on the delivery of successful innovation in projects, the research has provided data, which UAE organisations can use to assess project managers. The literature emphasises the influence of PMIC on their ability to deliver successful innovation in projects (Dulaimi, Nepal & Park, 2005; Edum-Fotwe & McCaffer 2000; Trivellas & Drimoussis, 2013; Vila, Pérez & Coll-Serrano, 2014).

The findings also reveal that it is crucial to build up and develop project managers' innovation competencies, as the competitive advantage can mainly be achieved through innovation (Goswami & Mathew, 2011). Konigova and Fejfar (2012) have added that that project manager innovation competencies allow organizations to achieve competitive advantage in different markets, especially in current environments that are characterised by changes and dynamic growth.

In addition, organization can hire the right project manager, who has the required competencies (Cheng, Dainty & Moore, 2005). In support to this, Dulaimi, Nepal and Park (2005) have pointed out that the project manager who has the right competencies may not be an easy task. The reason is that project manager's multifaceted role in innovation has a substantial influence in accomplishing project targets and objectives in order to develop innovative practices on site. Such a significant role should be complemented by a project manager's competency and professionalism. In other words, Human Resources professionals can use the findings of this knowledge for recruitment and development purposes, as project managers can be evaluated during resume screening, interviews, and reference checking. HR managers can attempt to realize if the desired competencies are available in their resumes. When directing interviews, the interviewer can ask behavioral type questions to verify the nature and degree of competencies owned by a project manager, and if the candidate acquires the different competencies required for that particular job position. Speaking with the candidates' references can give better idea about the competencies they own and whether they can use them when required (Skulmoski & Hartman, 2010). However, it is worthwhile to prepare guidelines that identify the required competencies. Such guidelines can help HR managers to accomplish their work more effectively in the recruitment process, particularly, when they prepare a job advertisement for a project manager position (Ahsan, Ho & Khan, 2013). Vila, Pérez and Coll-Serrano (2014) have added that organizations that are willing to promote their products, knowledge, or technological innovation can focus on recruiting, promoting, and assisting project managers who acquire the appropriate competencies, thereby inspiring an increase in propensity to be innovative.

Project managers should be aware that their innovation personality traits have an influence of their innovation competencies, and in return, this affects the delivery of successful innovation in projects. Golsteyn and Schildberg-Hörisch (2017) have argued that the interesting part about personality traits that they are assumed to have a high level of stability over time. Thus, this study have proved their mediation effect, so that project managers give more focus to understand, develop, and improve them to get favorable results towards innovation. Simultaneously, project managers can also be advised that emphasising the innovation personality traits helps in fostering positive attitudes towards the delivery of successful innovation in projects. For example, Projects' nature of work requires calm and friendly project managers who are able to cope up with different personalities, are capable of establishing social relationships, have the aptitude to work under stress, and can deal with demanding situations to meet goals (Hlatywayo, Mhlanga & Zingwe, 2013). Yet, the innovation personality traits are main factor to determine the differences in project managers' innovation levels. HR managers can use personality questionnaires at the recruiting stage to find out if the applicant for the project manager position has the required personality traits to deliver successful innovation in projects.

Furthermore, Project managers can also be advised that emphasising the innovation supportive environment helps in fostering positive attitudes towards the delivery of successful innovation in projects. In this regard, Dulaimi, Nepal and Park (2005) have clarified that organizations can promote innovation on projects through creating appropriate organizational climate that encourages innovation and facilitates resource supply. Gambatese and Hallowell (2011) have added that a positive organizational climate is very effective, as it inspires the creation of fresh ideas, a vigorous organizational structure that supports efforts to determine and try new ideas, and a well organized core values and strategies to help in overcoming any innovation challenges.

This study has shown that through exhibiting the project manager innovation competencies (considering the PMIPT and the PMIE), delivering successful innovation in project will accomplished. Thus there is a new direction not only for hiring project managers, but also training existing/new project managers to emphasize the required competencies.

10.5 Research key findings

The research has significant number of findings that contribute to project management, innovation, competencies, personality traits and environment pool of knowledge. The key findings of this research are:

1. The delivery of successful innovation in projects is identified by the project managers' control of the new scope, and their responds to any scope change that might take place.
2. The project manager innovation competencies that influence the delivery of successful innovation in projects are impact and influence competencies, cognitive competencies, personal effectiveness competencies, and managerial competencies.
3. The project manager innovation personality traits that influence the delivery of successful innovation in projects are alertness and quickness, self-confidence, decision-making, openness to innovation, honesty and integrity, and energy and toughness traits.
4. The project manager innovation environment criteria that influence the delivery of successful innovation in projects are stakeholders, resources, culture, and market.
5. There is a positive direct relationship between the project manager innovation competencies and the delivery of successful innovation in projects
6. The project manager innovation personality traits mediate the relationship between project manager innovation competencies and the delivery of successful innovation in projects.
7. The project manager innovation environment mediates the relationship between project manager innovation competencies and the delivery of successful innovation in projects.

8. The framework of this study, shown in Figure 9.11, is an important outcome of this study for two main reasons. First, it contributes to the research in the areas of innovation, competencies, personality traits, and environment literature. At the same time, this framework can be used to conduct training courses or conference to enhance the awareness of project managers about the competencies, personality traits, and favorable environment that can help them deliver successful innovation in projects. Second, this framework enriches the practical implications, as it can be used to create a list, of project managers' competencies and personality traits that are required to deliver successful innovation, to evaluate new and existing project managers. This in return will help in distinguishing project managers who have higher potential to deliver successful innovation in projects from those with less potential to deliver successful innovation in projects. Simultaneously, organizations can use this framework as a guide to provide a favorable environment that supports innovation, and facilitate the mission of project managers to deliver successful innovation in projects.

10.6 Research limitations

Although this research makes a sufficient number of contributions to the existing literature, there are some limitations that have to be acknowledged, which are:

The first limitation is that the researcher has been subject to time constraints, which have somehow minimized the number of participants. In order to counteract this inevitable weakness it is worthwhile to recall that the study data have been gathered from different organizations, which in return has enhanced the validity of the study results. Besides, Podsakoff et al. (2003) have argued that respondent anonymity is protected which assists in reducing the method variance for any chosen source of data. The researcher has considered this suggestion in the design of the online questionnaire and its administration. Yet, it has not been possible for the researcher to track respondents' e-mail addresses, names, organization name, or any reference to their identity.

The second limitation of this research is that the study has adopted a non-probability sampling strategy, because of access problems. This has banned the researcher from applying probability methods to select the respondents from a sample of all UAE project managers, which could have allowed the researcher to create generalized research outcomes and produce a general inference for the UAE population. Unfortunately, mitigation against this weakness has been very difficult, as majority of the present organizations prohibit researchers to interview project managers, for understandable reasons (i.e. confidentiality and competitive advantage). At the same time, project managers may not feel confortable to answer questions about their competencies, traits, real environment, or if they have delivered successful or unsuccessful innovation in projects. Hence, the limitation about the study sample is in regard to the application of the probability technique in selecting the sample to assure equity in choosing the respondents. This may not enable the researcher to generalize the research findings; though convenience sampling is used on participants form different organizations. In other words, the researcher has overcome this limitation as far as practicable.

