The influence of Digital Skills on Project Innovation Success

تأثير المهارات الرقمية على نجاح مشاريع الإبتكار

by

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Abstract (in English)

Digital skills assist organizations to maintain competitive advantages and increase innovation capacity in a fast-changing digital economy. Although digital skills are growing in importance, research that examine the influence of these skills on projects, specifically, innovation projects, are found to be scant, creating a knowledge gap. The focus of this research is the identification of digital skills clusters that would impact project innovation success. Therefore, the aim is to investigate those skills clusters and ascertain if they influence project innovation success in the UAE. Various literatures were reviewed to identify digital skills clusters that would impact project success as well as identify project innovation success factors, which are the desired outcomes for employing digital skills. For the research methodology, a quantitative approach was used by conducting a survey questionnaire of those working in project management profession or innovation or information technology. The survey aimed to gather data that would answer research hypotheses regarding the various relationships between digital skills clusters and project innovation success. The data was analyzed using statistical analyses such as correlation and regression, to identify relationships. The five core digital skills clusters that were identified from literature were technical skills, information skills, communication and collaboration skills, content-creation skills and problem-solving skills. In which, each cluster consists of several variables. This research has filled knowledge gap since it addressed the interplay between the three disciplines of digital literacy (skills), project management and innovation management, through grouping the different types of digital skills into clusters then identifying the influence or contribution of each cluster towards innovation success in projects. In addition to ranking the importance of each cluster and identifying the most influential factors. The results show that digital skills clusters have positive impact on project innovation success. It is recommended for organizations to upgrade their digital skills and fill skills gap to become innovation leaders and boost their performance.

Keywords: Project management, Digital literacy, Digital competency, Digital skills clusters, Digital economy, Digital content, innovation, innovation factors/enablers, innovation projects

ملخص البحث (باللغة العربية)

تساعد المهارات الرقمية المؤسسات على الحفاظ على المزايا التنافسية وزيادة القدرة على الابتكار في اقتصاد رقمي سريع التغير. على الرغم من تزايد أهمية المهارات الرقمية، إلا أن البحوث التي تتناول تأثير هذه المهارات على المشاريع، وعلى وجه التحديد، مشاريع الابتكار، تعتبر ضئيلة، مما يخلق فجوة معرفية. بالتالي، يركز هذا البحث على تحديد مجموعات المهارات الرقمية التي يمكن أن تؤثر على تنفيذ مشاريع ابتكار ناجحة. لذلك ، فإن الهدف من هذا البحث هو التحقق من مجموعات المهارات الرقمية والتأكد مما إذا كانت تؤثر على نجاح مشاريع الإبتكار في دولة الإمارات العربية المتحدة.

تم إجراء مراجعة موسعة للأبحاث ذات صلة لتحديد مجموعات المهارات الرقمية التي من شأنها أن تؤثر على نجاح مشاريع الإبتكار وكذلك تحديد عوامل نجاح الابتكار في المشروع، وهي النتائج المرجوة لتوظيف المهارات الرقمية.

بالنسبة لمنهجية البحث، فقد تم استخدام منهج البحوث الكمية عن طريق إجراء استبيان إلكتروني لأولئك الذين يعملون في مهنة إدارة المشاريع أو الابتكار أو تكنولوجيا المعلومات. يهدف المسح إلى جمع البيانات التي من شأنها الإجابة على الفرضيات البحثية المتعلقة بالعلاقات المختلفة بين مجموعات المهارات الرقمية ونجاح الابتكار في المشروع. تم تحليل البيانات باستخدام كل من تحليلات الارتباط والانحدار لنمذجة العلاقات. كانت مجموعات المهارات الرقمية الأساسية الخمس التي تم تحديدها من البحوث ذات الصلة هي المهارات التقنية ومهارات المعلومات ومهارات الاتصال والتعاون ومهارات إنشاء المحتوى ومهارات حل المشكلات، حيث تتكون كل مهارة على عدة عوامل. لقد ملأ هذا البحث فجوة معرفية لأنه خاطب التفاعل أو العلاقة بين ثلاثة تخصصات مختلفة وهي المعرفة الرقمية (المهارات) وإدارة المشاريع وإدارة الابتكار، وذلك من خلال تجميع الأنواع المختلفة من المهارات الرقمية في مجموعات ثم تحديد تأثير أو مساهمة كل مجموعة في نجاح مشاريع الإبتكار. بالإضافة إلى تصنيف أهمية كل مهارة وتحديد العوامل الأكثر تأثيرا. أظهرت نتائج البحث أن مجموعات المهارات الرقمية لها تأثير إيجابي على نجاح مشاريع الإبتكار وبالتالي نوصي المؤسسات بترقية مهاراتها الرقمية وسد فجوة المهارات لتصبح قادة الابتكار ولتعزيز أدائها.

كلمات البحث: إدارة المشاريع، المعرفة الرقمية، ، الكفاءة الرقمية، مجموعات المهارات الرقمية ، الاقتصاد الرقمي، المحتوى الرقمي، الإبتكار، عوامل الإبتكار، مشاريع الإبتكار

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1 Chapter One: Introduction

This chapter presents an introduction of the research content by demonstrating a background of the relevant concepts and including an overview of the problem statement, research scope, research aim and objectives, research questions and research structure.

1.1 Background

An increasing number of organizations are considering project management as an overarching tool for their survival (Kerzner, 2009), wherein, it is used as a tool to increase the probability of successful projects (Ghaben & Jaaron, 2015). With the expansion of digital economy, project management (PM) profession has witnessed rapid changes in the past decades, as more challenges and opportunities have appeared (Project Management Institute, 2018). PMI reported that project leaders face several challenges with project complexity, volatility, ambiguity and dynamics. In addition to the challenges associated with the impact of disruptive technologies and the radical new ways of working (Rodriguez, 2018). PMI claim there are various challenges with the traditional project management methodologies, approaches and skills, to manage projects effectively. For organizations to succeed in digital environment, they need to be innovative, agile, forward-thinking, experimental and adapt rapidly to the evolving digital environment (Project Management Institute, 2018; 2019). All of that suggest the need for organizations to take on a full range of skills and competencies to be innovative, achieve agility and thrive in digital times (Marsh, 2018, Project Management Institute, 2018). The future entails that organizations need to mature their abilities and upskill their talents to enable success in today's digital environment. Hence, the light has been shed on the concept of “digital skills” since it is increasingly becoming an important topic and a valued commodity (Van Deursen and Helsper, 2015).

1.2 Modern Project Management

The profession of project management is known to be an “emerging profession” (Weaver, 2007). Studies have shown that project management domains fall into two types which are traditional PM and modern PM (Alban, 2016). Wherein, modern project management has been growing in importance in PM field. To differentiate between the two types, Shenhar & Dvir (2007), describe traditional PM as the formal or standard approach, in which, it is based on a certain model that is fixed and known. Similarly, Alban (2016), state that the traditional management process uses standardized techniques and methods which have been developed for decades, and it is applied for most domains by using known scope and common technology. Shenhar & Dvir (2007) adds that traditional project management considers two main factors for project success, the assumption that all projects of the same size, and the triple constraints of PM. They sate that these two classical factors are no longer satisfactory in the current environment, specially, since it is applicable for a small and specific group of projects. Alban (2016) state the same, that some projects do not completely fit the traditional type. For that reason, he states that modern PM methods came into the picture to deal with the traditional PM shortcomings, since is used for distinctive and unique projects, giving an example of agile and scrum methodologies (Alban, 2016). Adaptive PM emerged as a term for modern PM, which suggests adopting new flexible approaches or models for some projects that traditional approach would not fit and without necessary eliminating traditional PM, it includes modern projects that are known to be complex, vague, uncertain, unpredictable and dynamic (Shenhar & Dvir, 2007). Innovation projects fall into this category because unlike conventional projects, innovation projects by its definition are known to be unique, elusive, and coupled with high uncertainty (Filippov & Mooi, 2010). Therefore, it is argued by Keegan and Turner (2002) that traditional PM approaches needs to be revised for innovation projects since it is believed to restrain innovation. This view confirms that modern approaches would be recommended for managing innovation. Thus, fthe application of digital skills within PM context is investigated as one of the recent modern models to achieve innovation success in this context.

1.3 Digital Skills

Digital skills and talents are increasingly becoming in-demand since organizations are facing wider gaps in finding the right talents that can handle the impact of innovation or disruptive technologies (Milano, 2019). The importance of digital skills has been highlighted by many reports as presented by Forbes or World Economic Forum or OECD (Milano, 2019; Patel, 2017). Patel (2017) presented a study that found more than 90% of jobs in the United Kingdom demand a certain level of digital skills, finding out that there is digital skills impasse in the U.K, costing it billions of pounds and affecting its economy severely causing a major concern for organizations and governments. Patel also presented training gap since training on digital skills has not kept pace with the cosnstantly changing technologies (Patel, 2017).

PMI argue that to keep pace with innovation and disruptive technologies, project leaders and teams need to apply new skills, such as, digital skills to adapt with this changing environment (Project Management Institute, 2018; 2019). To model the relationship between digital skills and capabilities with project performance. A study by Khin & Ho (2018) found that both digital capability and digital orientation link to digital innovation since positive relationship was found, indicating that digital competency is an important factor of digital innovation. It was also found by him that it is more likely for companies to develop innovative digital solutions which will increase their performance when they are dedicated on taking digital technologies and enhancing their skills to better manage these technologies are most properly going to develop innovative digital solutions (Khin & Ho, 2018).

1.4 Innovation

Innovation is defined as the carrying out new idea or process or product to stay fit against competitors in the marker and create competitive advantage (Galbraith, 1984; Ghaben and Jaaron, 2015). The importance of innovation has been highlighted due to its various advantages, which include achieving economic competitive advantage and economic benefits (Clark, 2012; Pattersson, 2009). Another view is provided by Johnsson (2016), looking beyond its competitive advantage or economic benefits, stressing that innovation should be carried out in an ever-increasing pace to fulfill market needs and changing environment. Some literatures highlighted the positive impact of innovation on performance and competitiveness (Choi et al., 2013; Khin & Ho, 2018). Also, as evident, Kuckertz et al (2010), found that companies who are faster in applying innovative initiatives win over companies who are opposite to that. However, achieving successful innovation projects is easier said than done since innovation projects are known to be complex, highly risky and uncertain (Filippov & Mooi, 2010). This has thus raised concerns for managing innovation and specifically for delivering successful innovation since the expected outcome is to look at innovation success factors and not the traditional factors of success.

Studies which relate digital skills to successful innovation are limited. However, Khin & Ho (2018), tested the link between innovation and digital capability in the context of digital technology, in which, he reported that digital skills have positive impact on innovation in digital context. Similarly, Mohammadyari & Singh (2015) reported through a study that successful technology results was achieved because of the contribution of digital skills in the workforce.

1.5 Problem Statement

The United Arab Emirates has embarked a journey to become one of the leading countries in fostering and encouraging innovation (The UAE government, 2020). The country's visionary leadership has been undertaking a series of innovation-focused initiatives, aiming for an innovation-driven economy that corresponds with the UAE's vision 2021 (Janahi, 2018; 2020). This direction is believed to have increased pressure on managing innovation projets and delievering successful innovation. For project success in particular, the aim is not to measure success based on the triple constraints of cost, scope and schedule, it goes beyond that by measuring other factors (Shenhar & Dvir, 2007; Andersen et al., 2006). The intended success of innovation projects should be to explore innovation performance factors (Johnsson, 2016). All of that calls for the need to introduce modern project management approaches (Shenhar & Dvir, 2007), specially, since innovation projects are known to be highly uncertain and unique, unlike conventional projects (Filippov & Mooi, 2010; Ghaben & Jaaron, 2015). One approach include an idiosyncratic area of using project management tools to handle innovation projects, as suggested by Filippov and Mooi (2010), who presented the concept of "innovation project management". It is a concept that shows the relationship between two distinctive studies which are PM and Innovation Management. However, since many organizations today are impacted by disruptive technologies and the changing digital economy, another approach has emerged as suggested by PMI (2018). It is embracing a full spectrum of digital skills and competencies to thrive in digital times and influence project performance (Project Management Institute, 2018). This emerging approach expands the concept of "innovation project management" which introduces the linkage between PM and innovation management, by adding another dimension which is digital literacy (skills).

The area of digital skills influence on project management and innovation still offers suggestions for further research, there are inadequate studies investigating the impact of digital skills on project performance, precisely, innovation success. In addition to that, no studies were found to have tested the effect of digital skills clusters on successful innovation in projects. Therefore, limited evidence on the positive influence of digital skills on performance warrants the examination of digital skills effect on project innovation success. It is also to fill knowledge gap by identifying the link or relationship between the three disciplines of digital literacy, project management and innovation management. The rationale behind measuring the impact of digital skills is that organizations and governments with strong digital skills and capabilities are in a better arrangement to carry innovation to create competitive advantages and satisfy stakeholders better, thereby increasing their competitiveness. The rationale is also because digital skill has been gaining prominence as many reports started talking about digital skills gap as a major concern for governments and organizations (Patel, 2017).

1.6 Research Scope

This research scope is to identify digital skills clusters from literature to test its relationship or influence on project innovation success factors that were also identified from relevant studies. The scope of this test covers employees working in the public and private sectors in the UAE, targeting a sample of experienced employees to provide meaningful and valid responses. In which, the research focused on those involved with project management, innovation, Information Technology and experts or consultants in the field. Therefore, the context of this research is applicable within the UAE, so the results will explicitly represent the country. This being said, it does not mean that the concepts of digital skills and innovation success are not applicable in other countries, there just needs to be evidence provided by other countries and by investigating larger population.

Based on the purpose of this research, the scope is to explores the interplay between three different disciplines which are digital literacy (skills), project management and innovation management. Since each discipline represent an enormous sea of studies, an in-depth review of these disciplines is beyond the research scope. Therefore, each discipline is reviewed to serve a specific purpose in order to investigate the interplay between the three distinctive disciplines. For digital literacy studies, it is to identify digital skills clusters, while for project management studies, it is to explore project success factors and the association between PM and digital skills. Finally, innovation management studies is reviewed to identify innovation enablers that contribute to innovation success. All of these studies are used as a reference to bridge the gaps between these fields and develop theoretical framework which will be tested out.

1.7 Research Aim and Objectives

The aim is to investigate the influence of digital skills clusters on achieving project innovation success. It is to determine if embracing digital skills and competencies within organizations in the UAE would lead to increment of successful innovation projects, in essence, to identify whether positive relationship exists between these two main variables, digital skills and project innovation success.

The objectives of this research are to:

- Explain the term “digital skill” and its association with project management profession;
- Identify digital skills clusters that influence project innovation success;
- Establish the rationale for employing digital skills and knowledge in project management, and identify gaps with the current skills and talents;
- Investigate if applying digital skills influence achieving innovation success in projects

The rationale for this study is to fill knowledge gap by identifying the interplay involving Project Management, Innovation Management and Digital Literacy (skills) studies. It is to highlight new emerging concept in modern PM, which is the application of digital skills within projects to increase performance and achieve innovation success. It is also to verify whether digital skills gap is considered a major concern and an obstacle to achieving innovation success in this digital age. By means, is learning digital skills worth the investment?

1.8 Research Questions

This paper seeks to address the next questions:

1. What is the definition of digital skill, and how it relates to project management profession?
2. What are digital skills clusters, its classifications and levels?
3. Does acquiring digital skills influence project innovation success?

1.9 Research structure

This study intends to investigate the influence of project management digital skills on achieving project innovation success. Overall, this study consists of six chapter as follows:

Chapter One presents an introduction of the research topic including a background of the relevant concepts and an overview of the research problem, research scope, research aim and objectives and research questions.

Chapter Two provides a literature of three different disciplines including digital skills, project management and innovation management. It is to investigate digital skills context in terms of definitions, classifications, levels, and digital skills in PM context. It is also to investigate innovation context and project success factors with a focus on innovation success factors.

Chapter Three presents the research hypotheses and proposed theoretical framework which demonstrates the independent and dependent variable that were identified.

Chapter Four reflects the research methodology that is applied in this study, it describes the research strategy, approach and design. Specifically, it describes the quantitative research method which is based on an online questionnaire.

Chapter Five displays the research outcomes and findings based on analyzing the collected data from questionnaire responses, through using SPSS.

Chapter Six reports discussions of the core findings and results, recommendations for further research, limitations of the study and summary of the outcomes.

2 Chapter Two: Literature Review

This chapter consists of literature review from various sources, presenting relevant studies to the topic to have an initial understanding of the concept and develop the theoretical framework. The first part shows studies regarding digital skills and the second part demonstrates project success factors, exclusively, innovation success factors.

2.1 Digital Skills Definition

In literature, there is a series of terms used by research circles to define the skills required for the digital economy. According to Orlik (2018), some of the popular phrases that have gained momentum in research are known as “digital literacy”, “digital competency”, “digital talent”, “digital skills”, “digital capabilities” and “twenty first century skills”, where they all have a slightly differing meaning from one another. Martin and Grudziecki (2006), also stress that there is a distinct difference between the three concepts of digital skills, digital competency and digital literacy. However, even with the slight difference in meaning, these underlying concepts all encapsulate similar theme. Generally, these concepts represent future skills the workforce needs to move forward in the age of digitization. Therefore, digital terminologies have become an area of focus in the past few decades as many academics have written definitions and introduced models to develop a theoretical understanding of the topic.

The notion of this conceptualization is not new, some argue, that it goes back to at least the 1980’s with the phrase “computer literacy” (Bawden, 2001). Later, it was developed to introduce a more popular term known as “digital literacy”, which had already been applied and practiced by some authors throughout the nineties (Bawden, 2001; Buckingham, 2010).