The third limitation is the use of cross-sectional design to assess the proposed mediation hypotheses. Although a cross-sectional design may sometimes forbid drawing conclusions about causality, the mediation analysis has helped in pinpointing causality in the relationships between the study variables; this issue is somewhat moderated throughout including a number of consequence variables in the study model. Yet, research may use a longitudinal methodology, which can be particularly valuable in examining mediation hypotheses about competencies, and personality traits in UAE organizations, so as to recognize their nature and the direction of existing relationships. The reason is that longitudinal data can determine time sequences, estimate strength and consistency of relationships between sub-scales of relevant models, and indicate how dyadic relationships improve over a specific period of time (Bhal & Ansari, 2007).

The fourth limitation is about the sample characteristics and size. The sample is collected from respondents working in different industries (business, construction, health care, and information technology, and other industries). The reason is that the current study is concerned about the delivery of innovation in projects, generally, without specifying a particular industry type. However, to overcome this weakness, it is possible to collect data only from one industry type (i.e. construction), so the outcome will be particular for that specific industry. On the other side, the sample size of the questionnaire is 88 respondents, which is adequate for the current study, but collecting a larger sample can strengthen the findings of the research. It can be possible to overcome this weakness through collecting the sample during a longer period of time, and reducing the number of question to minimize the time spent to fill in the questionnaires (as explained in the following limitation).

The fifth limitation is about the questionnaire structure. In clarification, the total number of items of the questionnaire is 99 questions. Although this questionnaire is relatively long and time consuming, each one of these items has been designed to produce a specific measurement in order to draw accurate conclusions. However, it can be possible to overcome this weakness through performing a pilot test that analyzes the results and excludes some of the questionnaire items (the ones with low reliability and validity), before collecting the actual data of the study.

10.7 Future research recommendations

The previously mentioned limitations of this research can be addressed in future work. Besides, the following are recommendations for future research, which can be of interest to researchers:

- Complement this research through adding the individual dimensions to the study model. Including the project managers' practices and resistance to the delivery of successful innovation in projects will most likely have an important value for both academia and industries.
- Analyse other data sets from the Gulf Cooperation Council (GCC) region and other developed countries can be useful to confirm and generalize the findings obtained in this research.
- Refine the extracted project manager innovation: competencies, personality traits, and environment factors, and the measurements for the delivery of successful innovation. In other words, new identified measurements can be added, or existing measurements can be modified. Such a refinement is suggested to confirm the appropriateness of the measurements' selection.
- Further work is required to study in detail the relationship between demographics and the study variables, as this study has only demonstrated the descriptive statistics of the demographics and have not included them in any further analysis.
- It would be remarkable for future research to replicate the current study using a longitudinal design to examine the mediation effects in long-term with repeated measurements to find out whether the obtained results about the mediation relationships are more likely to be sustained.
- The statistical techniques, which are used to achieve the objectives of the current study, are regression and SEM (using AMOS software that is well matched with SPSS software). Thus, it is recommended to use other statistical techniques and compare the new findings with the results of this study.

- For data collection in future research, it is recommended to collected data from one industry, as this will make the results more accurate for that particular type of industry. At the same time, it is remarkable to attain a higher sample size through allowing for longer period to collect the sample, and reducing the time spent to complete the questionnaires (as clarified in the following recommendation).
- It is advisable to improve the questionnaire structure in future research, as this can be achieved through analyzing the results obtained from the pilot test, and eliminating the unreliable or invalid measurements before collecting the actual data of the study.

10.8 Concluding remarks

This thesis has passed through a series of factor analysis (EFA, and CFA) of study measurements, as this provides sufficient evidence to confirm all of the proposed hypotheses. Project manager innovation competencies have an influence on the delivery of successful innovation in projects. The study has also demonstrated that some results are consistent with some studies that have been conducted in other contexts. For example, Edum-Fotwe and McCaffer (2000) have pointed out that the fundamental roles of project managers is to maintain their professional competencies, and to be responsible for the overall success that can be reached when delivering the owner's innovation targets within the agreed constraints of schedule, cost, safety, and quality requirements. Arditi, Gluch and Holmdahl (2013) have explained that project managers' competencies can be fundamental elements that allow them to accomplish their targets, advance themselves, and improve their outcomes. Trivellas & Drimoussis (2013) have added that project managers are urged to identify and cultivate their key skills and competencies (that they may need to improve) in order to foster both project team members' effectiveness and project's success. Yet, the study findings also reveal that the project manager innovation personality traits and the project manager innovation environment are considered to have a mediation effect on the relationship between the project manager innovation competencies and the delivery of successful innovation.

The findings from this study can help HR managers to assess new recruits, hence that the main negative effects that can influence the delivery of successful innovation in projects can be avoided. Besides, there is valuable data in the study for project managers on how they may be perceived by their innovation competencies and innovation personality traits. In other words, and as have been mentioned by many scholars, the study of competencies support a range of HR management applications involving recruitment, training, deployment, succession planning, promotion, and reward management, all of which are essential for to deliver successful innovation in projects (Arditi, Gluch & Holmdahl, 2013; Dainty, Mei-I & Moore, 2005; Liikamaa, 2015).

10.9 Summary

This chapter aims to integrate the key results to represent a detailed discussion about the direct and mediational relationships in the findings and associate them with the findings obtained from the existing literature. It also provides explanation about the robustness of the study methodology, the accomplishment of the study objectives, the academic and practical implications of this research, and the study limitation. This chapter also has intended to provide an overall model that demonstrates the positive direct relationship between project manager innovation competencies and the delivery of successful innovation in projects, considering the project manager innovation: personality traits and environment as mediators for this relationship.

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12. Appendices

Appendix A: General Model and Guidelines for HPMC's Rating Scales

Table 2: General Model for the HPMC's Rating Scales

Scale Values		CRS	
5	In addition, plans or implements strategies to perpetuate the contributions of the competency.	5	STRENGTH
4	In addition, uses higher order competency behaviour to involve other people and units in the organisation.	4	
3	Demonstrates the basic competency behaviours in response to specific events and inputs demanded in the specific situation.	3	ADEQUACY
2	Fails to demonstrate the minimum basic behaviour which defines the competency.	2	LIMITATION
1	In addition, behaviour represents negative instances or effects of the competency.	1	

Table 3: Rating Scale for Conceptual Flexibility

Rating	Behaviour Conceptual Flexibility
5	In addition, envisions (or sets up strategies to envision) the implications of alternative options on the overall organisations; gets the group to evaluate different options.
4	In addition, relates alternative concepts or perspectives by planning to gather or by gathering information about the pros and cons of each.
3	Demonstrates viewing problems or situations from two perspectives, generates alternative conceptions or options about major issues, and holds them simultaneously.
2	Views problems or issues from different perspectives serially; that is, at different times. Not considered simultaneously.
1	Adopts and/or supports the adoption of a single perspective or option.

Appendix B: The study questionnaire

Questionnaire Cover Letter

Dear Participant,

Innovation is becoming a necessity to survive in the current highly competitive markets. In support to this, the recent project management practices encourage a successful adoption and implementation of new ideas and opportunities that can add value. Thus, the primary aim of the research is to critically investigate the competencies required by project managers (PMs) to deliver successful innovation in projects performed in the UAE.

In particular, your input can help us find relationships between PM competencies, PM traits, PM environment, and the delivery of successful innovation in projects. We estimate that it will take you approximately 20-25 minutes to complete the survey.

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

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

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

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

Yours faithfully

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The Questionnaire

PART 1 Project manager innovation competencies

1.0 Leadership

Please rate the importance of the following leadership skills for delivering innovation in projects

1. Leadership competency measurements	Not Important	Slightly Important	Moderately Important	Important	Very Important
1.1 Inspire others to create ideas and find new opportunities					
1.2 Proactively take initiative to innovate					
1.3 Use appropriate influence strategies to get rid or navigate around any obstacles					
1.4 Make decisions that help in delivering innovation					
1.5 Avoid analysis paralysis when new opportunities are identified through exhibiting a preference towards action					
1.6 Be alerted to new opportunities and can easily get adapted to challenges					
1.7 Care about building and developing new relationships					
1.8 Find practical and creative ways to resolve existing conflicts					
1.9 Forming, and developing an effective team that can deliver successful innovation					

2.0 Communication

Please rate the importance of the following communication skills for delivering innovation in projects

Communication competency measurements	Not Important	Slightly Important	Moderately Important	Important	Very Important
2.1 Listen to others without interrupting them					
2.2 Speak using a clear (local or foreign) language that is appropriate to the audience					
2.3 Write (emails, memos, report, etc.) clearly and concisely using any language					
2.4 Present products, ideas, or reports effectively					
2.5 Use computers and the internet efficiently					
2.6 Communicate in a tone and manner that shows respect					
2.7 Communicate the importance of innovative solutions systematically and openly					
2.8 Demonstrate strong awareness about innovation and					

3.0 Teamwork

Please rate the importance of the following teamwork skills for delivering innovation in projects

Teamwork competency measurements	Not Important	Slightly Important	Moderately Important	Important	Very Important
3.1 Share expertise, encouragement, and knowledge to strengthen team performance					
3.2 Support and collaborate with team members to solve any problems that may occur					
3.3 Share accountability for team results					
3.4 Attain constructive resolution of conflict					
3.5 Build, develop, and motivate teams to bring forward new ideas					
3.6 Recognize and award original ideas and ideas for improvement					
3.7 Frequently challenge others to be initiative and take risk					

4.0 Creativity

Please rate the importance of the following creativity skills for delivering innovation in projects

Creativity competency measurements	Not Important	Slightly Important	Moderately Important	Important	Very Important
4.1 Create new ideas by combining existing ideas					
4.2 Evaluate ideas/ products/ services to see how they can be improved					
4.3 Think about how to do things in a different way					
4.4 Look for new ideas outside of the work field, and try to apply them					
4.5 Look for new methods to create value in capabilities, products, processes, services, and strategies					
4.6 Look for surprising connections between things					
4.7 Approach challenges creatively though thinking outside the box					

5.0 Commitment

Please rate the importance of the following commitment skills for delivering innovation in projects

Commitment competency measurement	Not Important	Slightly Important	Moderately Important	Important	Very Important
5.1 Consider innovation as a main goal and central focus at work					
5.2 Believe that the major satisfaction in life comes from attaining successful innovation					
5.3 Believe that the most important achievements that take place involve innovation					
5.4 Is willing to put in a great deal of extra effort to support and implement innovation					
5.5 Get fully engaged when performing innovation relevant activities					
5.6 Have the ability to modify and change any course of action when required					

PART 2 Project manager innovation personality traits

Please rate the extend to which you agree or disagree with the following statements

Note: if you are not a project manager, please rate your project manager's innovation personality traits.

I see myself as someone who	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1. I am sociable and talkative					
2. I have an assertive personality					
3. I am full of energy					
4. I am adventurous and welling to take risk					
5. I generate a lot of enthusiasm					
6. I am sometimes shy, inhibited					
7. I am generally trust others					
8. I challenge others to be initiative and take risk					
9. I am sometimes rude to others					
10. I tend to find fault with others					
11. I like to cooperate with others					
12. I am considerate and kind to almost everyone					
13. I do things efficiently					
14. I tend to be disorganized					
15. I can be somewhat careless					
16. I persevere until the task is finished					
17. I am a reliable worker					
18. I make plans and follow through with them					
19. I remain calm in tense situations					
20. I get nervous easily					
21. I am depressed, blue					
22. I am emotionally stable, not easily upset					
23. I can be described as moody					
24. I worry a lot					
25. I am curious about many different things					
26. I have an active imagination					
27. I am sophisticated in art, music, or literature					
28. I prefer work that is routine					
29. I like to reflect, play with ideas					
30. I values artistic, aesthetic experiences					

PART 3 Delivering successful innovation in projects

1.0 Innovation for successful time outcomes

Please rate the importance of the following innovation success (time) models for delivering successful innovation in projects

Innovation success (time) models	Not Important	Slightly Important	Moderately Important	Important	Very Important
1.1 Creative ideas resulted in better control over project schedule					
1.2 Ability to respondent to scope change in a timely manner					
1.3 Speed of time from ideas submission to scope change feedback					
1.4 Ability to access project data and knowledge in a timely manner					
1.5 Speed and ability to exploit ideas to improve project success					

2.0 Innovation for successful Cost outcomes

Please rate the importance of the following innovation success (cost) models for delivering successful innovation in projects

Innovation success (cost) models	Not Important	Slightly Important	Moderately Important	Important	Very Important
2.1 Creative ideas resulted in better control over project costs					
2.2 Amount of earnings achieved through innovation relative to objectives, industry competitors, and overall competitive position					
2.3 Shareholder payments that reflect the growth achieved through applying new ideas					
2.4 Workplace payments for employee attraction, retention, and motivation.					
2.5 Customer and market payments for market share and customer loyalty					

3.0 Innovation for successful quality outcomes

Please rate the importance of the following innovation success (quality) models for delivering successful innovation in projects

Innovation success (quality) models	Not Important	Slightly Important	Moderately Important	Important	Very Important
3.1 Creative knowledge acquired by the project through the project					
3.2 Creative ideas improved overall control exercised over the project					
3.3 Enhanced quality of communication between the project members and users					
3.4 Creative ideas improved users' feelings regarding participation in the project					
3.5 Richness and robustness of innovation platforms, clusters of ideas, or opportunities selected and developed					
3.6 Strength of leadership commitment to growth through innovation as mentioned in the strategic initiatives and targets					

PART 4 Project manager innovation environment

1.0 Stakeholders

Please rate the influence of the following stakeholder issues on the delivery of successful innovation in projects

Stakeholders	Never	Seldom	Sometimes	Often	Almost always
1.1 Stakeholders agree on decisions in the favor of innovation					
1.2 Stakeholders cooperate together to deliver successful innovation					
1.3 Stakeholders are satisfied about the outcome of innovation					

2.0 Resources

Please rate the influence of the following resources issues on the delivery of successful innovation in projects

Resources	Never	Seldom	Sometimes	Often	Almost always
2.1 The right resources are selected to accomplish successful innovation					
2.2 The resources are allocated effectively to deliver successful innovation					

3.0 Culture

Please rate the influence of the following culture issues on the delivery of successful innovation in projects

Culture	Never	Seldom	Sometimes	Often	Almost always
3.1 Leveraging cultural diversity leads to successful innovation					
3.2 Working together to capture opportunities in spite of any cultural differences increases the chance of innovation success					
3.3 Innovative cultures enhance the delivery of successful innovation					

4.0 Market

Please rate the influence of the following market issues on the delivery of successful innovation in projects

Market	Never	Seldom	Sometimes	Often	Almost always
4.1 The market creates competitive advantage that emphasizes the success of innovation					
4.2 The market orientation influences the success of innovation					
4.3 New markets can emerge as a result of successful innovation					

PART 5 General Information

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

1. Job position

- ☐ Project manager
- ☐ Project management office member
- ☐ Project manager assistant
- ☐ Project team member

2. Gender

- ☐ Male
- ☐ Female

3. Education

- ☐ Less than high school
- ☐ High school
- ☐ College
- ☐ Bachelors
- ☐ Post graduate

4. Number of years worked in the current position

- ☐ 1 year or less
- ☐ 2 - 7
- ☐ 8 - 13
- ☐ 14 - 19
- ☐ 20 years or above

5. Nature of industry

- ☐ Business
- ☐ Construction
- ☐ Health care
- ☐ Information Technology (IT)
- ☐ Other industries

6. Organization type

- ☐ Government
- ☐ Simi-government
- ☐ Private
- ☐ Not-for-profit

Thank you for successfully completing this questionnaire.