But, it was Gilster (1997) who firstly introduced this terminology naming it after his book, “digital literacy”, he defined it as the “ability to understand and use information in multiple formats from a wide range of sources when its presented via computers” (p. 1). Simultaneously, he specify it as a set of competencies to use the internet by communicating as well as finding, managing and altering digital information (Gilster, 1997). Many scholars integrated elements of Gilster model into their framework, in the sense where he emphasized that these skills represent acquiring ideas (Martin and Grudziecki, 2006; Bawden, 2008). Nevertheless, his definition received a lot of arguments because some believed that it is very broad and generic. Yet, it seems that as a general term, further studies and definitions came into the picture to support his concept. As more encompassing terms emerged to further relate to the whole concept. Among these terms is “digital skills”, which is widely acknowledged as a more elaborate concept. To support this statement, Van Deursen and Van Dijk (2014) argue that using the term “digital skills” is more preferable than using “digital competency” or “digital literacy” since it entails a broad set of activities and indicates a capacity that is utilized rather than a potential.

Van Deursen and Van Dijk (2014), explained in their book, “digital skills: unlocking the information society”, in which, they added on the knowledge implied by digital literacy by using the concept of digital skills, since it better describes the kind of communications, execution and interaction required to thrive in the information-rich community, where channels varies. Experts in the field, Van Deursen and Helsper (2015), highlighted that within digital literacy theories, digital skills have gained prominence after years of concentrating on other topics such as technology access. The Broadband Commission for Sustainable

Development (2017) made the same remark, that in addition to technology access, these skills are increasingly becoming essential in order to make good use of technologies and benefit from it. So, the question is what are digital skills. An early dentition of “digital skills” is provided by Jan van Dijk (2005), he defines it as a “collection of skills needed to operate computers and their networks, to search and select information in them, and to use them for one’s own purpose” (p. 73). His definition entails that it represents operational or technical skills as well as information and strategic skills. Over the years, his definition has been refined and developed in various studies.

At present, a single unified definition of digital skill does not exist (Bawden, 2008), because as stressed by many, digital skills need to be constantly updated to adapt to technological changes. According to the Broadband Commission for Sustainable Development (2017), “current definitions of digital skills and competencies are related closely to recent ongoing trends in ICTs. New devices, applications and genres of technology will often involve altered, sometimes additional, skills and competencies” (P, 23). Members state that due to the growth and development of new technologies, there will be a rise in “digital skills” that will relate to people’s understandings of digital technologies rather than the direct use of these technologies.

In addition to this, even though there are many conceptualization of digital skills, it has been reported by Skillsoft (2019) that these theoretical definitions are short and lacking. They stress that modern organizations need to develop their own definition of digital skills based on what fits them and through mapping these skills to their organizational goals (Skillsoft, 2019). Similarly, Orlik (2018) listed four steps that can support modern organizations to define their own digital skills. The first step is comparing existing models of digital skills as identified in research. The second is identifying the context of use, which means the employees who require these skills, the setting which will be applied and the time-frame of its relevance (Orlik, 2018). This step is required because there is a diverse set of people and they are of different levels, roles, job category and education levels. Understanding the demand of these skills as influenced by the digital environment is the third step. The final one is understanding how the dentition should be articulated to the targeted audience (Orlik, 2018). Overall, from analyzing the required skills for the future, digital skills was reported to be one of the top ten skills indicating that it is a highly essential skill in modern organizations (Senter and McClelland, 2015; Marsh, 2018). (Project Management Institute, 2018)

Nevertheless, digitization has also led to the acceleration of innovation since it drives organization's competitiveness. Therefore, some studies have integrated the concept of digital skills with innovation (Marsh, 2018; Khin and Ho, 2018; Project Management Institute, 2018). A recent report of PMI supports that, which presented a survey findings that identified positive relationship between innovative organizations and the application of digital skills, tools and approaches within their organizations (Project Management Institute, 2018).

2.2 Digital skills Classifications

As defined above, the term digital skills is viewed as plural since it encompasses a collection of specific skills and abilities. Thus, several scholars have classified digital skills into various skill-set, types and categories. Steyaert (2002) introduced a popular frameworks for classifying digital skills, which was then developed by Van Deursen and Van Dijk, it classified digital skills into four main types of skills. The first one is “operational skills” referring to the basic technical skills of how to use technological devices, or more specifically, how to use network hardware and software. The second type is “formal skills” and it refers to the ability to navigate and browse network sources such as understanding hyperlinks and how to move between web pages. “Information skills” is the third type and it denotes to the ability to look for, choose, process and assess information online. The fourth and final type is “strategic skills”, it relates to the capability to use online information to achieve a specific outcome. Throughout the years, they have elaborated on their concept to come up with more refined classification of digital skill-set (Van Deursen and Van Dijk, 2009; Van Deursen and Van Dijk 2010; Van Deursen et al., 2014; Van Dijk and Van Deursen, 2014). In their later work in 2014, they added two additional skill-set to their framework which are “communication skills” and “content-related skills”, making it a total of six key skills (Van Deursen and Van Dijk, 2014). Wherein, “communication skills” was interpreted as knowing how to exchange meaning or information with others through using communication channels, mails, instant messages and creating online contents. While, “content-related skills” as the skills of the user to generate content online. In order to make clear distinguish between the various skill-set, they have categorized these skills into two categories. As agreed by many, content-related skills are considered as an important addition to digital skills clusters, they are referred to as “creative skills” (Ferrari, 2012; Helsper, 2008; Van Dijk and Van Deursen, 2014).

The European Digital Competence Framework, known as DigComp, have backed similar interpretation of the above, it consist of five key components of digital competencies which include “problem-solving, information, content-creation, communication, and safety competencies” (Ferrari, 2013; the department of Elearning, 2015; Vulorikari et al, 2016). It can be seen that it covers three skill types from the previous model and two additional skill set, which are safety and problem-solving skills. This conceptual framework explicitly outlines the true meaning of being digitally intellect in a progressively digital economy (the department of Elearning, 2015). Even though this framework offers tools to help policymakers improve citizens digital skills, it can be used as a valid reference to identify digital skills needed by project managers.

Technology is increasingly becoming an integrated part of project management profession. Many studies have addressed digital tools, methodologies and approaches that can be applied when managing projects in the digital age. Currently, there is no standard procedure to identify and define the various types of digital skills that can be applied within PM context. Additionally, there is a growing demand to escalate the current traditional PM skills to apply digital inclusion in a beneficial and meaningful way. Thus, the focus here is to outline clusters of digital skills in PM context. In essence, identifying digital skills in literature that can be applied across project management functions and process. The identified digital skills in this research are based on several conceptualizations and models that have classified digital skills into more specific skill-set. Basically, the five clusters selected for this study were derived from digitals kills related studies by Iordache et al (2016), Van Deursen, Helsper and Eynon (2014), Van Dijk and Van Deursen (2014), UNESCO (2013), Ferrari (2013), Ala-Mutka (2011), Bawden (2008),Vulorikari, et al (2016). These studies and models are consistent with digital and internet skills literature, they present strong content validity for digital skills.

However, they do not implicitly link digital skills with PM or project success factors. Therefore, this research selects the most relevant digital skills in literature to integrate it with PM. It is also to investigate how these skills might impact specific factors of project performance, specifically, innovation success, to determine the relationship between digital skills and project innovation performance. This study is addressing digital skills that are applied to innovation projects. These skills are classified into five major clusters, technical skills, information skills, communication and collaboration skills, digital content-creation skills and problem-solving skills.The following sections present digital skills variables that are associated with each cluster.

2.2.1 Technical skills

These skills are categorized as medium-related skills and it refers to the operational and core skills for operating digital devices and mediums (Van Deursen, 2010). Essentially, it is the know-how of using both hardware and software. Van Deursen et, al (2014), presented some examples of these operational skills which include knowing how to connect a Wi-Fi network, download or upload files, adjust settings and complete online forms. In literature, there were varying opinions regarding these skill-set, many frameworks emphasize that these are the primary skills for digital use, while in contrast, frameworks like DigComp, does not consider technical skills as a component of the digital competency framework since it already acknowledges that technological skills are included and it goes beyond that (Iordache et al., 2017). The department of e-learning (2015) presented Alex Grech definition of digital competency which has similar view, his definition entails that digital skills consist of various social practices, so it is not just about technological skills, it goes beyond that. While, Bawden

(2008), show the conflicting views of individuals since some view digital competency as being mainly related with technical skills while others view it as the socio-emotional view of working in digital surrounding, including thinking skills such as creativity, analytical thinking and solving problems. Nevertheless, it is believed that technical skills are essential requirement because, as stressed by Van Deursen (2010), the disappearance of the operational and technical skills means that content-related skills will not be performed since it depends on it. Therefore, digital skills need to include both the fundamental skills for using the technology and the skills to use online content (Van Deursen et al., 2014). Moreover, a significant factor for highlighting the importance of technological skills is that they are prone to change due to the constant advances in technological tools and devices (Ala-Mutka, 2011). Generally, most frameworks agree that operational or technical skills are necessary in order to use technologies (Iordache et al., 2016). Therefore, this research consider technical skills as one of the digital skills clusters that need to be considered as a factor.

H2: Technical skills will positively influence successful innovation of projects

Table (1): technical skills indicators

<table>
<tr><th>Technical skills variables</th><th>Source</th></tr>
<tr><td>Ability to use hardware</td><td rowspan="2">(Iordache et al., 2016)
(Van Deursen et al., 2014)
(Van Deursen & Van Dijk, 2014)
(UNESCO, 2013)
(Ferrari, 2013)
(Ala-Mutka, 2011)
(Bawden, 2008)</td></tr>
<tr><td>Ability to handle digital structures</td></tr>
<tr><td>Ability to use digital tools and software</td><td>(Iordache et al., 2016)
(Van Deursen et al., 2014)
(Van Deursen & Van Dijk, 2014)</td></tr>
</table>

Ability to use the internet	(UNESCO, 2013) (Ferrari, 2013) (Ala-Mutka, 2011)

2.2.2 Information Skills

As identified by many models, there are several skills and abilities that represent information skills, it is commonly known as knowing how to examine and assess online information (Iordache et al., 2017). Another common definition is provided by Ferrari (2013), he states it is the ability to assess the accuracy, reliability, quality and integrity of information as well as to compare and integrate it from various sources. He adds that it is the ability to store and retrieve data by classifying and organizing information using various methods. Moreover, it includes the capabilities to use information management software or application (Ferrari, 2013). According to Van Deursen et al (2014), some examples of technical skills include the capability to discover information easily on the internet, using a broad range of strategies when searching online, deciding the best keyword for searching online, verifying retrieved information, selecting search results with confidence, verifying the accuracy and reliability of information by checking different websites. These are general examples of information skills, other detailed examples suggested by Sena (2019) include the ability to collect data and interpret it using analytic tools such as Google Analytic, ability to classify and audit information, and ability to logically structure information using digital tools to aid in process (simple tools include POP, Frame Box, etc). Another practical example for information skills in the workforce is provided by the Scottish Council for Voluntary Organisations (2018), it includes storing files securely on encrypted hardware. In project management context, information and data are essential for making solid project assumptions, building on strong hypothesis and possibly eliminating any potential risks. Therefore, acquiring digital information skills as shown in the table below appears to be useful to project managers and teams, especially for project planning. Indeed, one of the digital skills that was identified by PMI is the ability to make decision based on the presented data (Project Management Institute, 2018). This suggests that using information skills is important for data analysis.

H3: Information skills will positively influence successful innovation of projects

Table (2):information skills variables

<table>
<tr><th>Information Skills variables</th><th>Source</th></tr>
<tr><td>Ability to analyze and critically assess the reliability and credibility of sources of data, information and digital content</td><td rowspan="4">(Vuorikari et al., 2016)
(Iordache et al., 2016)
(Van Deursen et al., 2014)
(Van Deursen & Van Dijk, 2014)
(Ferrari, 2013)
(Ala-Mutka, 2011)
(Bawden, 2008)
(Martin & Grudziecki, 2006)</td></tr>
<tr><td>Ability to analyze, understand and critically assess the digital content and information</td></tr>
<tr><td>Ability to recover and store data and information in digital settings</td></tr>
<tr><td>Ability to search, identify, and locate data, information and digital content</td></tr>
<tr><td>Ability to organize and manage data, information and digital content</td><td>(Iordache et al., 2016)
(Van Deursen et al., 2014)
(Van Deursen & Van Dijk, 2014)
(Ferrari, 2013)
(Ala-Mutka, 2011)
(Martin & Grudziecki, 2006)</td></tr>
</table>

2.2.3 Digital Communication and Collaboration Skills

Almost all models include communication skills as a major cluster of digital skills since the majority of these models have discussed the concept of exchanging and sharing content. Accordingly, this cluster is categorized as content-related skills. Through examining various frameworks, all have mentioned that this skill-set is related to creating and understanding messages as well as exchanging and sharing content. According to Ferrari (2013), digital communication skills represent interacting through different digital means, sharing content that is created or available online, collaborating using digital channels and media, creating and managing digital identities and finally understanding the behavioral norm through virtual interaction. Collaboration was also discussed at the other end, it involves interacting and collaborating online such as the participation in online networks. Another indicator that has been discussed in many models is “Netiquette”, described by Van Dijk & Van Deursen (2014) as the proper behavior or manner that must be applied online, in which they stress that it needs to be learned in practice. In addition to this, a skill that has been discussed by few include creating digital identity, which is explained by Ala-Mutka (2011) as creating various identities to be used in different contexts. Some practical examples of this skill-set is provided by the Scottish Council for Voluntary Organisations (2018), it includes the ability to participate in video conference meetings and using web-based application for document sharing. Besides all that has been mentioned, in PM context, communication skill is considered as one of the most critical skills for managing projects. In PM studies, this skill-set have been described generally, however, here we relate it closely to using digital technologies, the same goes for collaboration.

H4: Digital communication and collaboration skills will positively influence successful innovation of projects

Table (3): digital communication and collaboration skills variables

Communication & Collaboration Skills variables	Source
Know how to share digital content and information with others through digital means	(Vuorikari et al., 2016) (Iordache et al., 2016) (Van Deursen et al., 2014) (Van Deursen & Van Dijk, 2014) (Ferrari, 2013) (Ala-Mutka, 2011) (Martin & Grudziecki, 2006)
Ability to use digital technologies for collaborative processes (i.e. interact & collaborate with others as well as participate in online communities and networks)	
Know how to manage the produced data through several digital tools and channels	
Know how to manage and generate digital identities	(Vuorikari et al., 2016) (Iordache et al., 2016) (Van Deursen & Van Dijk, 2014) (Ferrari, 2013) (Ala-Mutka, 2011)

2.2.4 Digital Content-Creation Skills

This cluster reflects media skills such as the capabilities to generate content in different environment and formats while also ensuring that the produced content such as images, videos and multimedia should be of a certain acceptable quality in order to be published online (Van Dijk & Van Deursen, 2014; Van Deursen et al, 2014). According to Iordache et al (2016), the majority of digital literacy frameworks mentioned the creation and editing of new content as part of content-creation skills. Martin & Grudziecki (2006), state that this skill-set pertains to the ability to create new digital output or knowledge, information and media content, which is for the purpose of achieving a specific task or solving a problem. Another skill that was pointed in these models is the ability to modify and integrate existing material or content, which can be highly linked to intellectual property rights and license awareness since using existing content requires users to understand property rights, identify the different types of license and find information on license rules (Iordache et al, 2016; Ferrari, 2013). Others define content-creation skills as the ability to develop new ways of doings or generate ideas (Hinrichsen and Coombs, 2013; Mengual-Andres et al., 2016). They also identifies content-creation skills as a variable of creativity dimension, which is one of the identified twenty first century skills dimensions. A practical example of this cluster includes knowing how to edit or write in HTML (i.e. formatting text for the web, adding text, images and videos), creating or editing or inputting content through a content management system (i.e using Wordpress).

H5: Digital content-creation skills will positively influence successful innovation of projects

Table (4): digital content-creation skills variables

<table>
<tr><th>Digital Content-Creation Skills variables</th><th>Source</th></tr>
<tr><td>Know how to generate new digital content or knowledge through digital means</td><td rowspan="3">(Vuorikari et al., 2016)
(Iordache et al., 2016)
(Van Deursen et al., 2014)
(Van Deursen & Van Dijk, 2014)
(Ferrari, 2013)
(Ala-Mutka, 2011)
(Martin & Grudziecki, 2006)</td></tr>
<tr><td>Ability to amend, re-elaborate, and integrate existing digital content to create something new and original</td></tr>
<tr><td>Ability to produce creative expressions through digital means</td></tr>
<tr><td>Understanding how to deal with intellectual property rights and license</td><td>(Vuorikari et al., 2016)
(Iordache et al., 2016)
(Van Deursen et al., 2014)
(Ferrari, 2013)
(Ala-Mutka, 2011)</td></tr>
<tr><td>Programming (Ability to build a series of comprehensible instructions for a computing system to perform a specific task)</td><td>(Vuorikari et al., 2016)</td></tr>
</table>

2.2.5 Digital Problem solving Skills

Fair number of models have discussed problem-solving skills as a cluster (Martin & Grudziecki, 2016; Ala-Mutka, 2011; Ferrari, 2013; Vulorikari, et al, 2016). For example, Ferrari (2013), define it as the needed skills to make decision concerning which digital tools to use for any specific goal or purpose. It is also known as knowing how to use digital tools for solving problems, such as technical or conceptual problems. It is believed that these skills can also be called decision-making skills because it involves making informed decisions to reach solution through using the support of digital tools. For instance, it includes knowing how to use smart tools and systems, such as virtual analytic, for decision-making (Marsh, 2018). Digital problem solving skills also include innovating with technologies and creatively using digital tools. An example of that can be through The skills that are associated with that include the capability to exploit technological potential or explore the web/market to search for solutions (Ferrari, 2013). In addition, it is the ability to identify digital skills gaps for the purpose of improvement and adapting with digital advancement, the constantly changing technologies.