Appendix C: Coding of the research measurements

Item	Code	Label	Item	Code	Label
1	LD1	Leadership skill (1 of 9) - Q1	51	PT37	Personality trait (15 of 30) – Q37
2	LD2	Leadership skill (2 of 9) - Q2	52	PT37	Personality trait (16 of 30) – Q37
3	LD3	Leadership skill (3 of 9) - Q3	53	PT37	Personality trait (17 of 30) – Q37
4	LD4	Leadership skill (4 of 9) - Q4	54	PT37	Personality trait (18 of 30) – Q37
5	LD5	Leadership skill (5 of 9) - Q5	55	PT37	Personality trait (19 of 30) – Q37
6	LD6	Leadership skill (6 of 9) - Q6	56	PT37	Personality trait (20 of 30) – Q37
7	LD7	Leadership skill (7 of 9) - Q7	57	PT37	Personality trait (21 of 30) – Q37
8	LD8	Leadership skill (8 of 9) - Q8	58	PT37	Personality trait (22 of 30) – Q37
9	LD9	Leadership skill (9 of 9) - Q9	59	PT37	Personality trait (23 of 30) – Q37
10	CM10	Communication Skill (1 of 8) - Q10	60	PT37	Personality trait (24 of 30) – Q37
11	CM11	Communication Skill (2 of 8) - Q11	61	PT37	Personality trait (25 of 30) – Q37
12	CM12	Communication Skill (3 of 8) - Q12	62	PT37	Personality trait (26 of 30) – Q37
13	CM13	Communication Skill (4 of 8) - Q13	63	PT37	Personality trait (27 of 30) – Q37
14	CM14	Communication Skill (5 of 8) - Q14	64	PT37	Personality trait (28 of 30) – Q37
15	CM15	Communication Skill (6 of 8) - Q15	65	PT37	Personality trait (29 of 30) – Q37
16	CM16	Communication Skill (7 of 8) - Q16	66	PT37	Personality trait (30 of 30) – Q37
17	CM17	Communication Skill (8 of 8) - Q17	67	TI67	Innovation delivery - time (1 of 5) - Q67
18	TM18	Teamwork skill (1 of 6) - Q18	68	TI68	Innovation delivery - time (1 of 5) - Q68
19	TM19	Teamwork skill (2 of 6) - Q19	69	TI69	Innovation delivery - time (1 of 5) - Q69
20	TM20	Teamwork skill (3 of 6) - Q20	70	TI70	Innovation delivery - time (1 of 5) - Q70
21	TM21	Teamwork skill (4 of 6) - Q21	71	TI71	Innovation delivery - time (1 of 5) - Q71
22	TM22	Teamwork skill (5 of 6) - Q22	72	CS72	Innovation delivery - cost (1 of 5) - Q72
23	TM23	Teamwork skill (6 of 6) - Q23	73	CS73	Innovation delivery - cost (1 of 5) - Q73
24	CR24	Creativity skill (1 of 7) - Q24	74	CS74	Innovation delivery - cost (1 of 5) - Q74
25	CR25	Creativity skill (2 of 7) - Q25	75	CS75	Innovation delivery - cost (1 of 5) - Q75
26	CR26	Creativity skill (3 of 7) - Q26	76	CS76	Innovation delivery - cost (1 of 5) - Q76
27	CR27	Creativity skill (4 of 7) - Q27	77	QL77	Innovation delivery - quality (1 of 6) - Q77
28	CR28	Creativity skill (5 of 7) - Q28	78	QL78	Innovation delivery - quality (1 of 6) - Q78
29	CR29	Creativity skill (6 of 7) - Q29	79	QL79	Innovation delivery - quality (1 of 6) - Q79
30	CR30	Creativity skill (7 of 7) - Q30	80	QL80	Innovation delivery - quality (1 of 6) - Q80
31	CT31	Commitment skills (1 of 6) - Q31	81	QL81	Innovation delivery - quality (1 of 6) - Q81
32	CT32	Commitment skills (2 of 6) - Q32	82	QL82	Innovation delivery - quality (1 of 6) - Q82
33	CT33	Commitment skills (3 of 6) - Q33	83	SK83	Environment - Stakeholder (1 of 3) - Q83
34	CT34	Commitment skills (4 of 6) - Q34	84	SK84	Environment - Stakeholder (2 of 3) - Q84
35	CT35	Commitment skills (5 of 6) - Q35	85	SK85	Environment - Stakeholder (3 of 3) - Q85
36	CT36	Commitment skills (6 of 6) - Q36	86	RS86	Environment - Resources (1 of 2) - Q86
37	PT37	Personality trait (1of 30) – Q37	87	RS87	Environment - Resources (2 of 2) - Q87

38	PT37	Personality trait (2 of 30) – Q37	88	CU88	Environment - Culture (1 of 3) - Q88
39	PT37	Personality trait (3 of 30) – Q37	89	CU89	Environment - Culture (2 of 3) - Q89
40	PT37	Personality trait (4 of 30) – Q37	90	CU90	Environment - Culture (3 of 3) – Q90
41	PT37	Personality trait (5 of 30) – Q37	91	MK91	Environment - Market (1 of 3)
42	PT37	Personality trait (6 of 30) – Q37	92	MK92	Environment - Market (2 of 3)
43	PT37	Personality trait (7 of 30) – Q37	93	MK93	Environment - Market (3 of 3)
44	PT37	Personality trait (8 of 30) – Q37	94	JP94	Job position - Q94
45	PT37	Personality trait (9 of 30) – Q37	95	GN95	Gender - Q95
46	PT37	Personality trait (10 of 30) – Q37	96	ED96	Education - Q96
47	PT37	Personality trait (11 of 30) – Q37	97	EX97	Experience - Q97
48	PT37	Personality trait (12 of 30) – Q37	98	IN98	Industry nature - Q98
49	PT37	Personality trait (13 of 30) – Q37	99	OT99	Organization type - Q99
50	PT37	Personality trait (14 of 30) – Q37			

Appendix D: Variables with their amount of missing data

	N	Mean	Std. Deviation	Missing		No. of Extremes[a]	
				Count	Percent	Low	High
LD1	88	4.0795	1.14693	9	9.3	10	0
LD2	88	3.9205	1.07449	9	9.3	0	0
LD3	88	3.7386	1.23637	9	9.3	0	0
LD4	88	3.9091	1.14105	9	9.3	0	0
LD5	88	3.3636	.96110	9	9.3	4	0
LD6	88	3.8295	1.13686	9	9.3	0	0
LD7	88	3.8182	1.15017	9	9.3	0	0
LD8	88	3.9091	1.13093	9	9.3	0	0
LD9	87	4.1264	1.10816	10	10.3	0	0
CM10	88	3.9432	1.12809	9	9.3	0	0
CM11	88	3.8750	1.18237	9	9.3	0	0
CM12	87	3.8621	1.14295	10	10.3	0	0
CM13	87	3.8736	1.03210	10	10.3	0	0
CM14	86	3.7326	1.14197	11	11.3	0	0
CM15	87	4.0115	1.07286	10	10.3	0	0
CM16	87	3.6322	1.10090	10	10.3	5	0
CM17	87	3.7011	1.14237	10	10.3	0	0
TM18	86	4.0000	1.07375	11	11.3	0	0
TM19	87	4.0690	1.00918	10	10.3	7	0
TM20	87	3.7241	1.11741	10	10.3	0	0
TM21	86	4.1395	1.00777	11	11.3	7	0
TM22	87	3.8276	1.15343	10	10.3	0	0
TM23	87	3.3563	1.06724	10	10.3	4	0
CR24	87	3.4253	1.12717	10	10.3	4	0
CR25	86	3.6744	1.07858	11	11.3	0	0
CR26	86	3.8140	1.09019	11	11.3	0	0
CR27	86	3.4535	1.22385	11	11.3	0	0
CR28	87	3.7011	1.24932	10	10.3	0	0
CR29	86	3.3372	1.27058	11	11.3	0	0
CR30	87	3.9885	1.21516	10	10.3	0	0
CT31	86	3.5581	1.18426	11	11.3	7	0
CT32	87	3.9770	5.46017	10	10.3	8	1
CT33	87	3.5057	1.18000	10	10.3	6	0
CT34	87	3.7816	1.03907	10	10.3	4	0
CT35	87	3.7126	1.06649	10	10.3	0	0
CT36	87	3.7701	1.08586	10	10.3	0	0

PT37	88	3.7273	1.19123	9	9.3	0	0
PT38	88	3.6932	1.07594	9	9.3	4	0
PT39	87	3.8161	1.08401	10	10.3	0	0
PT40	88	3.8864	1.14903	9	9.3	0	0
PT41	87	3.7701	.85862	10	10.3	1	0
PT42	88	3.0000	1.21296	9	9.3	0	0
PT43	88	3.4318	1.04821	9	9.3	6	0
PT44	88	3.6023	1.02318	9	9.3	5	0
PT45	87	3.5057	1.15006	10	10.3	4	0
PT46	88	3.4318	1.14265	9	9.3	0	0
PT47	88	3.9659	.92784	9	9.3	7	0
PT48	88	3.9205	1.05287	9	9.3	10	0
PT49	87	3.9885	.97043	10	10.3	10	0
PT50	88	3.6136	1.20756	9	9.3	0	0
PT51	88	3.5341	1.20295	9	9.3	7	0
PT52	88	3.9205	.88696	9	9.3	7	0
PT53	88	4.1023	.88460	9	9.3	5	0
PT54	88	3.9545	1.06035	9	9.3	9	0
PT55	88	3.7045	1.08447	9	9.3	5	0
PT56	87	3.5517	1.21769	10	10.3	8	0
PT57	88	3.7273	1.16192	9	9.3	0	0
PT58	88	3.5341	1.21247	9	9.3	7	0
PT59	88	3.4432	1.20209	9	9.3	7	0
PT60	88	3.1591	1.24924	9	9.3	0	0
PT61	88	3.6250	1.08609	9	9.3	4	0
PT62	88	3.8295	1.07449	9	9.3	0	0
PT63	87	3.2414	1.16105	10	10.3	0	0
PT64	88	3.3977	1.27342	9	9.3	11	0
PT65	87	3.7011	1.10090	10	10.3	7	0
PT66	88	3.5455	1.25862	9	9.3	0	0
TI67	88	3.7500	1.16708	9	9.3	0	0
TI68	88	3.7955	.97272	9	9.3	2	0
TI69	88	3.7159	.99364	9	9.3	3	0
TI70	88	3.7159	1.08224	9	9.3	4	0
TI71	88	3.8182	1.00052	9	9.3	0	0
CS72	88	3.8864	1.11862	9	9.3	0	0
CS73	87	3.6207	1.02573	10	10.3	3	0
CS74	88	3.6023	1.08850	9	9.3	5	0
CS75	87	3.8621	1.12242	10	10.3	0	0
CS76	88	3.8068	1.02675	9	9.3	0	0

QL77	88	3.7159	1.02776	9	9.3	4	0
QL78	87	3.8851	.93293	10	10.3	0	0
QL79	87	4.1609	1.05515	10	10.3	8	0
QL80	87	4.0345	.89505	10	10.3	6	0
QL81	86	3.6395	.96908	11	11.3	4	0
QL82	86	3.9884	.95171	11	11.3	7	0
SK83	86	3.9419	4.38542	11	11.3	3	1
SK84	87	3.5402	1.07622	10	10.3	2	0
SK85	87	3.5862	1.09493	10	10.3	4	0
RS86	87	3.8736	1.15944	10	10.3	0	0
RS87	87	3.9770	1.09944	10	10.3	0	0
CU88	86	3.7442	1.18009	11	11.3	0	0
CU89	86	3.9070	1.09144	11	11.3	0	0
CU90	87	3.9310	1.09749	10	10.3	0	0
MK91	87	3.8506	1.17660	10	10.3	0	0
MK92	86	3.7209	1.01345	11	11.3	3	0
MK93	87	3.7241	1.11741	10	10.3	0	0
Job.Position	86	2.1047	1.32868	11	11.3	0	0
Gender	87	1.7471	.46301	10	10.3	0	0
Education	85	4.2824	.76550	12	12.4	1	0
Experience	87	2.5517	1.46079	10	10.3	0	0
Ind.Nature	86	2.6512	1.59976	11	11.3	0	0
Org.Type	87	2.4253	.89744	10	10.3	0	0

a. Number of cases outside the range (Q1 - 1.5*IQR, Q3 + 1.5*IQR).

Appendix E: Regression Weights obtained from AMOA

Table E.1: Regression Weights for PMIC1 and DSI

			Estimate	S.E.	C.R.	P	Label
Response	<---	Impact	.725	.123	5.875	***	
Control	<---	Impact	.838	.107	7.846	***	
CM17	<---	Impact	1.055	.109	9.643	***	
CM16	<---	Impact	1.033	.103	10.010	***	
CM15	<---	Impact	1.099	.103	10.650	***	
CM14	<---	Impact	1.040	.123	8.454	***	
CM13	<---	Impact	1.003	.102	9.872	***	
CM12	<---	Impact	.969	.116	8.377	***	
CS73	<---	Control	.885	.113	7.837	***	
CS74	<---	Control	.969	.117	8.273	***	
CS75	<---	Control	1.056	.116	9.092	***	
CS76	<---	Control	.943	.110	8.600	***	
QL77	<---	Control	.969	.106	9.116	***	
QL78	<---	Control	.872	.096	9.085	***	
QL79	<---	Control	1.043	.113	9.214	***	
LD4	<---	Impact	1.110	.116	9.527	***	
LD1	<---	Impact	1.093	.113	9.655	***	
CM10	<---	Impact	.916	.114	8.024	***	
CM11	<---	Impact	1.084	.118	9.162	***	
CT34	<---	Impact	1.000				
TM21	<---	Impact	.967	.096	10.058	***	
TM19	<---	Impact	.915	.095	9.595	***	
TM18	<---	Impact	1.015	.103	9.852	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.842	.108	7.766	***	
CS72	<---	Control	1.027	.119	8.643	***	
QL82	<---	Control	.835	.105	7.988	***	
QL81	<---	Control	.763	.104	7.327	***	
QL80	<---	Control	.798	.096	8.348	***	
TI67	<---	Response	1.000				
TI68	<---	Response	.974	.127	7.657	***	
TI69	<---	Response	.732	.118	6.196	***	