H6: Digital problem-solving skills will positively influence successful innovation of projects

Table (5): digital problem-solving skills variables

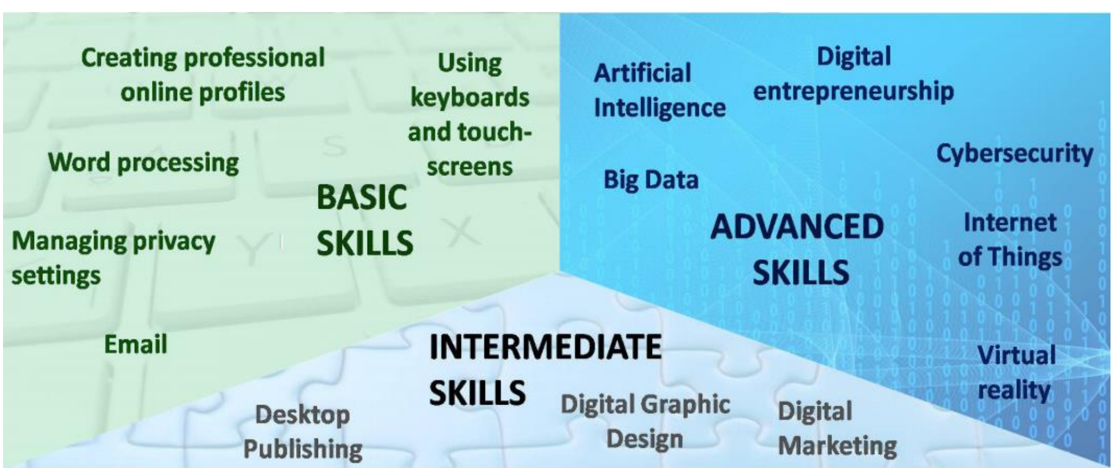
Problem-solving skills variables	Source
Ability to make decisions regarding digital needs	Vulorikari, et al (2016) Ferrari (2013) Ala-Mutka (2011) Martin & Grudziecki (2006)
Ability to solve technical problems when using digital devices (i.e. trouble-shooting or other complex issues)	

Ability to make decisions on the most suitable digital tools based on a particular need;	
Creatively use and innovate with technologies	
Ability to identify digital skills gap	

2.3 Digital Skills Levels

Although definitions and classifications of digital skills vary, these skills are present in a range from the basic fundamental skills to the more advanced specific skills. According to the Broadband Commission for Sustainable Development (2017), "digital skills" not only consist of skills, but it is a mixture of attitude, traits, expertise, know-how and decisive understanding. Ferrari (2013), showed that the five identified skill areas can be found in varying degree based on three proficiency levels. They range between basic, intermediate and advanced levels of skills. The first one is entry-level, it represents the basic functional skills to perform tasks and use online applications and digital devices (Broadband Commission for Sustainable Development, 2017; International Telecommunication Union, 2018). It includes skills such as the ability to connect to the internet, use keyboard, manage files on laptop, access information, and setup accounts. It also includes cognitive skills such as numeracy, reading and writing. These skills are essential to function at a minimum level in order to interact with others and access services, so it's about accessing and engaging with these technologies. The second level represents intermediate skills, referred to as generic digital skills. It include the ability to critically use technologies such as creating content and performing certain functions including digital marketing and graphic design. These skills are to make beneficial and substantial use of digital technologies. This level reflect "digital literacy" or "digital skills" models that were identified in literature, such as the European Digital Competence Framework for Citizens, OECD framework of digital skills and digital literacy model of Canada Centre for Digital and Media literacy (Broadband Commission for Sustainable Development, 2017). The final level refers to the advanced spectrum of digital skills, "the specialized skills". It represent the higher-level skills required by experts working in ICT profession and occupation; it is the required skills to use technology in transformative way such as programming and developing applications. Basically, it is the abilities to make use of digital technologies such as coding, Artificial Intelligence (AI), machine learning, big data analytic and Internet of Things (International Telecommunication Union, 2018). This level is associated with digital-related jobs that requires certain skill-set and it usually results from extensive training, advanced education and extensive practical experience (Broadband Commission for Sustainable Development, 2017; ITU digital toolkit). Figure 1 below shows the continuum of digital skills.

Figure (1): digital skills continuum



Source: (International Telecommunication Union, 2018)

It is essential to understand the maturity level of digital skills within organizations in order to concentrate on the key skills that needs to be improved. Overall, the presented papers provide significant insight into the different models and frameworks of digital skills and the distinguish made between them. The majority of these explain digital skills in the context of education or ICT skills. Apparently, there is lack of emphasis of the application of digital skills in PM context.

2.4 Digital Skills in Project Management Context

A considerable body of research exists on topics related to digital literacy and skills for nations, citizens and educational systems, in which these studies include aspects of education and e-inclusion. Van Deursen & Van Dijk (2014) also state that digital skills is a broad concept, so it encompases aspects of various disciplines, which include educational science, computer and technology science, in addition to media studies. Despite the abundance of digital skills studies, limited sources and information is provided regarding digital skills in the context of project management profession, since the majority of PM studies address traditional project management skills. There appears to be PM studies that have examined the required skills for IT-based projects, yet, it has not been found that there are PM studies which have explicitly examined the influence of digital skills on project performance or innovation performance. Even in innovation studies, the concept of digital skills is not fully addressed as a main variable of the competency factor which is one of the innovation factors or enablers (Johnsson, 2016). For instance, the competency factor in Johnsson study presented general competencies and skills as well as those that are explicitly related to innovation.

Recently, the Project Management Institute in its pulse of the profession report, the future of work, highlighted the importance of digital skills and technology for project managers since its last report concentrated on integrating technology into PM (Pulse of the profession, 2019). The report defined technology-related skills as “PMTQ”, Project Management Technology Quotient, which pertain to the must-have and essential skills for those working in project management and those adapting to change as a result of technology. Another definition of “PMTQ” is the ability to manage projects while having high adaptability and integration of technology based on the projects and organizational needs. When it comes to PMTQ, organizations fall into two groups it is either being PMTQ innovators or PMTQ laggards. The first group represents an entity that prioritize digital fluency and knowledge while laggards represent the opposite. For project managers to have high PMTQ, it is easier said than actually done. However, it was reported that a high PMTQ requires an organizations to establish a culture driven by innovation and agility, to have a culture that support PM while integrating with technology (Project Management Institute, 2019). It also requires acquiring digital sustainability and grouping the right talents in the right projects. Moreover, a research conducted by McKinsey in 2015 shows that businesses have idealistic ambition when it comes to digital projects. Therefore, a survey was conducted to measure digital maturity out of 150 big corporations around the world, in order to develop a metric of their digital maturity level or what they called as “Digital Quotient”, in which the outcomes highlighted important factors for digital performance (Catlin et al., 2015).

There have been also a number of researches that have studied critical skills for managing Information Technology (IT) projects, which relate to technology and internet skills.

However, these studies mainly examine the skills associated with IT projects only. According to Keil et al (2013), addressing the skills that are required for IT projects is mainly due to the higher failure rate of IT projects. Since he states that “the lack of required skills’ is identified as a major risk that affects IT projects. Thus, it is important to highlight these skills because it appear that they are highly correlated with project results.

Previous studies have identified the skills and competencies required for project managers. Katz (1974) is among the pioneers who investigated the skills related to management field, he identified three effective skills which are human, technical and conceptual skills. The first refers to knowing hoe to engage effectively in a group as a team member. The technical skill is defined as specialized competencies and knowledge for a specific discipline including the ability to use techniques and tools. The third, conceptual skills, is the competency to view an organization as a whole. Katz work was built on by many scholars to utilize his approach and explore further skills. For example, El-Sabba (2001), refined his interpretations by looking at it from the perspective of project managers. He claims that project manager’s technical skills has the least influence on PM practices while human skills has the highest influence. Other studies have also highlighted the importance of human skills for project success (Thite, 1999; Zimmerer and Yasin, 1998). Moreover, Strang (2003a) mentions that for ensuring successful management of projects, there needs to be a mixture of technical skills, cognitive skill, interpersonal skills and abilities to know people and situations, beside incorporating proper leadership behaviors. According to Kerzner (2009), some of the required skills for project managers which include leadership skills, technical skills, resource allocation, planning, organizing, conflict resolution, team-building and etc. He refers leadership skills to the ability to provide direction or assistance in problem-solving, handling conflicts, communicating clearly, facilitating group decisions and eliciting commitments. His definition of technical expertise refers to the understanding of technology through evaluating technical terms and solutions, making decisions regarding technical issues and communicating with project teams in technical terms, Kerzner (2009) also list planning skills. Due to project complexity, volatility and ambiguity, many organizations have embarked digital transformation to keep their competitive position. Reis et al (2018) defines digital transformation as improving businesses and influencing customers through the use of new technologies. As a result of digital revolution and transformation, many organizations are experiencing radical new ways of working and changes in the competencies required for project managers (Skillsoft, 2019). Therefore, there is high-pressure to have the right talent base to succeed and achieve project goals (Skillsoft, 2019). Though traditional PM skills and methodologies are critical for carrying out projects, and findings have shown its contribution to project success. However, some considers these skills or methodologies old and outdated because digital economy have emerged new skill-sets, which are digital-age skills. In addition, modern project management introduced new practices such as Agile methodologies.

2.5 Project Success

As mentioned above, a growing number of organizations use the project approach as a tool for transforming and creating change in pursue of their objectives. Even though each project seeks pre-eminence and excellence, the nature of projects is usually subject to extreme budget and schedule constraints. It is also commonly accepted that projects entail a complex series of processes which clarify why so many projects fail to accomplish their original goals (Andersen et al., 2006). Hence, many practitioners and scholars have investigated project successfulness and the factors that constitute project success and improve performance. More importantly, Andersen et al. (2006) claim that a significant contribution to project success is having a clear understanding of what accounts for project success. They properly mean that project participants should be aware of the required deliverables and outcomes in order to have an expectation of project achievements. They also state that project success can be interpreted narrowly as fulfilling the desired outcomes of a project in terms of schedule, budget and specification (Andersen et al., 2006). Although this definition was widely recognized as acceptable in early PM literatures, now there are other recognized set of measures or expected factors since the context of project has shifted greatly throughout the years (Pinto and Slevin, 1988; Shenhar & Dvir, 2007; Andersen et al., 2006). Some argue that nowadays a project is not necessarily guaranteed to be successful by executing it within the initial estimated schedule and budget; it goes beyond the triple constraints or what is known as traditional success factors (Bonghez & Grigoroiu, 2013; Toor & Ogunlana, 2010). Bonghez and Grigoroiu add that project success encompasses other factors which include alignment to business strategy, client or stakeholder acceptance, added value, ethical considerations and so on.

Project success has been regarded as an imperative topic in research circles given that several researchers have highlighted the importance of this topic and identified factors which impact project success. Many scholars hold the view that there is no particular set of success factors that are fitting or applicable to all projects; the influence of these factors differ depending on the industry, project specification and importance, etc (Toor & Ogunlana 2010; Shenhar & Dvir, 2007). It is important to implement effective project management approaches to maximize the probability of successful projects. Good project management techniques are used as a vehicle to influence the level of project success. Therefore, failure of PM to achieve success include factors such as lack of communication and proper planning, project team's incompetence or non-commitment, mismanagement of techniques and uncooperative stakeholders (Attarzadeh & Ow, 2008). Yet, many agree that it is not necessarily PM that causes failure of projects seeing as success still depends on the project idea, higher aim, and etc (Toor & Ogunlana, 2010; Munns & Bjeirmi 1996, Dulaimi et al 2002).

Scholars differentiated between what is known as "project management success" and "project/product success" (Munns & Bjeirmi, 1996; Andersen et al., 2006). Project management success is determined at the end of the project and it represents performance which is using PM techniques and tools to have successful achievement of time, quality, cost and goals of project activities (Munns & Bjeirmi, 1996; Toor & Ogunlana, 2010; Papke-Shields et al 2010). Whereas, product or project success is concerned with the effect of a project once it is terminated, it pertains to achieving stakeholder and client satisfaction as well as meeting particular project objectives (Toor & Ogunlana 2010; Papke-Shields et al 2010). Combining both PM success and project success represents "overall project success"; it is the broader concept that manages the long lasting effect of a project (Andersen et al., 2006). By that, it means the long-term achievement of a project and the overall added value of it. However, it is important to note that not necessarily both can be achieved at the same time, a project might achieve PM success but not the overall project success, the opposite might occur as well. It can also be observed that project success consist of many aspects or measures which include project efficiency measures (i.e. completeness within budget and on time), business measures (implication on the organization's strategies), satisfaction measures (i.e. stakeholder or client satisfaction) and future measures (i.e. innovation and other development) (Toor & Ogunlana 2010; Shenhar & Dvir, 2007; Papke-Shields et al 2010).

2.6 Project Success Factors

There are various project success factors identified in literature which contribute to project performance and successfulness. The studies presented thus far provide insight that traditional success factors are not enough to influence project success. Consequently, some comprehensive studies attempted to examine specific factors such as innovation factors, which have been gaining prominence recently. In fact, quite a few studies have linked "innovation" with "project management" (Filippov and Mooi, 2010; Ghaben and Jaaron, 2015). According to Filippov and Mooi (2010), these two concepts emerged on organizational strategies and policy agenda, so there has been a growing interest to address the interaction between PM and innovation management. Even though PM and innovation management are two distinct disciplines which are not explicitly addressed together, Filippov and Mooi argue that it is important to identify the relationship between the two disciplines. Especially since innovation work is increasingly carried out as a project, and PM is the engine for applying new ideas so it is assumed that all projects may entail some degree of creativity or innovation.

The intention of this study is to investigate if PM digital skills influence project performance, more specifically, innovation success factors. Therefore, the interplay between innovation and PM is examined in a way that would answer this objective. Actually, Based on various literatures, it has been proven that interplay does exist between innovation and management studies (e.g. project management). However, the relationship between these two areas is rather implicit (Filippov & Mooi, 2010). Yet, few publications examined the link between project management and innovation on different levels and they agree that some link can be found (e.g., Cozijnen et al, 2000; Brady and Söderlund, 2008; Kavanagh and Naughton, 2009; Ernst and Lichtenthaler, 2009; Amaro dos Santos et al, 2008).

2.7 Innovation Success

Understanding the concept of innovation is important to recognize innovation factors. Therefore, a brief overview of innovation context is provided in this section, yet an in-depth review is beyond the scope. Existing innovation literatures presented different meanings and interpretations of the concept (Filippov and Mooi, 2010; Ghaben & Jaaron, 2015; Johnsson, 2016). Innovation can be defined as pursuing competitive advantage (i.e. adding value, benefits or improvements) through applying new ideas and recombining current knowledge (Filippov and Mooi, 2010; West et al, 2004; Johnsson, 2016). Similarly, OECD (2005) describes it as the successful application of something new or the improvement of goods, services or processes. By creating competitive advantages, it is believed that companies differentiate themselves to preserve a good fit in this highly competitive and dynamic market. From looking at the history of innovation, it can be seen that innovation work has dramatically changed and developed over time as a result of developing innovation processes throughout the decades (Johnsson, 2016). As mentioned earlier, innovation is often carried out as a project. So, Filippov and Mooi (2010) mention that projects in general are divided into innovation projects or conventional projects. They state that both types differ in nature where conventional projects are regular projects with no clear innovation content, such as operational and construction projects, while innovation projects are quite the opposite (Filippov & Mooi, 2010). The main differences as identified by Filippov and Mooi are in project complexity, project objectives and level of risk-taking. Firstly, innovation projects tend to be more complex in nature than conventional projects because of its unique process. They are associated with high uncertainty and need for diverse resources. Secondly, the objectives for innovation projects tend to be elusive and loosely defined without detailed goals. On the contrary, conventional projects tend to be clearly defined and well described. Finally, Risk-taking is higher for innovation projects since its processes tend to be based on trials and experiments and as described its objectives are often elusive and ambiguous (Filippov & Mooi, 2010).

Overall, the focus in this research revolves around innovation projects, some example of its categories include research projects, technology projects and new product development (Filippov & Mooi, 2010). Despite the various categories of innovation projects, there is no doubt that innovation projects are complex in nature. However, these projects differ from one another depending on the scale of innovation intensity. To elaborate on that, Henderson and Clark (1990) classified innovation based on intensity level; they identified four types which are incremental, modular, architectural and radical. The lowest intensity starts from incremental innovation (to create substantial improvement on existing service/product) moving up to the highest which is radical innovation (to create a revolutionary service/product which is unique).

2.8 Project Innovation Success Factors

According to Ghaben and Jaaron (2015), there are various tools that can be used to increase the likelihood of achieving successful projects, and project management is regarded as one these significant tools. Yet, they add that not so many projects succeed to achieve their objectives since it is highly dependent on having strong competitive advantage. Therefore, they suggest that project management processes, techniques and relationships needs to be enhanced through innovation work in order to increase competitiveness and project success. Ghaben and Jaaron (2015) hypothesis is that when PM, specifically construction PM, is integrated with innovation practices, it could lead to successful projects by offering solutions to harmful problems. Another research by Johnsson (2016) also highlights the importance of innovation. Yet, his research views innovation differently because he looks beyond the competitive advantage or economic benefits of innovation. He stresses that companies should aim to increase their speed of innovation work and continuously implement new innovation initiatives. Others point out the same, they believe that innovation of products, services or processes has to be carried out in an ever-increasing pace to fulfill market needs and changing environments, also since the life-cycle of products has shortened over the period (Dobni, 2006; Barczak et al, 2009; Tidd and Bessant, 2013; Chen et al, 2010). In agreement with that, it was found that companies who are faster in applying innovative initiatives win over companies who are opposite to that, because the more time it takes a firm to carry out new innovation work, the poorer will be its innovation performance Kuckertz et al (2010).

Overall, many scholars have recognized the need for innovation in projects. For construction projects, for instance, Gann (2000) remarked that if construction firms want to create a competitive advantage that would set them apart from others, such as building technical reputation, they need to drive their capabilities in managing innovation. Ghaben and Jaaron (2015) describe the management of some industries, i.e. construction, as being ambiguous, weak, inadequate, and slow to respond to changing needs. Therefore, they argue that in order to adapt with the challenging conditions, PM needs to be more flexible and constantly changing. As introduced by Newton (2014), when it comes to project performance elements, innovation may be considered as fourth addition to the traditional elements of PM triangle. Generally, innovation factors or enablers are becoming an addition to project performance elements. In support to that, there has been an increased interest on knowing which factors impact an organization's innovation capabilities (Ghaben & Jaaron, 2015). Therefore, several models were introduced to depict critical factors for successful innovation management. Among those is "the house of innovation" model, which assess innovation practices based on four factors that include the drive of innovation by the organizational structure and culture, the alignment of innovation strategy with the business strategy, the development of a product lifecycle process to create ideas, and the enablement aspects for innovation management (Kearney, 2006).

According to extensive literature reviews, innovation factors and enablers were identified as shown in table 6. These factors are based on various dimensions such as those particular to the organization itself (internal work environment) and those that relate to the organization and its surrounding environment (external work environment) (Ghaben and Jaaron, 2015).

They are also based on various perspectives (organizational, team, individual) (Johnsson, 2016). It is assumed that adopting these innovation factors would enhance an organization's PM competencies and improve their innovation performance.

Table (6): Innovation Factors

Innovation Factors	Variables	Relative Source
Climate	<u>Organizational perspective:</u> Develop innovation climate to stimulate creativity and innovation in the workplace (i.e. leadership support, team-learning support, empowerment, etc)	Balsamo et al. (2008) Crespell & Hansen (2008) Watkins & Marsick (1996) Ekvall (1996)
	<u>Team perspective:</u> Encourage team members to embrace and support innovation within teams (i.e. trust, team cohesion, etc.)	Denti and Hemlin (2012) Kianto (2011) Balsamo et al. (2008)
Culture	Provide innovative culture within the organization How innovation work is supported by informal rules and norm.	Ghaben and Jaaron (2015) Denti and Hemlin (2012) Aagard and Gertsen (2011) Balsamo et al. (2008) Smith et al. (2008)
Collaboration	<u>Organizational perspective:</u> How the set up of an organization ease collaboration between departments and external parties.	López-Fernández et al. (2011) West et al. (2004) Ghaben and Jaaron (2015) Ross et al. (2012) Aagard and Gertsen (2011)
	<u>Team perspective:</u> Create networks with other knowledgeable persons or suppliers	Gambatese and Hallowell (2011) Kianto (2011) Ghaben and Jaaron (2015)
Knowledge	Innovation-related knowledge regarding how to execute innovation work.	Ross et al (2012) Aagard and Gertsen (2011) López-Fernández et al (2011)

Competence & Innovation competence	Individual perspectives: Individual skills and capabilities	Illeris (2013) West et al. (2004)
	Skills and experience explicitly related to innovation.	Bozic (2016) Räsänen et al. (2015)
Management	Organizational perspective: Leadership and management support for innovation work.	Aagard and Gertsen (2011) Denti and Hemlin (2012) Gambatese and Hallowell (2011) López-Fernández et al. (2011) Smith et al. (2008)
	Team perspective: team leadership or project management	West et al. (2004)
	Strategic management: - Establish a vision which embraces innovation and SMART objectives - Formulate Strategies - Conduct internal and external audit (SWOT analysis)	Ghaben and Jaaron (2015)

2.8.1 Climate

Climate can be defined as the way a team works together based on their shared view of work atmosphere such as the policies and procedures put in place (Anderson and West, 1998; Johnsson, 2016). Climate differs from culture, it can be considered as experiencing the culture of an organization at a given time. It is an organization's mood where it is subject to constant change and it can be shaped by leaders of an organization (Johnsson, 2016). Denti and Hemlin (2012) assume that climate can be significantly influenced by leaders when they support ideas, act as role models and engage in work. Furthermore, several authors found that project managers can play an important role to encourage a climate of innovation within project team (Bossink 2004; Panuwatwanich, Stewart & Mohamed 2008).

According to Johnsson (2016), prior research of high performing innovation teams focused on various factors, and one of these includes establishing innovation climate to stimulate creativity and innovation. In fact, it has been pointed out that companies perform better at product innovation when they establish a positive innovation climate (Cooper, 2013; Kianto 2011; Nybakk et al., 2011). Creating an innovative climate seems to be highly important to foster innovation ecosystem, especially when developing innovation teams. As an evident, West et al (2004) mention that developing innovation climate in the workplace is one of the seven steps to develop an innovation team within an organization. Actually, Johnsson (2016) believe that creative ideas are generated by employees, thus, it is important to motivate employee's creativity through having an innovative climate.

There are various factors that stimulate creativity and innovation within an organization. Earlier study by Watkins and Marsick (1996) show factors that help achieve innovation, they include six factors which are empowering people, supporting team learning, promoting inquiry and discussion, creating on-going learning, establishing system networks and connecting with the environment. Later, Crespell and Hansen (2008) refined previous studies of innovation climate and present six validated factors which are perceived by employees to enhance creativity within an organization, they include director motivation, challenge, team unity and cohesion, openness to innovation, resources accessibility and self-direction.

2.8.2 Culture

Culture is different from climate; it is very difficult to change as it takes longer to change than climate. Organizational culture is defined as a set of shared rules, values, norms, symbols, thinking and knowledge within an organization, where employees share these together (Crespell and Hansen, 2008). These shared set of values and beliefs influence employee's behaviour within a firm. Johnsson (2016), state that culture is the mentality of how members do things within an organization, the behaviours, based on the rules and norms within. Ahmed (1998), points out that a major decisive factor which affects innovation is organizational culture. Similarly, Ghaben and Jaaron (2015) ascertain that providing an innovative culture within an organization is one of the innovation practices which improve innovation performance.

There are various factors associated with innovation culture, for instance, Johannessen and Olsen (2011), emphasize that communication skills is one of the factors that create innovation culture, to promote creative mindsets so that innovation projects become more familiar (Johnsson, 2016). Other factors include leadership, risk-taking, autonomy, tolerance to failure, trust, openness, management of staff, dominant traits, experimentation (Crespell and Hansen, 2008; Aagard and Gertsen, 2011; Denti and Hemlin, 2012).

2.8.3 Collaboration

Smith et al. (2008), declare that collaboration, either short or long-term, can help to achieve innovation since having a blend of various viewpoints helps to be more open to new thoughts and ways of doing things. Similarly, Lloyd-Walker, Mills & Walker (2014), state that collaboration between diverse project teams usually leads to innovation. Achieving collaboration between individuals requires building good relationships, having social interactions and open communications (Balsamo et al. 2008). There are two types of collaboration that affect innovation; they are internal and external collaboration. Some examples of internal collaboration include cross-functional teams, interactions between departments, employees and etc (Johnsson, 2016). Cross-functional teams, for example, do not only improve productivity but they can result in intangible benefits such as improved communication and team-work (Balsamo et al., 2008). Yet, such teams are dependent on some aspects such as having participatory management that empower team members, openness to make decisions and implement new ideas as well as having collaborative culture within the organization (Cooper, 2005; Smith et al., 2008).

On the other hand, external collaboration also impacts innovation teams, it is the interaction with external parties for various purposes such as understanding customer's needs and market opportunities (Cooper, 2005; Coviello and Joseph, 2012); interacting with users to gather knowledge (Ross et al. 2012; Yu & Hang 2010); interacting with suppliers to update knowledge of new technologies and implement new innovations (Yu & Hang, 2010); networking and sharing knowledge with experts (Mele et al, 2012); learning from competitors to build innovation capabilities and strengthen creativity (Bucic, 2012); and building strategic alliances with partners (Bossink, 2004). It can be summarized that all external parties (i.e. customers, suppliers, users, partners, competitors, networks) have some degree of influence towards innovation.

It has been proven by various studies that collaboration played a more critical role than other innovation enablers. It was found that it is the most important factor from team perspective, it is considered as a significant factor from management perspectives (Aagard and Gertsen, 2011; López-Fernández et al, 2011; West et al, 2004), it is found that it cause negative impact on innovation projects if it is not satisfied. In addition, many claim that it directly affect project performance. It can be noted that collaboration is one of the most important factors of innovation; therefore, it is important to identify any variables that impact achieving collaboration. For example, collaboration is dependent on the willingness of the parties to cooperate successfully, either internal or external parties.

2.8.4 Management

Innovation management is one of the most important factors of innovation. As indicated by Johnsson research, companies need to increase their speed of innovation practices and continuously implement new innovations to stay competitive. He refers to management as an organization's leadership, senior management, project managers and management support for innovation. There are several techniques to accelerate the management of innovation within organizations. They include recognizing the value of innovation management by the organization, increasing the proportion of low-risk experiments without hindering the whole organization, acting like innovators, promoting a culture of questioning and problem-solving, appointing external professionals to explore new ideas (Birkinshaw and Mol, 2006). It is also the willingness of managers to invest in disruptive innovation and not only focus on the traditional view of success (Lettice and Thomond, 2008). Another viewpoint to implement innovation in the long run is the commitment of all levels of management within an organization (Longo, 2007). It appears that strong and ongoing commitment is the main input to strategic innovation. However, usually organizations face challenges with innovation because it is difficult for them to agree on which innovation to select and how to allocate scarce resources (Dooley et al, 2000). These challenges along with innovation barriers make it difficult to implement and manage innovation. Some of the innovation barriers include accessing competent staff and having varying cultures (Parolin et al, 2013). Structure also influences innovation process; it is through executing such process efficiently to stay competitive (Brennan and Dooley, 2005).

Strategic management is defined as the analysis, decisions, strategic planning, monitoring, assessing of needs and actions to gain and sustain competitive advantages (Dess et al, 2005). It is simply associated with the analysis to set out a clear and realistic definition of the entity vision, mission statement and its strategic objectives (Baldwin, 2014). To ensure adequate success in innovation, strategic management should be concerned with establishing a clear vision that embrace innovation, setting objectives that are SMART, formulating and implementing strategies, analyzing external and internal environments (Ghaben & Jaaron, 2015; Huiru, 2011).

2.8.5 Knowledge

Innovation-related knowledge refers to the theoretical understanding and expertise of innovation topics. Whilst, knowing how to use knowledge for a practical subject and fill a knowledge gap, is known as knowledge management (Johnsson, 2016). An example of innovation-related knowledge includes the understanding of innovation processes (Tidd and Bessant, 2013). Many researchers examined knowledge and knowledge management as innovation enablers to understand the importance of these two factors. Johnsson (2016), acknowledge that these two factors apear to be of the most important innovation factors and enablers. His study presents a collection of literature reviews that highlighted the importance of knowledge and its management. For example, he presented that when these two factors were not fulfilled; it resulted in negative effects on the innovation project. In addition to that, Tidd and Besant (2009) found that innovation-related knowledge impacted other innovation factors such as time and human resources. They claim that a higher degree of knowledge and knowledge management strengthens the team and increases collaboration which would thoroughly solve some issues related to time and resources, thus, impacting these two factors.

Despite all that has been mentioned, Hung et al. (2010), remarks that knowledge alone does not create value, it should be used in a particular manner. For example, using knowledge on how to deal with the involved stakeholders during an innovation project contributes to stakeholder engagement which may help to gain a satisfying outcome of innovation (Weisenfeld, 2003). Furthermore, there are other factors that should be accompanied with knowledge, it includes education (training and learning by employees before participating in the innovation process) and competency (hiring skilled and qualified employees for innovation project) (Smith et al, 2008). Another critical point is the ability to continually create new knowledge because maintaining an everlasting competitive advantage requires new updated knowledge instead of existing knowledge (Johnsson, 2016).

2.8.6 Competency

Competency can be simply defined as the set of abilities, skills and related knowledge or experience that is needed to perform certain work with proficiency (White, 1959). As an innovation factor, it represents an individual's general skills and experience (West et al, 2004; Illeris, 2013). It also represents skills that are explicitly related to innovation (Bozic, 2016; Räsänen et al, 2015). To highlight the significance of competency, Johnsson (2016), stresses that competency is essential for achieving successful innovation work. Due to its importance and since it is correlated with innovation, the concept of "innovation competency" emerged in research circles. Hence, innovation competency is defined by Kairisto-Mertanen et al

(2011) as representing three dimensions which are interpersonal dimension (focuses on teamwork, leadership, communication skills, etc), individual dimension (Focuses on personal thinking, decision-making, problem solving, risk-taking, etc) and network dimension (focuses on working relationships, networking skills, working in different environments, etc).

Based on various models and framework, there are several factors that demonstrate competency. A model by Illeris (2013), called "the competence flower", reveal factors that relate to the personal profile of an individual. It includes expertise, abilities, skills, manners, collaboration and sociability, independency, judgement and choices, holistic viewpoint, and structural comprehension. He also refers to the importance of some capabilities such as imaginary thinking, creativity, elasticity, empathy and having critical viewpoint. It is noted that Illeris model views competency in general terms. Bozic (2016), on the other hand, has developed it further by explicitly examining innovation competence. He wanted to present a holistic understanding of the required competencies when conducting innovative initiatives within an organization. Consequently, he proposed a framework for innovation competence which consists of four main areas that include content, intrapersonal and interpersonal characteristics and innovation work. The first area is content and it comprises of innovation interpretations, innovation frameworks, good innovation practices and innovation proficiencies such as asking questions, monitoring, networking, conducting trials and experiments. The second area is intrapersonal characteristics which are the competencies and skills that reside within an individual and it encompass of self-confidence, self-motivation, ability to observe and learn, independence, curiosity and intuition. On the other hand, Interpersonal characteristic are the competencies that are applied with others, for example, it consists of active listening, compassion, improvisation, participating and etc. The final area is innovation work and it is the centre of Boiz framework, it incorporates exploring, creating and implementing ideas. The two models highlight that competence may be a decisive factor that team members need to posses.

Despite the importance of possessing general competencies and innovation-related competencies, there is a growing opinion that organizations need to embrace a full spectrum of skills and competencies to succeed in the digital-age. PMI highly stressed on this opinion, they state that innovative organization are forward-thinking, so they need to focus on future skills, such as digital skills (Project Management Institute, 2018). It is suggested through this research that digital skills are also one of the innovation enablers which impact the success of innovation projects. As explained in the first part of the research, digital skills clusters encompasses of technical skills, information skills, communication and collaboration skills, content-creation skills and problem-solving skills (Vulorikari et al., 2016; Iordache et al., 2016; Van Deursen et al., 2014; Van Deursen & Van Dijk, 2014; Ferrari, 2013; Ala-Mutka, 2011; Bawden, 2008; Martin & Grudziecki, 2006; UNESCO, 2013). Innovation skills were investigated to see if it relate with digital skills. According to Eich (2018), it was reported by the world economic forum that creativity, originality, critical-thinking, problem-solving skills and programming are all considered as innovation skills that are growing in importance.

There are various types of innovation capabilities such as technical and non-technical capabilities. Technical refers to the abilities to develop new products, manage facilities successfully and carry out specific technical role (Camisón and Villar-López, 2012), it is said to be of high importance to innovation (Bossink, 2004; Manley, 2006; Cetindamar et al., 2009). Essentially, technical competency is said to be a matter of technology management (Cetindamar et al, 2009) and knowledge management (Cepeda and Vera, 2007). Conversely, it is claimed by Camisón and Villar-López (2012) that non-technical abilities are also just as important, they refer to the capabilities to perform new processes and methodologies as well as create best-practice knowledge. Milton and Rogers (2013) put forward seven steps for innovation process and Räsänen et al. (2015) used their process to sort out when innovation competence is needed. Räsänen et al (2015) have also used Kairisto-Mertanen et al definition of innovation competence and updated it further by adding sub-dimensions which include "creative problem-solving skills; systems thinking; goal orientation; team working; and networking skills" (Johnsson, 2016).

3 Chapter Three: Theoretical Framework

3.1 Background

Based on the observations and interpretations from the literature review, the theoretical framework was developed by identifying digital skills clusters and their variables that are perceived to influence project innovation success, as presented in tables 1, 2, 3, 4 and 5 (Vulorikari et al., 2016; Iordache et al., 2016; Van Deursen et al., 2014; Van Deursen & Van Dijk, 2014; Ferrari, 2013; Ala-Mutka, 2011; Bawden, 2008; Martin & Grudziecki, 2006; UNESCO, 2013). Then identifying innovation enablers and their variables as the outcome for innovation success which will be tested with digital skills clusters, as presented in table 6 (Balsamo et al, 2008; Crespell and Hansen, 2008; Watkins & Marsick, 1996; Ekvall, 1996; Denti and Hemlin, 2012; Kianto, 2011; Ghaben and Jaaron, 2015; Aagard and Gertsen, 2011; Smith et al, 2008; López-Fernández et al, 2011; Ross et al, 2012; West et al, 2004; Gambatese and Hallowell, 2011; Illeris, 2013; Bozic, 2016; Räsänen et al, 2015). The developed theoretical framework suggests that digital skills clusters are the independent variables while project innovation success factors are the dependent variables, as displayed in figure 3.

3.2 Research hypothesis

There are five hypotheses that were identified based on the literature review to identify the various relationships between the independent and dependent variables. In which, these hypotheses were tested and examined in the data analysis section of this research. The examination of these hypotheses was based on the questionnaire responses.