Table E.2: Regression Weights for PMIC2 and DSI

			Estimate	S.E.	C.R.	P	Label
Control	<---	Cognitive	.887	.127	6.974	***	
Response	<---	Cognitive	.788	.138	5.725	***	
CS73	<---	Control	.860	.117	7.362	***	
CS74	<---	Control	1.030	.130	7.942	***	
CS75	<---	Control	1.075	.127	8.429	***	
CS76	<---	Control	.899	.116	7.770	***	
QL77	<---	Control	.985	.116	8.503	***	
QL78	<---	Control	.924	.106	8.716	***	
QL79	<---	Control	1.051	.123	8.573	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.890	.118	7.528	***	
CS72	<---	Control	1.070	.129	8.275	***	
QL82	<---	Control	.864	.109	7.900	***	
QL81	<---	Control	.816	.112	7.299	***	
QL80	<---	Control	.777	.102	7.594	***	
TI67	<---	Response	1.000				
TI68	<---	Response	.972	.124	7.836	***	
TI69	<---	Response	.727	.122	5.948	***	
CT36	<---	Cognitive	1.000				
CR28	<---	Cognitive	1.348	.147	9.177	***	
CR27	<---	Cognitive	1.114	.151	7.380	***	
CR26	<---	Cognitive	1.084	.128	8.435	***	
CR25	<---	Cognitive	.922	.128	7.205	***	
TM20	<---	Cognitive	1.010	.134	7.555	***	
LD9	<---	Cognitive	1.006	.133	7.580	***	
LD8	<---	Cognitive	1.038	.138	7.535	***	
LD2	<---	Cognitive	1.145	.130	8.832	***	

Table E.3: Regression Weights for PMIC3 and DSI

			Estimate	S.E.	C.R.	P	Label
Response	<---	Effectiveness	.676	.144	4.676	***	
Control	<---	Effectiveness	.845	.138	6.116	***	
CS73	<---	Control	.843	.119	7.067	***	
CS74	<---	Control	.966	.125	7.757	***	
CS75	<---	Control	1.110	.133	8.351	***	
CS76	<---	Control	.950	.117	8.104	***	
QL77	<---	Control	1.006	.119	8.444	***	
QL78	<---	Control	.894	.106	8.443	***	
QL79	<---	Control	1.021	.120	8.482	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.833	.089	9.348	***	
CS72	<---	Control	1.074	.133	8.090	***	
QL82	<---	Control	.864	.109	7.932	***	
QL81	<---	Control	.815	.113	7.223	***	
QL80	<---	Control	.834	.106	7.840	***	
TI67	<---	Response	1.000				
TI68	<---	Response	.949	.134	7.082	***	
TI69	<---	Response	.788	.130	6.074	***	
CR24	<---	Effectiveness	1.000				
TM23	<---	Effectiveness	.884	.143	6.192	***	
TM22	<---	Effectiveness	1.213	.156	7.794	***	
LD7	<---	Effectiveness	1.007	.160	6.281	***	
LD6	<---	Effectiveness	.925	.159	5.822	***	
LD3	<---	Effectiveness	1.060	.167	6.355	***	

Table E.4: Regression Weights for PMIC4 and DSI

			Estimate	S.E.	C.R.	P	Label
Control	<---	Managerial	.851	.135	6.289	***	
Response	<---	Managerial	.803	.150	5.366	***	
CS73	<---	Control	.875	.118	7.404	***	
CS74	<---	Control	.987	.126	7.839	***	
CS75	<---	Control	1.091	.130	8.397	***	
CS76	<---	Control	.958	.119	8.060	***	
QL77	<---	Control	.995	.117	8.492	***	
QL78	<---	Control	.921	.105	8.766	***	
QL79	<---	Control	1.002	.119	8.417	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.851	.087	9.753	***	
CS72	<---	Control	1.048	.129	8.099	***	
QL82	<---	Control	.861	.111	7.782	***	
QL81	<---	Control	.791	.110	7.183	***	
QL80	<---	Control	.784	.102	7.667	***	
TI67	<---	Response	1.000				
TI68	<---	Response	1.001	.133	7.541	***	
TI69	<---	Response	.685	.126	5.449	***	
CT35	<---	Managerial	1.000				
CT33	<---	Managerial	1.256	.160	7.861	***	
CT32	<---	Managerial	1.156	.167	6.923	***	
CT31	<---	Managerial	1.216	.154	7.890	***	
CR29	<---	Managerial	1.183	.171	6.923	***	

Table E.5: Regression Weights for the mediation of PMIPT on PMIC1 and DSI

			Estimate	S.E.	C.R.	P	Label
Traits	<---	Impact	5.038	.584	8.634	***	
Control	<---	Traits	.123	.020	6.150	***	
Response	<---	Traits	.172	.030	5.649	***	
Response	<---	Impact	-.244	.148	-1.650	.099	
Control	<---	Impact	.153	.096	1.594	.111	
CM17	<---	Impact	.998	.103	9.694	***	
CM16	<---	Impact	1.050	.098	10.759	***	
CM15	<---	Impact	1.028	.094	10.976	***	
CM14	<---	Impact	.878	.104	8.402	***	
CM13	<---	Impact	.912	.092	9.887	***	
CM12	<---	Impact	.932	.109	8.551	***	
CS73	<---	Control	.830	.116	7.173	***	
CS74	<---	Control	1.021	.127	8.023	***	
CS75	<---	Control	1.075	.124	8.698	***	
CS76	<---	Control	.942	.116	8.129	***	
QL77	<---	Control	1.015	.114	8.898	***	
QL78	<---	Control	.913	.102	8.968	***	
QL79	<---	Control	1.041	.116	8.970	***	
LD4	<---	Impact	1.039	.103	10.139	***	
LD1	<---	Impact	1.035	.105	9.879	***	
CM10	<---	Impact	1.020	.112	9.144	***	
CM11	<---	Impact	1.060	.109	9.766	***	
CT34	<---	Impact	1.000				
TM21	<---	Impact	.953	.089	10.716	***	
TM19	<---	Impact	.888	.089	9.984	***	
TM18	<---	Impact	1.000	.096	10.381	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.847	.083	10.174	***	
CS72	<---	Control	1.035	.122	8.498	***	
QL82	<---	Control	.845	.104	8.160	***	
QL81	<---	Control	.803	.106	7.594	***	
QL80	<---	Control	.793	.098	8.050	***	
TI67	<---	Response	1.000				
TI68	<---	Response	.973	.123	7.927	***	
TI69	<---	Response	.812	.123	6.584	***	
PMIPT1	<---	Traits	1.000				
PMIPT2	<---	Traits	-.040	.104	-.386	.699	
PMIPT3	<---	Traits	.551	.050	10.977	***	
PMIPT4	<---	Traits	.428	.044	9.843	***	
PMIPT5	<---	Traits	.340	.043	7.865	***	
PMIPT6	<---	Traits	-.040	.050	-.787	.431	