H1: Digital skills Clusters will positively influence successful innovation of projects

H2: Technical skills will positively influence successful innovation of projects

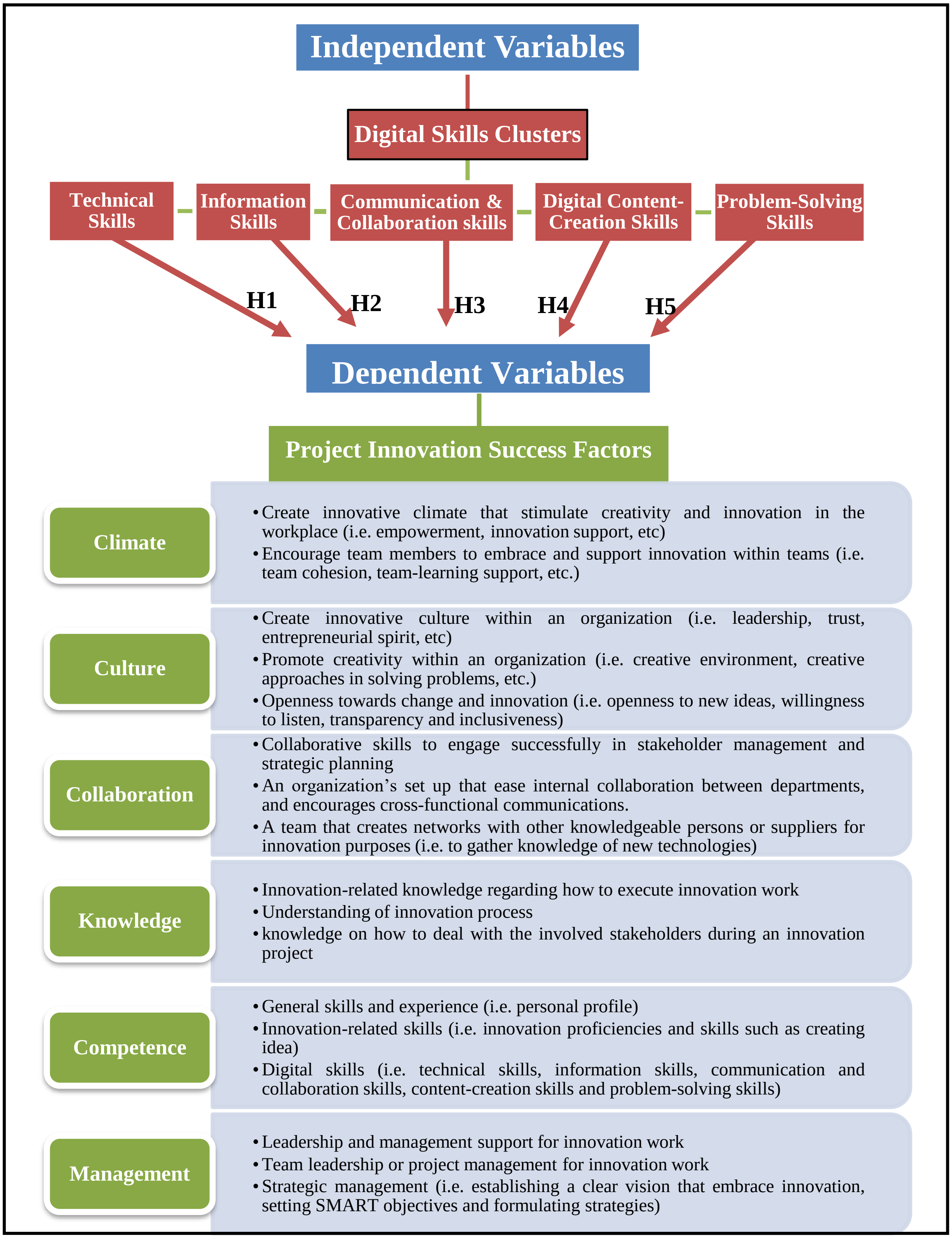
H3: Information skills will positively influence successful innovation of projects

H4: Digital communication and collaboration skills will positively influence successful innovation of projects

H5: Digital content-creation skills will positively influence successful innovation of projects

H6: Digital problem-solving skills will positively influence successful innovation of project

Figure (3): Theoretical Framework



4 Chapter Four: Research Methodology

4.1 Introduction

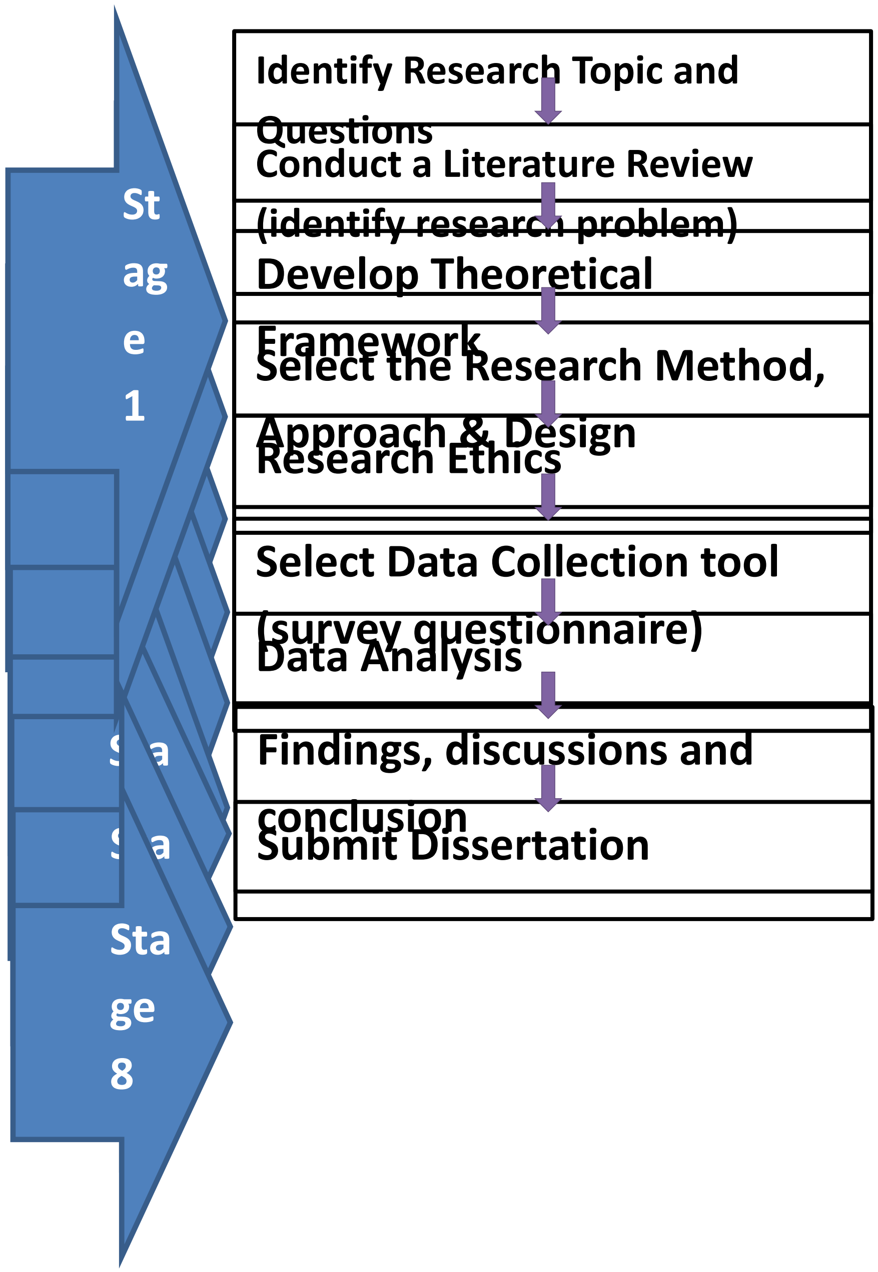
This chapter presents the methodology that was applied to answer the research questions and validate the presented hypotheses. It provides details on research methodology, research strategy, research approach and limitations, data collection and sampling methods, the selected research instrument and data analysis. Firstly, the primary research methodology used for this paper is a quantitative research method. A questionnaire was designed to collect data based on independent variables (PM digital skills clusters) and depended variables (Project innovation success factors) that were identified from literature reviews and the developed theoretical framework. The aim of this chapter is to provide an understanding of how this research was conducted.

4.2 Research Strategy

The adopted research process relied on the quantitative process that was reported in (Bryman, 2012). The process started with identifying the research topic and questions, then a critical literature review was conducted to collect valid theories, in order to develop the theoretical framework and design the research questionnaire based on that. Literatures that were selected for this study were from various subjects and disciplines since the topic of this research examines various disciplines which are related to project management, innovation management and digital skills (literacy). For these literatures, a variety of sources were used including books, journals, reports and articles. The methodologies used in these sources differ based on each discipline. For example, digital skills studies have mostly used surveys and tests as research methodology (Helsper, 2008; Van Deursen, 2010; Van Deursen & Van Dijk, 2014; Van Deursen et al., 2014). In contrast, innovation studies have mostly used mixed methods including semi-structured documentations, interviews, surveys, observations, etc (Ghaben & Jaaron, 2015; Johnsson, 2016).

Figure (4) below illustrates the adopted research process.

Figure (4): the adopted research process



4.3 Research approach and limitation

This study used both qualitative and quantitative research methods. The qualitative part represents the critical review of relevant academic literatures, empirical studies, institutional reports and various publications of the concept from existing research (Bryman, 2012). The scope of this study is to investigate three different disciplines which are project management, digital skills and innovation management, making it challenging to cope with the number of publications that are related to each discipline, given the vastness of each subject. Therefore, some of the selected resources and publications for this study were based on systematic methods, such as quick-scan analysis (Iordache et al., 2016; 2017), and systematic literature reivew technique (Smith et al., 2008). Although some believe that systematic literature review is effective, few argue that it is greatily influnced by bias (Mulrow, 1994; Denyer and Neely, 2004). Therefore, in order to eliminate any bias, these selected resources were carefuly chosen after anlayzing their contribution to this study and ensuring that the infomration they present are acknowleged in their respective literatures. Not to mention that an extensive reivew was carried out for original work including books, academic work and instituational reports, to interpret the concepts comprehensively.

Through conducting a literature review, it has been observed that the quantitative research method has been mostly used for digital skills studies (Helsper, 2008; Van Deursen, 2010; Van Deursen & Van Dijk, 2014; Van Deursen et al., 2014). While, for innovation studies, it has been observed that a mixed method has been used (Ghaben & Jaaron, 2015; Johnsson, 2016). On the other hand, the quantitative part of this research represents the survey questionnaire that was designed based on digital skills clusters as independent variables and project innovation success as dependent variable, which is developed based on the theoretical framework as well as on literature. The selection of the research method was based on Veal (2006) statement regarding the important factors in selecting the appropriate method, which he identified as previous studies, reliability and creditability of data, data accessibility, and research questions and hypotheses. Overall, the questionnaire was designed to test hypotheses and answer some research questions.

A limitation of this research is the ability to reach out targeted employees from both the public and private sectors, to provide their responses in the questionnaire. A network of a list of employees already exists, but it does not explicitly include all the targeted population for this study, including project managers, innovation managers, etc. Therefore, the collected data are limited to respondents from various sectors, backgrounds and varying roles in their entities. In addition to that, due to time constraints, the number of collected responses did not meet the targeted number, a total number of (76) is considered too little to generalize and build on a strong hypothesis. So, it is believed that further research is needed to validate the research findings and results. Other research limitations are also presented in the final chapter of this research.

4.4 Data collection and Sampling methods

There are various methods that can be used to collect data, which include surveys, case studies, experiments, grounded theories, archival research, etc (Saunders et al, 2007). In this study, both primary and secondary data collections were used. For primary data collection, an online questionnaire was conducted to collect responses for data analysis, to establish research findings and test research hypotheses. The targeted population includes employees that are either involved with project management or innovation or those who have information technology background such as IT experts. In addition to employees of senior positions or experts or consultants. To be more specific, the target was to get responses from project managers, project team members, innovation managers, Chef Innovation Officers (CIO), innovation team members, innovation or IT experts and consultants. For distributing the questionnaire, it was sent electronically to more than 250 employees working in the public and private sectors in the UAE. As mentioned above, a list of network already existed which included employees working in various entities (both public and private) and from different fields or sectors. Whereas, for secondary data collection, the used literatures were from different sources including books, journals, publications, reports and articles. In which, the credibility and reliability of these sources have been tested to ensure validity of the selected qualitative data.

The sampling method for this study is non-probability sampling, in which snowball sampling and convenience sampling were used (Bryman, 2012). Although some believe that non-probability sampling is inferior to the other sampling technique, probability sampling; others believe there are strong reasons for using non-probability sampling technique (Uprichard, 2011; Bryman, 2012). There are practical reasons, the fact that the procedure for this technique is time and cost effective, it is considered much easier and faster when compared to the other probability techniques. This is particularly the case for convenience sampling which is a method for selecting the most easily accessible individuals (Uprichard, 2011). It was chosen as a method due to lack of access and since there was an already existing network of governmental entities and private companies, so it is more convenient and time effective. Nevertheless, it was believed that this method alone is not enough to reach some specific roles of the targeted population, more specifically, reaching innovation managers or Chef Innovation Officers (CIO). Therefore, snowball sampling was also used, it was by contacting a small group of participants who have backgrounds in innovation to ask them to share the questionnaire with innovation managers or CIO in their entities.

4.5 Research instrument

The research instrument for this study was through a survey, it is a common and widely-used research tool which is designed to collect data quickly and efficiently from a sample population (Bryman, 2012; Lietz, 2010). The questionnaire template for this study was designed based on the theoretical framework presented in chapter three and the research questions. It was developed in way that would be precise to the topic and the objectives of this research in order to collect relevant and valid responses. The survey was prepared electronically using a website named (eSurveyCreator) for online surveys. Then the survey link was distributed online to employees working in the public and private sectors. Through this survey, the collected data will be analyzed to test the relationships between the variables (Saunders, Lewis & Thornhill 2009).

4.5.1 Survey Questionnaire

As indicated above, the survey questionnaire was developed to answers the research questions and test research hypotheses. It is mainly to investigate the relationships between the various digital skills clusters and their influence on project innovation success. The questionnaire starts with an introduction to provide a brief information regarding the research topic, aim and ethical considerations. In addition to mentioning the questionnaire structure which is composed of three parts as the following:

1. Part One: General Information (Demographics)
2. Part Two: PM Digital Skills
3. Part Three: Project Innovation Success

The first part aims at gathering respondent's demographic information to have a better understanding of the representative population. It consists of 8 multiple choice questions regarding respondent's gender, educational level, job sector/ field, job roles, years of experience in general or in managing projects. In addition to two questions regarding respondent's perception on the interplay between the three disciplines and their perception of the effectiveness of digital skills when applied to projects. The second part consists of questions related to the independent variable (project management digital skills), it includes a total of 31 items using Five-point Likert scale. This part includes a question about ranking the importance of digital skills clusters and questions about each cluster to verify the relationship between each cluster and their influence on project innovation success. The third and last part consists of questions related to the dependent variable (project innovation success factors), it includes a total of 23 items using Five-point Likert scale. This part also includes a ranking question and questions about each factor of innovation success. Moreover, a general text box was used for suggesting additional factors and for writing any comments regarding the survey. For part 2 and 3, the questions were derived from the literature and theoretical framework. Generally, the questionnaire used various types of questions ranging from multiple choice questions, ranking, and Five-point Likert scale (strongly agree-strongly disagree). Although it has been argued that 7-point scale seems to be more consistent than the 5-point scale (Cronbach 1951) and it offers better differentiation of choices than the shorter-scale (Masters 1974; Alwin 1992); others, like Foddy (1993), support 5-point scale by relating it to the content or question, he argues it is preferable to use the shorter scale if the answers need absolute judgement (Lietz, 2010). Nevertheless, the research questions also used three types of measurement scales which include nominal, ordinal, and interval measurements (Bryman, 2012).

4.5.2 Pilot Study

A quantitative piloting of the survey questionnaire is essential to evaluate the survey content and ensure that all questions are suitable and understandable for the intended participants (Presser & Blair, 1994; DeVellis, 2003; Litwin, 2003; Lietz, 2010). Pilot testing is also intended for pointing out potential problems or checking for errors that needs corrections such as repetitions (Carvalho & White, 1997; Punch, 2005). Therefore, before distributing the questionnaire, a pilot study was conducted to ensure the validity and reliability of the research instrument. A pilot sample was created and distributed to three professionals who work in this field in order to ask for their feedback. Following that, comments were received from all participants, in which all of their suggestions and comments were considered and the questionnaire was amended accordingly. Some of the enhancements include shortening the length of some question, adding the definition of “digital skills” and adding some examples to describe variables. These comments correspond to what was reported by Lietz (2010) as best practice for research questions such as considering questions specificity, length, wordings and order. It was also observed from participant’s answers that some questions need to be refined and others need to be more descriptive by providing some example. Therefore, it is believed that pilot testing contributed to the overall quality of the survey questionnaire (Lietz, 2010).

4.6 Ethical Adherence

Considerations to ethical principles is considered as one of the most vital part of any research or dissertation (Bryman, 2012). Some of the ethical principles or standards in dissertations include obtaining consent from participants, respecting their dignity, protecting their privacy, ensuring an adequate level of confidentiality and ensuring anonymity of participants Bryman and Bell (2007). They also state that research should be conducted with integrity and honesty without any misleading information or deception. In order to address ethical considerations in this study, the research was carried out based on ethical principles and the code of ethics Bryman and Bell (2007). Participation in the questionnaire was voluntary and the questionnaire covered the ethical part by mentioning the protection of participant’s privacy and ensuring their confidentiality and anonymity. Also, based on this quantitative research method, there was no direct contact with individuals, so no direct reference to be made.

4.7 Data Analysis Method

To analyze the collected data, SPSS software was used as a method for statistical analysis. It was used to provide different statistics that can help to interpret, analyze and better understand the collected data in order to test research hypotheses and investigate findings. Based on this research design, various tests were conducted in which they were related to three main statistical groups, they are reliability, associations and predictions. For measuring reliability, Cronbach's alpha (α) was used, which is a well known test for measuring reliability in other words measuring internal consistency (Bryman, 2012). This test was used to verify whether a number of items on a scale are measuring the same underlying construct, to is to ensure that they do not lack coherence (Bryman, 2012; DeVellis, 2017). It fits this study because it is commonly used for questionnaires with multiple Likert questions. The basic requirement of this test is to have several items measured on continuous scale. For that, the questionnaire was already composed of Likert scale data, in which they were analyzed at the interval measurement (Boone & Boone, 2012). For measuring associations, Spearman's rank-order correlation test was conducted which is used to measure the statistical relationship or association between two variables that are both measured on continuous scale or both on ordinal scale, or one continuous and one ordinal scale (Bryman, 2012; Sheskin, 2011). The Spearman's coefficient, value of r_s or ρ indicates that if it is nearer to (+1) or (-1) then the stronger the association between the ranks, but if its (0) then there is no association, or if its near (0) then the association is weak. This test was used to know the association between the identified variables in this study, to know if there is any association between digital skills clusters and project innovation success. For predictions and relationships, both linear and multiple regressions were used in this study (Weisberg, 2014). Linear regression was conducted to assess the relationship between each IV and the overall DV, it was to predict the value of project innovation success from the value of digital skills clusters. Whereas multiple regression was used to rank the importance of digital skills clusters and to find out the most important influential predictor. Regression tests were conducted after verifying the various assumptions about them.

4.8 Conclusions

This chapter presents the methodology that was applied to answer the research questions and test the presented hypotheses. This study used quantitative approach as the primary research methodology since it is believed to be an appropriate method to investigate the proposed framework. The data was collected using an online survey questionnaire and it was distributed to the targeted population using convenience sampling and snowball sampling. To ensure the validity of the survey questionnaire, pilot testing was conducted to test the reliability of the instrument. The accepted responses is 76 in total. Ethical considerations where also included in this study to confirm that ethical issues were addressed. The method for data analysis was through using SPSS statistical software, wherein, various tests were used and which are explained in details in the following chapter.

5 Chapter Five: Data Analysis and Findings

5.1 Introduction

This chapter demonstrates the research results of the collected data which was analyzed by using SPSS software as analysis tool (Bryman, 2012). It displays the results and findings from various tests that were chosen based on the research design, questions and hypotheses. For this study, the tests that were conducted include reliability (DeVillis, 2003), correlation and regression tests, wherein, each test serves specific purpose. Reliability tests were used to validate question's reliability while correlation and regression were tested to answer research hypotheses of the various relationships between digital skills clusters and project innovation success (Bryman, 2012). In addition to that, importance analysis of the IV and DV was also used.

5.2 Descriptive Statistics

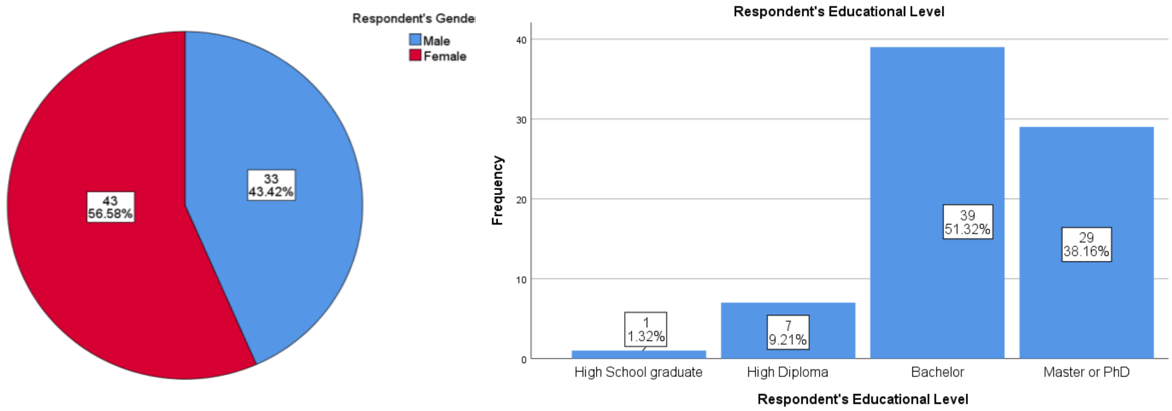
5.2.1 Data Validation

Based on the selected sampling methods, it is necessary to validate the collected responses to ensure that the data represents accurate findings. Based on the overall responses, it was found that the participation rate was 50%, in which the completion rate was around 70% and the average completion time was around 10 minutes. Initially, around 120 responses were received, but after validating the collected data, the total number of completed and accepted responses amounted to 75 respondents. This elimination was made because it is important to validate the collected responses to increase the accuracy of the data and minimize any irrelevant or wrong answers that do not relate to the research topic or scope. The validation was done by removing incomplete responses (more than 40 responses were incomplete) and irrelevant responses that do not relate to the targeted population or fit the specialization of this research, as found from the demographic information. The collected responses varied, representing employees who are from varying positions and roles including project managers, project team members, innovation managers, innovation team players, innovation experts or IT experts. In addition to those of senior positions who are general managers, directors, or experts and consultants.

5.2.2 Demographic Variables

The first part of the survey questionnaire presents general information of respondents or what is known as demographic characteristics. Based on the collected responses, the demographic data was analyzed to have a better understanding of respondent's personal information such as gender and educational level, also, their job background such as their job sector, primary roles, experiences and other demographic data. It is mainly to assess the distribution of the targeted population and link their answers to research variables. The findings have shown a range of revealing information on the demographic variables. The pie chart below revealed that out of 76 responses, females accounted for 57% of the overall responses as they dominated by a small margin of 13.16%, this can be interpreted as having a good balance of gender ratio. Also, the bar chart shows respondent's educational level, it appears that half the population have bachelor degree, a count of 39, followed by that 38% who have Master or PhD, a count of 29 while the rest educational levels amounted for 10% of the total responses.

Figure (5): personal information graphs



It was found that respondents primarily work in the government sector, representing 39% of all responses, followed by 20% who work in other fields/sectors that were not mentioned in the multiple choice list. Some other fields include insurance, logistics, aviation, corporate marketing communication, semi-government, real-estate and etc. Whereas, the finance and banking sector was found to represent the third most frequent sector with 17 percent of the overall responses. The overall population held a wide range of roles and positions, a total of 25 worked in managing positions including general managers, project managers and innovation managers or (CIOs), this indicates that almost half the responses, a percentage of 47, held senior and high positions. While, 23 (30%) worked in other roles from the ones mentioned in the survey, which included, for instance, positions such as directors, senior manager, assistant managers, head of sections, team leaders or members, business development manager, engineers and others. It can be noticed that some of these roles represent higher or senior positions. For the rest of positions, 19 (25%) worked as project team members and innovation team members while 9 (11.8%) worked as experts and consultants. When it comes to years of working experience, third of the total respondents, 24, had a working experience of more than 15 years, followed by 21 who have experience that range between 2-5 years, 13 had 11-15 years of experience, 9 had one year or less and the remaining 9 had experience from 6 to 10 years of experience. Concluding from this result that almost half the population, around 48%, have working experience of more than 10 years, which is a good indicator since many questions were based on experience. Another question was about the years of experience in managing projects, the results showed that around 40% did not have any experience or had it for one year or less, 31% had between 2-10 years while the rest around 29% had more than 10 years experience in managing projects. The values of the mean, median, mode and standard deviations for each variable are reflected in table 7, noting that each variable have different values as entered in SPSS. For example, educational level is labelled from 1 (high school) to 5 (Master/PhD), job sector from 1 (construction & manufacturing) to 8 (other), primary role from 1 (general manager) to 9 (other), years of experience from 0 (none) to 5 (more than 15 years), interplay existence from 1 (yes) to 3 (do not know) and effectiveness of digital skills from 1 (very effective) to 5 (very ineffective).

Table (7): Descriptive Statistics

	Educational Level	Job Field/Sector	Primary Role	Years of Experience	Years of Experience in Managing Project	Interplay between 3 disciplines	Effectiveness of digital skills
N	76	76	76	76	76	76	76
Mean	4.26	5.12	5.20	3.29	2.29	1.37	4.12
Median	4	5	5	3	2	1	4
Mode	4	5	9	5	1	1	4
Std Deviation	.681	1.932	2.989	1.459	1.696	0.746	0.632
Minimum	2	1	1	1	0	1	2
Maximum	5	8	9	5	5	3	5

In addition to the above, there were two general questions that were asked to investigate participants initial perception of the topic before starting with answering the independent and dependent variables questions. The first question aimed to know if respondents' think there is interplay between the three disciplines of project management, innovation management and digital skills. The majority of respondents replied with yes representing 78.9% of the total population, whereas, the other 21% replied with unsure (5.3%) and unaware (15.8). The means value was 1,37, median 1 (yes) and standard deviation 0.746, as presented in table 7. The second question aimed to figure out the effectiveness of digital skills when applied in projects such as innovation projects. The findings revealed that based on participants experience 31 said its very effective, 32 effective, 11 satisfactory and 1 person said its ineffective, another one said its very ineffective. Overall, the majority, around 80%, have found it very effective to apply digital-age skills when applied to projects. However, this result will not conclude the study, it only aimed to have an understanding of how participants perceive digital skills when applied to projects.

5.3 Reliability Test

This research used Cronbach's alpha to test internal consistency, it is a reliability test used to validate the research questionnaire (Bryman, 2012). Specifically, to review items that compose the scales to check if the presented scales are stable and if they produce reliable and consistent outcomes. In other word, it is to determines how closely or how well a set of questions are grouped together (DeVillis, 2003). Based on several recommendations in the most frequently cited sources, the value of Cronbach's Alpha should be above 0.70 to be considered acceptable (Yu, 2001; DeVillis, 2003; Kline, 2005;). Therefore, Cronbach's alpha was run to validate the research instrument by checking if the items are above or within the minimum acceptable level of reliability. This test was run multiple times since the questionnaire was composed of multiple scales underlying two main variable groups, digital skills clusters and project innovation success factors.

Firstly, the test was run for all 39 items including both independent variables (digital skills clusters) and dependent variables (project innovation success factors), it resulted in a high level of consistency with a Cronbach's alpha of 0.962 as shown in table 8 below. Further, it was found that deleting any of the items would not have increased the alpha level.

Table (8): Cronbach's Alpha results for all items

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.962	.962	39

Then, the test was run for the two variable groups separately since each group measures a different underlying construct. Cornbach's analysis was conducted on "digital skills clusters" (independent variables), with a total of 22 items. As can be seen from table 9, the alpha level was at 0.939 indicating a high level of inter-item reliability. Whereas, for "project innovation success factors", the results are shown in table 10 to be at high level of consistency with a coefficient of 0.935. Overall, it was found that there is an adequate level of inter-item reliability for all variable groups as presented, so there is no need to remove any item from the analysis.

Table (9): Cronbach's Alpha results for digital skills clusters

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.939	.940	22

Table (10): Cronbach's Alpha results for project innovation success

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.935	.935	17

Finally, the test was conducted for each skill-set (independent variable) to gain a precise and more accurate indication of reliability across the independent variable group, which is the group that we will be tested closely in the established hypotheses. It can be seen from the data in Table 11 that Cornbach's alpha coefficients for each independent variable were 0.701, 0.840, 0.815, 0.821, 0.793, respectively. In which all of the values were above 0.70, resulting in suitable and acceptable level of reliability.

Table (11): Cronbach's Alpha results for each digital skills cluster

Independent Variables	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Technical skills	.701	.706	4
Information skills	.840	.839	5
Communication & collaboration skills	.815	.820	4
Content-creation skills	.821	.827	5
Problem-solving skills	.793	.797	4

5.4 Correlation Analysis

Correlation statistical analysis was used to determine the relationship between a pair of variables (Bryman, 2012; Sheskin, 2011). In this study, Spearman's Rank-order Correlation test was conducted to determine the associations between digital skills clusters (independent variables) and project innovation success factors (dependent variables). The purpose is to examine research hypotheses, to identify if there is any relationships or associations between each digital skill-set and innovation success factors, to decide on accepting or rejecting the null hypotheses (Sheskin, 2011). It is to investigate if there is strong or weak association between the ranks, or no association meaning that they are hardly related to innovation success factors. The reason Spearman's Correlation was chosen is because the variables were not normally distributed, as confirmed by normality test. Given that the research instrument is composed by multiple Likert scale data, it is argued by some researchers that Likert scale data are not normally distributed (Norman, 2010). Therefore, a test of normality was conducted to check if bivariate normality exists and confirm whether each pair of variables were normally distributed. The tests of normality table that are shown in appendix E, as assessed by Shapiro-Wilk's test ($p < .05$) (Sheskin, 2011). Indicating that none of the variables were normally distributed, as assessed by Shapiro-Wilk's test.

A Spearman's rank-order correlation was run in stages, the first stage was to identify the relationship between the two main groups, digital skills clusters and project innovation success. 76 participants were recruited. From the analysis, it was found that $r_s(74)=0.781$, $p < .0005$, indicating statistically significant and strong positive correlation between these two groups (please refer to appendix F). Then for the second stage, the test was run to identify the association between each digital skills cluster and the overall project innovation success factors which is the composite score of all innovation factors. Table 12 below displays the results for the correlation tests between each pair of variables, the general view shows that there is association between each skill-set and the innovation success factors. As observed, the highest correlation is with problem-solving skills (r_s=0.733) and the lowest is with technical skills (r_s=0.501). Overall, the correlation coefficient is rather high for all clusters, which indicates a positive association. It is also statistically significant as indicated by Sign (2-tailed) $p < .0005$.

Table (12): correlations between each digital skills cluster and project innovation success

			Innovation_Success_Factors
Spearman's rho	Technical_Skills	Correlation Coefficient	.501**
		Sig. (2-tailed)	.000
		N	76
	Information_skills	Correlation Coefficient	.715**
		Sig. (2-tailed)	.000
		N	76
	CommandCollab_Skills	Correlation Coefficient	.605**
		Sig. (2-tailed)	.000
		N	76
	Contentcreation_Skills	Correlation Coefficient	.677**
		Sig. (2-tailed)	.000
		N	76
	Problemsolving_skills	Correlation Coefficient	.733**
		Sig. (2-tailed)	.000
		N	76

In the final stage, the test was run between all variables, each digital skills cluster and each project innovation success factor as exhibited in table 13. It can be noticed from the matrix that all variables are correlated showing that all relationships are statistically significant and positive. The correlation coefficients ranges between 0.314 (lowest coefficient) and 0.735 (highest correlation). In which, the lowest represents the association between technical skills cluster (independent variable) and knowledge factor (dependent variable). The results obtained from this analysis is that the more digital skills are applied in projects, the higher project success or more specifically innovation success. Also, since there was a statistically significant relationship between each pair of variables, the null hypothesis can be rejected.

Table (13): correlation test between all variables

		Technical_skills	Information_skills	CommandCollab_Skills	Contentcreation_Skills	Problemsolving_skills	Climate_variables	Culture_variables	Collaboration_variables	Knowledge_variables	Competence_variables	Manage_variables
Technical_skills	Correlation Coefficient	1.000	.614**	.490**	.564**	.428**	.402**	.502**	.385**	.314**	.476**	.506**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.006	0.000	0.000
	N	76	76	76	76	76	76	76	76	76	76	76
Information_skills	Correlation Coefficient	.614**	1.000	.729**	.709**	.642**	.465**	.704**	.596**	.499**	.632**	.636**
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	76	76	76	76	76	76	76	76	76	76	76
CommandCollab_Skills	Correlation Coefficient	.490**	.729**	1.000	.735**	.593**	.434**	.574**	.562**	.463**	.469**	.489**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	76	76	76	76	76	76	76	76	76	76	76
Contentcreation_Skills	Correlation Coefficient	.564**	.709**	.735**	1.000	.666**	.569**	.605**	.590**	.560**	.657**	.453**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	76	76	76	76	76	76	76	76	76	76	76
Problemsolving_skills	Correlation Coefficient	.428**	.642**	.593**	.666**	1.000	.583**	.600**	.660**	.663**	.611**	.646**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000
	N	76	76	76	76	76	76	76	76	76	76	76
Climate_variables	Correlation Coefficient	.402**	.465**	.434**	.569**	.583**	1.000	.703**	.626**	.557**	.536**	.575**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000
	N	76	76	76	76	76	76	76	76	76	76	76
Culture_variables	Correlation Coefficient	.502**	.704**	.574**	.605**	.600**	.703**	1.000	.711**	.642**	.674**	.700**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
	N	76	76	76	76	76	76	76	76	76	76	76
Collaboration_variables	Correlation Coefficient	.385**	.596**	.562**	.590**	.660**	.626**	.711**	1.000	.550**	.573**	.631**
	Sig. (2-tailed)	0.001	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000
	N	76	76	76	76	76	76	76	76	76	76	76
Knowledge_variables	Correlation Coefficient	.314**	.499**	.463**	.560**	.663**	.557**	.642**	.550**	1.000	.722**	.586**
	Sig. (2-tailed)	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000
	N	76	76	76	76	76	76	76	76	76	76	76
Competence_variables	Correlation Coefficient	.476**	.632**	.469**	.657**	.611**	.536**	.674**	.573**	.722**	1.000	.603**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
	N	76	76	76	76	76	76	76	76	76	76	76
Manage_variables	Correlation Coefficient	.506**	.636**	.489**	.453**	.646**	.575**	.700**	.631**	.586**	.603**	1.000
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	N	76	76	76	76	76	76	76	76	76	76	76

5.5 Regression Analysis

To further understand the influence of digital skills clusters on project innovation success, a regression analysis was performed. It is a statistical method used to determine how much of the variation in project innovation success is explained by digital skills clusters (Weisberg, 2014). In this study, more than one type of regression was performed. At first, a linear regression analysis was conducted between the main two groups (digital skills & project innovation success) then between each independent variable (the five predictors of skill-sets) and one dependent variable (the outcome, project innovation success). It was chosen as a method because the research hypotheses (H2-H6) was to investigate the relationship between each single digital skills cluster and project innovation success. Then, multiple regression analysis was also used to investigate the strongest predictor among the five digital skill-sets (Weisberg, 2014; Cook, & Weisberg, 1982; Hair et al., 2014).

5.5.1 Linear Regression

The results obtained from the preliminary analysis confirms the various assumptions about regression analysis as mentioned by Best and Wolf (2014). The assumptions of linear regression was checked by plotting a scatter plot between each individual independent variable and the dependent variable. Visual inspection of the plots indicates that all relationships are linear as shown in appendix G. In addition to that, the independence of residuals was tested, as assessed by a Durbin-Watson statistic of 1.977 between digital skills clusters and project innovation success, please see appendix I to view Durbin-Watson statistics between each two variables. Normality of residuals was also checked showing that the residuals were normally distributed as assessed by visual inspection of a normal P-P Plot, as illustrated in appendix H.