Table E.6: Regression Weights for the mediation of PMIPT on PMIC2 and DSI

			Estimate	S.E.	C.R.	P	Label
Traits	<---	Cognitive	6.003	.769	7.808	***	
Control	<---	Cognitive	.066	.151	.440	.660	
Response	<---	Cognitive	-.337	.225	-1.497	.135	
Control	<---	Traits	.142	.026	5.490	***	
Response	<---	Traits	.183	.037	4.911	***	
CS73	<---	Control	.840	.108	7.776	***	
CS74	<---	Control	.973	.116	8.373	***	
CS75	<---	Control	1.028	.115	8.961	***	
CS76	<---	Control	.891	.108	8.243	***	
QL77	<---	Control	.910	.104	8.740	***	
QL78	<---	Control	.880	.096	9.129	***	
QL79	<---	Control	.972	.108	9.021	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.811	.104	7.829	***	
CS72	<---	Control	1.009	.113	8.891	***	
QL82	<---	Control	.799	.098	8.129	***	
QL81	<---	Control	.787	.101	7.792	***	
QL80	<---	Control	.763	.092	8.310	***	
TI67	<---	Response	1.000				
TI68	<---	Response	.997	.121	8.239	***	
TI69	<---	Response	.742	.117	6.331	***	
CT36	<---	Cognitive	1.000				
CR28	<---	Cognitive	1.313	.148	8.891	***	
CR27	<---	Cognitive	1.031	.149	6.908	***	
CR26	<---	Cognitive	1.126	.135	8.319	***	
CR25	<---	Cognitive	.976	.132	7.398	***	
TM20	<---	Cognitive	1.046	.140	7.467	***	
LD9	<---	Cognitive	1.027	.138	7.423	***	
LD8	<---	Cognitive	1.030	.140	7.336	***	
LD2	<---	Cognitive	1.126	.133	8.440	***	
PMIPT1	<---	Traits	1.000				
PMIPT2	<---	Traits	-.044	.104	-.427	.669	
PMIPT3	<---	Traits	.573	.050	11.400	***	
PMIPT4	<---	Traits	.433	.044	9.802	***	
PMIPT5	<---	Traits	.328	.043	7.661	***	
PMIPT6	<---	Traits	-.028	.053	-.536	.592	

Table E.7: Regression Weights for the mediation of PMIPT on PMIC3 and DSI

			Estimate	S.E.	C.R.	P	Label
Traits	<---	Effectiveness	5.900	.920	6.415	***	
Response	<---	Effectiveness	-.544	.202	-2.698	.007	
Control	<---	Effectiveness	.087	.115	.761	.447	
Control	<---	Traits	.132	.020	6.476	***	
Response	<---	Traits	.195	.033	5.893	***	
CS73	<---	Control	.914	.121	7.542	***	
CS74	<---	Control	.998	.127	7.886	***	
CS75	<---	Control	1.118	.128	8.737	***	
CS76	<---	Control	.974	.121	8.070	***	
QL77	<---	Control	1.057	.122	8.694	***	
QL78	<---	Control	.926	.107	8.658	***	
QL79	<---	Control	1.044	.122	8.533	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.841	.093	9.034	***	
CS72	<---	Control	1.071	.127	8.410	***	
QL82	<---	Control	.879	.107	8.212	***	
QL81	<---	Control	.839	.112	7.497	***	
QL80	<---	Control	.789	.102	7.701	***	
TI67	<---	Response	1.000				
TI68	<---	Response	1.052	.133	7.897	***	
TI69	<---	Response	.858	.132	6.523	***	
CR24	<---	Effectiveness	1.000				
TM23	<---	Effectiveness	1.024	.162	6.317	***	
TM22	<---	Effectiveness	1.368	.180	7.603	***	
LD7	<---	Effectiveness	1.040	.173	6.012	***	
LD6	<---	Effectiveness	1.074	.177	6.059	***	
LD3	<---	Effectiveness	1.143	.184	6.210	***	
PMIPT1	<---	Traits	1.000				
PMIPT2	<---	Traits	.011	.107	.103	.918	
PMIPT3	<---	Traits	.585	.053	11.091	***	
PMIPT4	<---	Traits	.436	.044	9.803	***	
PMIPT5	<---	Traits	.339	.044	7.795	***	
PMIPT6	<---	Traits	-.041	.051	-.794	.427	

Table E.8: Regression Weights for the mediation of PMIPT on PMIC4 and DSI

			Estimate	S.E.	C.R.	P	Label
Traits	<---	Managerial	5.964	.918	6.495	***	
Control	<---	Managerial	.083	.123	.677	.498	
Response	<---	Managerial	-.044	.166	-.262	.793	
Control	<---	Traits	.131	.021	6.261	***	
Response	<---	Traits	.136	.027	5.106	***	
CS73	<---	Control	.901	.121	7.474	***	
CS74	<---	Control	1.041	.129	8.092	***	
CS75	<---	Control	1.120	.132	8.501	***	
CS76	<---	Control	.954	.122	7.812	***	
QL77	<---	Control	.984	.117	8.405	***	
QL78	<---	Control	.917	.106	8.617	***	
QL79	<---	Control	1.006	.121	8.320	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.858	.086	9.998	***	
CS72	<---	Control	1.088	.130	8.357	***	
QL82	<---	Control	.862	.109	7.902	***	
QL81	<---	Control	.829	.112	7.395	***	
QL80	<---	Control	.805	.103	7.823	***	
TI67	<---	Response	1.000				
TI68	<---	Response	1.014	.135	7.516	***	
TI69	<---	Response	.839	.133	6.318	***	
CT35	<---	Managerial	1.000				
CT33	<---	Managerial	1.290	.172	7.520	***	
CT32	<---	Managerial	1.282	.185	6.941	***	
CT31	<---	Managerial	1.310	.175	7.464	***	
CR29	<---	Managerial	1.120	.184	6.073	***	
PMIPT1	<---	Traits	1.000				
PMIPT2	<---	Traits	-.013	.107	-.120	.904	
PMIPT3	<---	Traits	.539	.050	10.835	***	
PMIPT4	<---	Traits	.421	.044	9.537	***	
PMIPT5	<---	Traits	.315	.042	7.567	***	
PMIPT6	<---	Traits	-.057	.052	-1.092	.275	

Table E.9: Regression Weights for the mediation of PMIE on PMIC1 and DSI

			Estimate	S.E.	C.R.	P	Label
Environment	<---	Impact	1.936	.276	7.011	***	
Response	<---	Impact	-.109	.149	-.735	.463	
Control	<---	Impact	.105	.096	1.094	.274	
Control	<---	Environment	.367	.060	6.101	***	
Response	<---	Environment	.398	.082	4.856	***	
CM17	<---	Impact	1.038	.111	9.374	***	
CM16	<---	Impact	1.061	.106	10.039	***	
CM15	<---	Impact	1.069	.104	10.298	***	
CM14	<---	Impact	.940	.118	7.982	***	
CM13	<---	Impact	.992	.103	9.622	***	
CM12	<---	Impact	.944	.117	8.043	***	
CS73	<---	Control	.806	.111	7.244	***	
CS74	<---	Control	.955	.118	8.122	***	
CS75	<---	Control	1.028	.117	8.824	***	
CS76	<---	Control	.905	.110	8.208	***	
QL77	<---	Control	1.003	.110	9.100	***	
QL78	<---	Control	.863	.097	8.937	***	
QL79	<---	Control	1.018	.113	9.048	***	
LD4	<---	Impact	1.040	.114	9.165	***	
LD1	<---	Impact	1.090	.114	9.572	***	
CM10	<---	Impact	.968	.116	8.315	***	
CM11	<---	Impact	1.112	.117	9.508	***	
CT34	<---	Impact	1.000				
TM21	<---	Impact	.985	.099	9.943	***	
TM19	<---	Impact	.934	.098	9.580	***	
TM18	<---	Impact	1.014	.106	9.612	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.876	.108	8.128	***	
CS72	<---	Control	1.024	.117	8.759	***	
QL82	<---	Control	.891	.104	8.539	***	
QL81	<---	Control	.822	.104	7.906	***	
QL80	<---	Control	.778	.098	7.960	***	
TI67	<---	Response	1.000				
TI68	<---	Response	.995	.130	7.678	***	
TI69	<---	Response	.829	.128	6.494	***	
PMIE1	<---	Environment	1.000				
PMIE2	<---	Environment	.837	.103	8.152	***	
PMIE3	<---	Environment	1.277	.148	8.634	***	
PMIE4	<---	Environment	1.205	.140	8.628	***	

Table E.10: Regression Weights for the mediation of PMIE on PMIC2 and DSI

			Estimate	S.E.	C.R.	P	Label
Environment	<---	Cognitive	2.087	.338	6.182	***	
Control	<---	Cognitive	.198	.097	2.035	.042	
Response	<---	Cognitive	-.016	.155	-.102	.919	
Control	<---	Environment	.346	.054	6.365	***	
Response	<---	Environment	.382	.076	5.061	***	
CS73	<---	Control	.845	.107	7.914	***	
CS74	<---	Control	.915	.112	8.206	***	
CS75	<---	Control	1.038	.114	9.120	***	
CS76	<---	Control	.868	.108	8.051	***	
QL77	<---	Control	.997	.108	9.263	***	
QL78	<---	Control	.900	.095	9.433	***	
QL79	<---	Control	1.015	.111	9.133	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.875	.104	8.418	***	
CS72	<---	Control	1.038	.115	9.031	***	
QL82	<---	Control	.839	.096	8.730	***	
QL81	<---	Control	.786	.100	7.833	***	
QL80	<---	Control	.791	.096	8.225	***	
TI67	<---	Response	1.000				
TI68	<---	Response	.948	.115	8.258	***	
TI69	<---	Response	.837	.122	6.833	***	
CT36	<---	Cognitive	1.000				
CR28	<---	Cognitive	1.400	.156	8.982	***	
CR27	<---	Cognitive	1.087	.157	6.919	***	
CR26	<---	Cognitive	1.159	.141	8.246	***	
CR25	<---	Cognitive	1.026	.140	7.344	***	
TM20	<---	Cognitive	1.068	.142	7.538	***	
LD9	<---	Cognitive	1.079	.144	7.477	***	
LD8	<---	Cognitive	1.055	.145	7.295	***	
LD2	<---	Cognitive	1.189	.137	8.675	***	
PMIE1	<---	Environment	1.000				
PMIE2	<---	Environment	.866	.104	8.360	***	
PMIE3	<---	Environment	1.285	.146	8.789	***	
PMIE4	<---	Environment	1.221	.142	8.625	***	

Table E.11: Regression Weights for the mediation of PMIE on PMIC3 and DSI

			Estimate	S.E.	C.R.	P	Label
Environment	<---	Effectiveness	2.220	.371	5.987	***	
Response	<---	Effectiveness	-.484	.182	-2.657	.008	
Control	<---	Effectiveness	.062	.106	.582	.560	
Control	<---	Environment	.368	.059	6.286	***	
Response	<---	Environment	.477	.088	5.406	***	
CS73	<---	Control	.901	.115	7.859	***	
CS74	<---	Control	.984	.119	8.241	***	
CS75	<---	Control	1.112	.124	8.960	***	
CS76	<---	Control	.951	.115	8.296	***	
QL77	<---	Control	1.031	.114	9.049	***	
QL78	<---	Control	.917	.104	8.841	***	
QL79	<---	Control	1.009	.114	8.820	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.867	.085	10.245	***	
CS72	<---	Control	1.097	.127	8.665	***	
QL82	<---	Control	.894	.104	8.619	***	
QL81	<---	Control	.847	.107	7.887	***	
QL80	<---	Control	.820	.101	8.082	***	
TI67	<---	Response	1.000				
TI68	<---	Response	1.092	.136	8.014	***	
TI69	<---	Response	.850	.137	6.206	***	
CR24	<---	Effectiveness	1.000				
TM23	<---	Effectiveness	.989	.151	6.535	***	
TM22	<---	Effectiveness	1.362	.167	8.171	***	
LD7	<---	Effectiveness	1.153	.171	6.731	***	
LD6	<---	Effectiveness	.994	.158	6.291	***	
LD3	<---	Effectiveness	1.147	.173	6.626	***	
PMIE1	<---	Environment	1.000				
PMIE2	<---	Environment	.867	.101	8.565	***	
PMIE3	<---	Environment	1.263	.143	8.827	***	
PMIE4	<---	Environment	1.213	.137	8.852	***	

Table E.12: Regression Weights for the mediation of PMIE on PMIC4 and DSI

			Estimate	S.E.	C.R.	P	Label
Environment	<---	Managerial	1.880	.321	5.856	***	
Control	<---	Managerial	.193	.091	2.127	.033	
Response	<---	Managerial	.135	.148	.907	.364	
Control	<---	Environment	.364	.056	6.519	***	
Response	<---	Environment	.345	.072	4.771	***	
CS73	<---	Control	.878	.110	7.987	***	
CS74	<---	Control	.997	.118	8.421	***	
CS75	<---	Control	1.044	.117	8.958	***	
CS76	<---	Control	.935	.110	8.533	***	
QL77	<---	Control	.969	.104	9.284	***	
QL78	<---	Control	.906	.095	9.570	***	
QL79	<---	Control	.973	.106	9.169	***	
TI70	<---	Control	1.000				
TI71	<---	Control	.848	.082	10.286	***	
CS72	<---	Control	1.059	.116	9.131	***	
QL82	<---	Control	.833	.098	8.528	***	
QL81	<---	Control	.818	.104	7.851	***	
QL80	<---	Control	.774	.095	8.159	***	
TI67	<---	Response	1.000				
TI68	<---	Response	.981	.113	8.691	***	
TI69	<---	Response	.826	.118	7.008	***	
CT35	<---	Managerial	1.000				
CT33	<---	Managerial	1.224	.150	8.150	***	
CT32	<---	Managerial	1.220	.162	7.509	***	
CT31	<---	Managerial	1.264	.153	8.260	***	
CR29	<---	Managerial	1.260	.170	7.427	***	
PMIE1	<---	Environment	1.000				
PMIE2	<---	Environment	.877	.108	8.133	***	
PMIE3	<---	Environment	1.352	.155	8.750	***	
PMIE4	<---	Environment	1.248	.145	8.602	***	