The following table presents the results that were generated from linear regression. It displays the regression model summary of all the regression tests that were conducted between each pair of variables. In which, the first test was run to present the relationship between the two main groups, digital skills clusters (predictor) and project innovation success (outcome). Then, the following tests were run to describe the relationships between each individual digital skills cluster and the main dependent variable which is achieving project innovation success.

Table (14): Linear Regression results summary

Regression Model Summary							
Dependent Variable		Project innovation success					
Predictors		Digital skills clusters	Technical skills	Information skills	Comm& collab skills	Content-creation skills	Problem-solving skills
Model Summary	R	0.770	0.564	0.688	0.564	0.691	0.767
	R^2	0.593	0.318	0.473	0.318	0.478	0.589
	Adj. R^2	0.587	0.309	0.466	0.309	0.471	0.583
	Std. Error	0.32179	0.41630	0.36592	0.41643	0.36431	0.32332
ANOVA	F	107.704	34.565	66.517	34.500	67.763	105.984
	P (Sig)	0.000	0.000	0.000	0.000	0.000	0.000
Coefficients	Unstan coeff β	Const 0.761 0.832	Const 1.879 0.569	Const 1.563 0.632	Const 1.983 0.536	Const 1.674 0.632	Const 1.541 0.650

	Unstan coeff Std. Error	Const 0.341 0.080	Const 0.413 0.097	Const 0.336 0.078	Const 0.394 0.091	Const 0.319 0.077	Const 0.269 0.063

Regression test results between digital skills clusters and project innovation success

Starting with the first test, it can be observed from the results above that there is a good fit of the regression model as determined by the proportion of variance (R, R^2 & adjusted R^2) and statistical significance of the model (df, F, Sig). For the proportion of variance, the value of R indicates a good level of predictions. It can be seen that for this test that the value of R^2 is 0.593 in which digital skills clusters accounted for 59.3% of the variations in project innovation success with adjusted R^2 of 58.7%. For statistical significance, it is illustrated in the table below that all relationships are statistically significant since $p < .05$ and they are all linear. For this test, digital skills clusters statistically significantly predicted project innovation success, $F(1, 74)=107.70$, $p < .0005$, so the model is a good fit. Moreover, the beta value of unstandardized B is 0.832 which indicates that the more digital skills are applied in projects , the more a positive influence on achieving innovation success. The regression equation used to describe the relationship is as follows: $Y= b_0 + (b_1 * X)$, Where y is project innovation success and x is digital skills clusters, b_0 is the constant and b_1 is the slope coefficient (Wisberg, 2014). This equation can be used to predict project innovation success based on the values of independent variables (i.e. digital skills clusters). Based on these results and findings from correlation tests, Hypothesis (1) is accepted, ***H1: digital skills will positively influence successful innovation of projects.***

Regression tests results between each individual digital skills clusters and project innovation success

As presented in table 14, digital skills consist of five clusters which are technical skills, information skills, communication and collaboration skills, content-creation skills and problem-solving skills. For the first cluster, technical skills, it can be seen that there is a good fit of the model because the values of R2 is 0.318 and adj. R2 is 0.309. It is also considered a good fit and indicates that the test predicts project innovation success, since technical skills statistically significantly predicted innovation success, $F(1, 74) = 34.565$, $p < .0005$. Also, the influence of technical skills on project innovation success is confirmed to be positive since the unstandardized coefficient beta value is 0.569. So, it is concluded that possessing technical digital skills helps in achieving successful innovation in projects. Based on that and the correlation test, Hypothesis (2) is accepted, *H2:* ***technical skills will positively influence successful innovation of projects***

Another regression test was run for the second cluster, information skills, which confirmed how well the model fits the data as represented by the values of R^2 and adjusted R^2 0.473 and 0.466, respectively. Information skills was found to be significant, $F(1, 74) = 66.517$, $p < .0005$, this result demonstrates that information skills is a good predictor for achieving project innovation success. The beta value is 0.632, this indicate that an increase in the level of information skills is met with a rise in achieving successful innovation in projects. This also means that the rate of innovation success within projects can be increased by having information digital skills. It can be concluded from these results and correlation results that

Hypothesis (3) is accepted, ***H3: Information skills will positively influence successful innovation of projects***

A test was also run for the third cluster, communication and collaboration skills, to assess the contribution of this skill-set to the prediction of project innovation success. The results showed that R^2 and adjusted R^2 all indicate that the model is fit with values 0.318 and 0.309, respectively. In addition, this variable is statistically significant, $F(1, 74) = 34.500$, $p < .0005$. The beta value is 0.536 and based on this, it is noted that project innovation success is influenced by communication and collaboration skills. These results and the correlation test confirm Hypothesis (4), ***H4: Digital communication and collaboration skills will positively influence successful innovation of projects.***

For assessing the fourth cluster, the test was run to determine whether content-creation skills have a significant influence on project innovation success. The analysis showed that the proportion of variance R^2 (0.478) & adjusted R^2 (0.471) are all high, indicating a very well fit of the model. Moreover, digital content-creation skills statistically significantly predicted project innovation success, $F(1, 74)=67.763$, $p < .0005$. It can be observed from the table that this skill-set influences project innovation success as presented by a beta value of 0.632. Therefore, having this skill-set within project team would contribute towards achieving successful innovation in projects. These findings and the correlation test conclude that Hypothesis (5) is accepted, ***H5: Digital content-creation skills will positively influence successful innovation of projects.***

Problem-solving skills, the fifth and final cluster, was also assessed to identify if this skill-set have a significant association with project innovation success. The results showed that there is a good fit of the model, as demonstrated by R^2 (0.589) & adjusted R^2 (0.583), they are both high. These values indicate that approximately 58% of the variance of project innovation success can be explained by problem-solving skills. It is also shown in the summary table that problem-solving skills is statistically significant, $F(1, 74)= 105.984$, $p < .0005$. This skill cluster has the highest beta value out of all the relationships with other clusters, which is value of 0.650, indicating that the greater the influence of problem-solving skills, the more positive will be the impact of project innovation success. Based on these results and the correlation test, Hypothesis (6) is accepted, ***H6: Digital problem-solving skills will positively influence successful innovation of projects.***

5.5.2 Multiple regression

Multiple regression analysis was used in this research to investigate the strongest predictor among the five digital skill-sets and among the variables of each cluster (Weisberg, 2014; Hair et al., 2014). This test was mainly used to measure the importance of digital skills clusters, to identify the relative contribution of each digital skill-set to the explanation of the variance in project innovation success (Weisberg, 2014; Hair et al., 2014). More specifically, it was run to rank the importance of the five digital skills clusters, which is explained further in “importance analysis” section. This study used stepwise as a method for multiple regression for determining statistically significant predictors (Kenton, 2020). It is one of the most popular methods which works by selecting the predictor with the largest correlation then selecting the next largest predictor, doing that sequentially until it stops the analysis once there are no significant predictors (Kenton, 2020). It was used for the purpose of highlighting the most significant predictors in this study, it is considered as a useful analysis since it decomposes the unique contribution of each variable as a predictor may identify (Petscher, et al, 2013). Multiple regression was conducted into two stages, the first stage was by entering all composite scores of digital skills clusters (i.e tech, info, comm, content, problem-solv skills). While, the second stage was by running the tests for each individual skill-set separately (i.e entering the four variables of technical skills, tech 1,tech2, etc).

The multiple regression model equation is $Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + e$, where Y represents project innovation success, X1-4 are the various digital skills clusters, β0 is the constant, β1-4 is the slope coefficient and e represent the errors. There were 6 models in total to examine the influence of digital skills clusters on project innovation success, one model for all digital skills clusters collectively (tech, info, comm, content, problem) and the rest 5 models representing the variables of each digital skills cluster (i.e. tech_v1, tech_v2, ...).

The validity of the 6 models were assessed by confirming various assumption that are associated with multiple regression (Best & Wolf, 2014). The first assumption about linearity was tested by plotting scatterplot and using partial regression plots. Visual inspection of the scatter plot proved that there is linear relationship between project innovation success and digital skills clusters collectively. Using partial regression plots also proved that there is linear relationship between project innovation success and each digital skills cluster. In addition, to confirm linearity, the residual mean was found to be zero. The second assumption was testing independence of residual, the results indicate there was independence of error as assessed by a Durbin-Watson statistic of 1.735 for digital skills collectively, and 2.06, 1.71, 1.98, 1.95 and 1.85, respectively for each skill-set. The data was also checked for potential multicollinearity after the model was generated, in order to ensure that it does not show critical levels of multicollinearity (Frost, 2020). The VIF was calculated for all models. For the first model, the results showed that the VIF was 1.926 while for rest five models the results were 1.26, 1.49, 1.39, 1.3 and 1.65, respectively. According to Frost (2020), the results of VIF between 1-5 are not considered a major concern to take corrective actions for multicollinearity, it suggests moderate correlations. In this case, the presented VIF are at the lower end (range between 1.2-1.9) which indicates that the tolerance values are all greater than 0.1, so it can be argued that the data are not majorly affected by multicollinearity and it does not require further actions to be undertaken. Normality of residuals was also assessed confirming that the residuals were normally distributed through visual inspection of a normal P-P Plot.

Table (15): stepwise regression for all digital skills clusters

<table>
<tr><th colspan="7">Multiple Regression Models Summary: Stepwise method</th></tr>
<tr><td colspan="7">Model 1: All Digital Skills Clusters</td></tr>
<tr><td>Predictors</td><td>R^2</td><td>Adj R^2</td><td>F</td><td>Sig</td><td>β</td><td>Removed variables</td></tr>
<tr><td>Problem-solving skills</td><td>0.589</td><td>0.583</td><td>105.98</td><td>0.000</td><td>0.650</td><td rowspan="2">Technical skills,
Information skills,
Comm & collab skills</td></tr>
<tr><td>Problem-solving skills
Content-creation skills</td><td>0.638</td><td>0.628</td><td>64.26</td><td>0.000</td><td>0.470
0.281</td></tr>
</table>

The regression result of the first model is presented in table 15. The results show that regressing technical skills, information skills, communication and collaboration skills, content-creation skills and problem-solving skills, all five predictors against project innovation success (model 1), resulted in including two clusters in the regression equation, they are problem-solving skills and content-creation skills as they were found to be statistically significant, F(1, 74) = 105.98, p < .0005, $F(2, 73) = 64.26$, $p < .0005$. It can also be seen that R square value is 0.589 for problem-solving skills and 0.638 for the two clusters combined together (problem-solving and content creation), both values indicate that the model is fit, and the combined values indicate that around 63% of the variance in project innovation success is explained by both problem-solving and content-creation skills joined together. The beta values in the table below also suggest that any increase in skills level for these two, it would result in positive influence in achieving innovation success.

Table (16): stepwise regression for technical skills variables

Model 2: Technical Skills						
Predictors	R^2	Adj R^2	F	Sig	β	Removed variables
Technical skills_V4	0.291	0.281	30.38	0.000	0.374	Technical skills_V1 Technical skills_V3
Technical skills_V4 Technical skills_V2	0.368	0.350	21.22	0.000	0.276 0.244	

The results for the second model is illustrated in table 16. The technical skills model was found to be significant, F(1, 74) = 30.38, p < .0005 and F(2, 73) = 21.22, p < .0005. Where only two technical skills variables added statistically significantly to the prediction of project innovation success, $p < .05$. they are the fourth variable of technical skills (i.e ability to handle digital structure) and second variable (i.e ability to understand and use digital systems, tools and software). The findings also indicate that these two variables impact project innovation success as shown by the beta value that is associated with the fourth variable, 0.374, and the beta value for the combination of fourth and second variables 0.276 and 0.244, respectively. Even though there is impact on project innovation success as suggested by the beta value, but when compared with the rest of the models, it appears that this cluster showed the lowest beta values.

Table (17): stepwise regression for information skills variables

Model 3: Information Skills						
Predictors	R^2	Adj R^2	F	Sig	β	Removed variables
Information skills_V5	0.428	0.420	55.41	0.000	0.441	Information skills_V1 Information skills_V3 Information skills_V4
Information skills_V5 Information skills_V2	0.483	0.469	34.13	0.000	0.331 0.219	

The findings of information skills model is displayed in table 17. It shows that adding the five variables of information skills results in having two variables that are significant, F(1, 74) = 55.41, $p < .0005$ and F(2, 73) = 34.13, $p < .0005$. They are variable five (i.e. Ability to organize and manage data, information and digital content) and variable two (i.e . "Ability to analyze and critically evaluate the credibility and reliability of sources of data, information and digital content"). The model was verified to be fit by R^2 value of 0.428 and 0.483, respectively. Overall, it can be assessed that the two significant variables when combined together contribute to achieving project innovation success as indicated by beta values of 0.331 and 0.219.

Table (18): stepwise regression for communication and collaboration skills variables

Model 4: Communication & Collaboration Skills						
Predictors	R^2	Adj R^2	F	Sig	β	Removed variables
Comm&Collab skills_V2	0.253	0.243	25.11	0.000	0.388	Comm&Collab skills_V3 Comm&Collab skills_V4
Comm&Collab skills_V2 Comm&Collab skills_V1	0.309	0.290	16.33	0.000	0.273 0.228	

Table 18 presents the findings of the fourth model which is associated with communication and collaboration skills. The outcomes reveal that variable 2 (i.e "Ability to use digital technologies for collaborative processes") and variable 1 (i.e. "Ability to share data, information and digital content with others through digital technologies") were found to statistically significant, thus, appearing in the regression equation. As indicated by F(1, 74)

= 25.11, p < .0005 and F(2, 73) = 16.33, p < .0005. The model is also considered fit since R^2 was 0.253 and 0.309respectively. The beta values were 0.388 for the second variable of communication skills and when joint with the first variable the values were 0.273 and 0.228. Similar to what was stated in the technical skills model, this skill-set is also found to have the lowest beta coefficients indicating that it has lower impact on project innovation success than the other skill-sets.

Table (19): stepwise regression for content-creation skills variables

Model 5: Content-creation Skills						
Predictors	R^2	Adj R^2	F	Sig	β	Removed variables
Content-creation skills_V2	0.521	0.515	80.51	0.000	0.503	Content-creation skills_V1 Content-creation skills_V3 Content-creation skills_V4
Content-creation skills_V2 Content-creation skills_V5	0.547	0.535	44.15	0.000	0.440 0.140	

The fifth model, as presented in table 19, demonstrates the most significant variables of content-creation skills. It has shown that there were two variables that statistically significantly predicted innovation success, F(1, 74) = 80.51, p < .0005 and F(2, 73) = 16.33, p < .0005. the fitness of the models was also confirmed by R square values, 0.515 and 0.535. The influence of content-creation skills on project innovation success is confirmed to be positive since the coefficient beta value is 0.53 for the second variable (Ability to modify, re-elaborate, and integrate existing digital content to create something new and original) and 0.440 and 0.140 when the second variable is combined with the fifth variable (i.e programming). The highest beta value corresponds to the ability to modify and integrate exiting digital content to create something new, indicating that it helps in achieving successful innovation in projects. This result is compatible with what was find in literature since content-creation skills were referred to be creative and innovative skills.

Table (19): stepwise regression for problem-solving skills variables

Model 6: Problem-solving skills						
Predictors	R^2	Adj R^2	F	Sig	β	Removed variables
Problem-solving skills_V4	0.478	0.471	67.86	0.000	0.466	Problem-solving skills_V1
Problem-solving skills_V4 Problem-solving skills_V3	0.556	0.544	45.65	0.000	0.319 0.250	
Problem-solving skills_V4 Problem-solving skills_V3 Problem-solving skills_V2	0.598	0.581	35.681	0.000	0.252 0.206 0.177	

The final model presented in table 19 demonstrates the results for problem-solving skills (the last identified cluster), it is clearly shown in the table that this cluster had the highest number of significant variables, it displays three variable while all other models display two. The model was found to be significant for the fourth variable (i.e ability to identify digital skills gaps), $F(1, 74) = 67.86$, $p < .0005$, R^2 0.478 also for the 4th variable combined with the third variable (i.e creatively use and innovate with technologies), $F(2, 73)= 45.65$, $p < .0005$, R^2 0.556, and its statistically significant when combining variable 4, 3 and 2 (i.e ability to make decisions regarding digital needs), $F(3, 72)= 35.681$, $p < .0005$, R^2 0.598. Based on these findings, it can be argued that applying problem-solving skills greatly influence project innovation success. Therefore, it is suggested for organizations to highly focus on strengthening this skill-set for their employees and project teams.

5.6 Variable Importance Analysis

5.6.1 Importance of Digital Skills clusters

Analyzing the importance of digital skills clusters which influence project innovation success is an important part of this research. Therefore, variable importance analysis (VIA) was performed based on the results of self-rating scale and regression tests (Wei, 2015). For the first part of the analysis, a Likert rating scale was included in the research instrument to assess the degree of factors/variables importance. It was through asking participants to indicate the level of importance of each digital skills clusters towards influencing project innovation success, as presented in appendix A. The results of this rating question are illustrated in table 20 below. Out of the 76 overall responses, the results showed that problem-solving skills is perceived to be the most important influential of innovation success with an arithmetic average of 4.36, which is between very important (a score of 5) and important (a score of 4). While content-creation skills is ranked the last, it is perceived as the least important influential out of all clusters. Yet it can be observed that content-creation skills have an average of 4.12 which is still considered high as it is near important (a score of 4). It can be concluded that all skills clusters appear to be almost equally important as shown in the table below, the means range between 4.36 and 4.1 (very important to important). It can be also observed that technical and information skill got the same rank with average of 4.34, which indicates that they are perceived equally important skills. The purpose of asking this rating question is to comprehend their direct thoughts of what are the most important digital skills clusters.

Table (20): importance of Digital Skills Clusters from Likert Rating Scale

Digital Skills Clusters	Total		Very imp	Imp	Neutral	Not imp	Not imp at all	Mean	Rank
Problem-solving Skills	76	∑ %	34 44.7%	35 46.1%	7 9.2%	0 0%	0 0%	4.36	1
Technical Skills	76	∑ %	36 47%	32 42%	6 7.9%	2 2.6%	0 0%	4.34	2
Information Skills	76	∑ %	39 51%	26 34%	10 13%	0 0%	1 1.3%	4.34	2
Communication &Collaboration Skills	76	∑ %	32 42%	37 48.7%	6 7.9%	1 1.3%	0 0%	4.32	3
Content-creation Skills	76	∑ %	23 30%	41 53.9%	10 13%	2 2.6%	0 0%	4.12	4

5.6.2 Ranking Digital Skills Clusters Importance in Regression

As mentioned earlier, the results from regression tests were also used to measure the importance of independent variables (Frost, 2020), aka digital skills clusters. The generated results from regression tests were compared with the previous results from the self-rating question. It is to have a better understanding of the importance of digital skills from the direct perspective of respondents against statistical standpoint. The regression tests or statistics that were used to measure importance included standardized coefficient beta, part correlation, stepwise regression and change in R^2 (Frost, 2020). Table 21 shows the resulted values and ranks out of all the four mentioned statistics as well as the ranking results from the rating question stated earlier.

Table (21): importance of Digital Skills Clusters from regression tests

Digital Skills Clusters	Standardized Coefficient β		Part Correlation		Stepwise Regression	Change in R Square		Rating Scale Results	
	Value	Rank	Value	Rank	Rank	Value	Rank	Mean	Rank
Problem-solving Skills	0.481	1	0.319	1	1	0.102	1	4.36	1
Content-creation Skills	0.255	2	0.142	2	2	0.02	2	4.12	4
Information Skills	0.213	3	0.113	3	Excluded Variable	0.013	3	4.34	2
Communication &Collaboration Skills	-0.129	4	-0.074	4	Excluded Variable	0.005	4	4.32	3
Technical Skills	0.073	5	0.052	5	Excluded Variable	0.003	5	4.34	2

The first statistic that was used is standardized coefficient beta, as confirmed by Frost (2020). Beta values were calculated using multiple regression by including all digital skills clusters. As shown in the table above, the highest coefficient value was 0.481 for problem-solving skills, so it is ranked first in importance. As stated by many, highest beta value indicates that it is the most important influential for making variance in the dependent variable. Followed in beta rankings were content-creation skills then information skills then communication and collaboration skills and finally technical skills. Their beta values were 0.255, 0.213, -0.129, 0.073, respectively.

The second statistic used was "part correlation" which is also generated the in the same table as the beta statistics, it is by using multiple regression for all cluster. It can be observed that the ranking for part correlation is exactly the same as beta ranking. The third statistic used was stepwise regression as presented in the previous section which ranked problem-solving skills as first then followed by content-creation skill indicating that it is the same result as the previous two statistics. The changes in R square was the last analysis used to measure importance, it was inspected by conducting multiple regressions in which each digital skills cluster was dropped one at a time to check the impact on R^2, as presented in appendix K3. As stated by Frost (2020), the difference in R^2 "represnts the unique portion of the goodness-of-fit that is attributable only to each independent variable". The results have showed that dropping problem-solving skills leads to greatest change in R square (0.102), hence, indicating that problem-solving skills is the most important out of all clusters. On the other hand, the analysis have shown that dropping technical skills leads to the lowest change in R^2, a change of 0.003.

Overall, it all the four statistics lead to the same ranking of digital skills cluster. The first rank was problem-solving skills then content creation skills followed by information skills then the fourth rank was communication and collaboration skills and ending with the fifth and final rank was technical skills. In comparison with the self-ranking scale, it can be noticed that both the self-ranking and statistical results have ranked problem-solving skills as the most important predictor, highlighting the significance of this skill-set and its impact on project innovation performance. The ranking for communication and collaboration skills was also the same for both results. However, it can be viewed from table 21 that the importance of other clusters differ between the self-ranking and ranking from the four statistics. Surprisingly, the major difference between the two was content-creation skills since it was ranked the last in self-ranking, but computational results showed that it ranked second in importance. This might reflect respondent's initial understanding when they answered the self-ranking question against when they were answering independents variables questions which follows the self-ranking question.

5.6.3 Importance of Project Innovation Success

The importance of project innovation success factors (dependent variables) was also assessed by including a Likert rating scale to measure the degree of factors importance. It was through asking participants to indicate the level of importance of each innovation factors towards influencing project innovation success. This purpose of this question is to have a better understanding of respondents perspectives of the most important innovation factors that influence innovation success. Table 22 have shown the ranking results of the 6 innovation factors out of all responses. As presented, management ranked first in importance with a mean of 4.39 followed by collaboration with an average of 4.38, indicating that the two are almost the same in importance. It is also noticed that culture and knowledge are perceived to be equally important. The lease two important innovation factors were climate then competence, respectively. However. It can be concluded that all factors are close in ranking since they all scored high averages that range between 4.39 to 4.24, meaning from very important (a score of 5) to important (a score of 4).

Table (22): importance of digital skills clusters from Likert rating scale

Project Innovation Success Factors	Total		Very imp	Imp	Neutral	Not imp	Not imp at all	Mean	Rank
Management	76	∑ %	39 51.3%	30 39.5%	6 7.9%	0 0.0%	1 1.3%	4.39	1
Collaboration	76	∑ %	37 48.7%	31 40.8%	8 10.5%	0 0.0%	0 0.0%	4.38	2
Culture	76	∑ %	32 42.1%	35 46.0%	9 11.8%	0 0.0%	0 0.0%	4.30	3
Knowledge	76	∑ %	33 43.4%	33 43.4%	10 13.2%	0 0.0%	0 0.0%	4.30	3
Climate	76	∑ %	29 38.2%	38 50.0%	8 10.5%	1 1.3%	0 0.0%	4.25	4
Competence	76	∑ %	34 45%	29 38.2%	11 14.5%	1 1.3%	1 1.3%	4.24	5

5.7 Conclusions

The collected data from the survey questionnaire were analyzed using SPSS statistical software. For analyzing demographic characteristics, the results have shown that the overall responses were dominated by females by a small percent (13%). The majority had academic degrees of bachelors or master or PhD, work in the government sector, have working experience of more than ten years. Moreover, respondents are found to have varying positions which include project managers, general managers, innovation managers, project team members, innovation team members, experts and consultants. Overall, the majority of positions were those of higher or senior positions. For analyzing the independent and dependent variables, the findings confirmed the research hypotheses and indicate that digital skills clusters significantly influence successful innovation in projects. Regardless of the relatively small sample, all the relationships between digital skills clusters and project innovation success were found to be positively correlated. To add on that, regression analyses confirmed the strength of the relationships by identifying how much of digital skills clusters explain project innovation success, indicating predictors impact on the dependent variable. Regression analysis also helped in ranking the importance of digital skills clusters. Overall, importance analysis was conducted for predictors as well as dependent variables. Further discussions and interpretation on the statistical results is presented in the next chapter.

6 Chapter Six: Discussions, Recommendations and Conclusions

6.1 Introduction

This chapter interprets the research results, provides recommendations and conclusion for the study. The first part of this chapter discusses the generated results from SPSS software to test the proposed framework (Bryman, 2012), and explain how the various digital skills clusters influence project innovation success by analyzing the various relationships between each individual skill-set and the desired outcome which is achieving successful innovation in projects. Wherein, the interpretations were based on the statistical results that were presented in the previous chapter and the findings from literature review. It is by comparing both findings to highlight any similarities or differences and to verify if the presented results are in line with literature findings (Bryman, 2012). The second part presents some recommendations, suggestions for further research and the study limitations. The last part of this chapter provides a conclusion which is a summary of the study outcomes based on the research objectives and questions.

6.2 Discussions

The results from the previous chapter confirm the proposed framework because all research hypotheses were accepted. The first hypothesis was supported since the results demonstrate that digital skills clusters have positive and significant influence on project innovation success. It means that digital skills clusters are important driving factors of innovation success, indicating that any increase in digital skills level will lead to higher probability of achieving project innovation success. This result highlights the importance and influence of digital skills in PM and innovation projects in particular. Therefore, it is consisted with the findings from PMI (2019) that organizations who are Project Management Technology Quotient (PMTQ) innovators are found to lead to better project performance when compared to organizations that are PMTQ Laggards (Project Management Institute, 2019). The institute added that these PMTQ innovator organizations are found to put high emphasis on the importance of digital skills and knowledge, they regard them as a high priority, which might explain why these organizations lead in project outcomes. The results from PMI survey identified positive relationship between innovative organizations and the application of digital skills, tools and approaches within their organizations (Project Management Institute, 2018). Other study have also found that digital literacy can contribute to successful outcomes of technology implementation (Marsh, 2018; Mohammadyari & Singh, 2015). Therefore, it can be interpreted that investing in skills and capabilities is as important as investing in technologies because organizations need to make full use of technologies by having competent and skilled talents. In addition to that, digital skills have been reported to be one of the most essential elements for organizations to work effectively in the digital workplace (Kiron et al., 2016; Soule et al.,2016); this is highlighted by findings from Van Deursen and Van Dijk (2012) that due to inadequate digital skills, around eight percent of productive time is lost, as presented in their study.

The correlation and regression analyses showed that out of all digital skills clusters problem-solving skills had the most influential impact on innovation success in projects. In specific, it showed that the "ability to identify digital skills gap" had the most influential impact followed by "creatively use and innovate with technologies" then "ability to make decisions regarding digital needs". The findings implies that problem-solving skill is a highly important cluster of digital skills. Therefore, higher efforts should be directed towards increasing the level of this skill-set as they contribute to higher variation towards project innovation success. Comparing this result with digital skills literature, a fair number of models reported problem-solving skills as one cluster of digital skills and emphasized on its importance (Martin & Grudziecki, 2016; Ala-Mutka, 2011; Ferrari, 2013; Vulorikari, et al, 2016). For example, Ferrari (2013) considers this skill-set as decision-making skill since it involves making decisions regarding which digital tools to use, solving problems and exploring technological solutions. This cluster was also defined as creatively using digital tools and innovating with technologies, which explains why its linked with innovation (Ferrari, 2013). Overall, it can be observed that problem-solving skills are perceived to be very important in projects, which might be since project management involves making judgment and decisions throughout project function and process (Parth, 2013; Cohen, 2005). In addition to that, it might be due to the various challenges presented by the constantly evolving technologies and expansion of technological solutions, which makes it difficult to make decisions regarding best solutions in the market or for solving technology-related problems. Unpredictably, early popular models of digital skills did not classify digital problem-solving skills as a component of digital skills, it was emphasized on later (Martin & Grudziecki, 2016; Ala-Mutka, 2011; Ferrari, 2013; Vulorikari, et al, 2016). This can be interpreted that this cluster emerged later due to realizing the need to address the complexity and abundance of available technologies as well as due to the increasing interest in digital transformation in this digital economy. These skills are also becoming increasingly important due to the rapid pace of changing work environment. In fact, critical thinking and problem solving are considered as innovation skills that are growing in importance, as reported by the world economic forum (Eich, 2018). Also, as reported in literature, Räsänen et al (2015) added creative problem-solving skills as one of the sub-dimensions of innovation competence, to highlight its importance (Johnsson, 2016).

The second most influential predictor is found to be content-creation skills, in which, the "ability to modify, re-elaborate, and integrate existing digital content to create something new and original", was found to be the most significant variable of this cluster. In literature, content-creation skills was identified as a component of digital skills in later work by Van Deursen and Van Dijk, in 2014. To signify the importance of this skill type, it was agreed by many that content-creation skills is a vital addition to digital skills clusters and was referred to as "creative skills" (Ferrari, 2012; Helsper, 2008; Van Dijk and Van Deursen, 2014). March (2018), have identified "creating content" as one of the main 4 skill groups of "the digital workplace skills framework". To add on that, the creative aspect of March framework was identified to be the ability to form new resources in various media formats by integrating existing digital artefacts or creating it from scratch. It can be noticed from these results that many frameworks refer to content-creation as creative skill and creativity is associated with innovation or even better some believe its synonymous with innovation. According to the world economic forum in their future of jobs report 2018, creativity and originality are the innovation skills for the future and they are found to be one of the tops three growing skills for 2022 (Eich, 2018). Nevertheless, the findings about the ability to create new resources is consisted with the definition of innovation (i.e applying new ideas and recombining existing knowledge). In general, the statistical results are related to theoretical underpinning.

The statistical results have found that after problem-solving skills and content-creations skills, these predictors come in ranking of their importance: information skills, communication and collaboration skills and technical skills, respectively. This result shows that information skills is found to be the third most influential digital skills clusters. Specifically, the variables that are associated with the ability to organize and manage digital content as well as the ability to analyze and critically assess the reliability and credibility of sources of digital content (Iordache et al., 2016). Comparing it with the findings form literature, digital information skills was discussed by various models due to its importance (Van Deursen and Van Dijk, 2014; Ferrari, 2013; Ala-Mutka, 2011; Bawden, 2008; Martin and Grudziecki, 2006). In addition, March (2018), have identified "finding, processing and applying information" as one of the 4 overarching skill groups of the digital workplace skills framework. Both the two variables that were found to be significant in the stepwise regression were presented in March framework as the needed information skills in the digital workforce skills framework. After this skill-set comes communication and collaboration skills as fourth in ranking when it comes to its impact on achieving successful innovation. it was found that the most significant variables with this skill-set were the ability to use digital technologies for collaborative processes and ability to share data, information and digital content with others through digital technologies (Vuorikari et al., 2016; Iordache et al., 2016). The least influential digital skill-set was found to be technical skills, which is also found to be the center of debate in digital skills literature since some researchers argue that technical or operational skills is one component of digital skills types (Van Deursen, 2010). Whereas, there are others who argue that it is not considered as a component of digital skills clusters because it is already acknowledged, it does not need to be separated into a cluster (Iordache et al., 2017). The result confirm the opinion of those who view technical skills not to be a separate cluster digital skills clusters. Despite that, technical skills was still found to be significant and positively correlated with project innovation success.

Previous literature have not studied the direct influence of digital skills clusters on project innovation success. The interplay between the three disciplines of digital skills, project management and innovation management was not investigated. Therefore, this study presents findings which connect all three studies as proved from statistical analyses, confirming that all digital skills clusters have positive relationships with project innovation success. The results were unexpectedly revealed to be highly important in determining which digital skills cluster to focus on and it highlighted the most significant variables of each cluster by using the stepwise method. Overall, the research outcomes underline that project management digital skills must be applied in order to boost the performance of innovation projects. The overall results are found to be complement other prior studies that have linked digital skills with performance, from different perspectives. As reported by March (2018), the lack of digital skills within organizations is affecting performance negatively as it resulted with reduced number of customers and lowered productivity. In general, researchers in the academic sphere have found that an organization's ability to fully engage in knowledge economy and gain from digital technologies can be reduced due to digital skills deficiency within the organization (Kiron et al., 2016; Jones and Hafner, 2012).

6.3 Recommendations

Based on the above interpretations and discussions, it was found that digital skills clusters contribute to project innovation success. Also, the majority of survey respondents believe that digital-age skills are effective when applied to projects (i.e. innovation projects). The majority also agree that one of the downfalls of traditional PM skills is that it lacks proper digital skills which can be applied through project function and process to deliver successful projects in today's digital environment. From all these results and the overall findings, it can be suggested that organizations take proactive actions to encourage the application of digital skills within their project teams or enforce these skills by incorporating digital means within project management approaches and methodologies. To do that, it is important to provide some recommendations on how to increase the level of digital skills.

Based on the research findings and findings from literature, a digitally skilled project team is a key ingredient to achieving successful projects (Marsh, 2018). Therefore, as a first step, it is important to have an understanding of an organization's digital maturity, in order to determine the current digital capabilities, deficiencies and skills level of employees (Marsh, 2018). This assessment can be what McKinsey referred to as "digital quitenet", a metric of digital maturity level which suggests measuring digital maturity through an assessment (Catlin et al., 2015). After measuring digital skills level of project teams, organizations can then suggest initiatives or mechanisms to improve the overall level based on the identified skills gaps. Wherein, these initiatives will focus on the skills they need to foster. Some of the suggested initiatives to boost digital skills include engaging employees in training programs, networking with digital talents, promoting an innovative digital culture within project teams and provide incentives to raise digital talent (Khin & Ho, 2018; Marsh, 2018; Catlin et al., 2015). Moreover, creating policies to enforce digital learning seems to be effective.

Digital skills gap is found to be a major concern in many studies as evident by various statistics as indicated in this research. Supporting that, it was found through this research that problem-solving skills, specifically, the ability to identify digital skills gap, have the most influential impact on innovation success. It is an indicator of the importance of recognizing digital gaps and taking corrective actions accordingly. Therefore, it is believed that the assessment exercise is important to identify skills gap.

6.4 Conclusions

This study investigated the influence of digital skills clusters on project innovation success. Digital skills clusters were identified from literature review of various studies and models. These skills are regarded by many as future skills and they are increasingly becoming one of the most important skills in the workforce. This high interest in digital skills and competencies is due to the various constraints and challenges to achieve innovation and digital transformation in this digital economy. Consequently, digital skills were presented in policy makers agenda and its theories were mostly discussed it terms of its usage within nation level or educational level within schools and universities. Few have addressed the application of digital skills within project management context and its influence on project performance or success. Therefore, digital skills have not been discussed in relation to project innovations success. The interplay between the three disciplines of digital skills (literacy), project management and innovation management have not been investigated nor inter-related. Hence, this study identified the predictors of project innovation success from digital skills classifications as problem-solving skills, content-creation skills, information skills, communication and collaboration skills and technical skills. The current study has found that managing innovation projects needs applying various digital skill-sets in order to increase the probability of successful innovation. Therefore, organizations and their upper managements in specific, must realize the importance and positive impact of digital skills on the success of innovation projects. Specially, if they aim to be innovators or extensively engage in innovation work or need to accomplish innovative performance. In order to do that, they need to assess the digital maturity of their teams and identify the most important skill-sets in order to enforce the application of digital skills when applied to projects. In addition, it was reported in this study that digital skills gap is a major concern for many organization, so making tangible improvements require organizations to adopt some mechanisms or initiatives to increase digital skills level as suggested in this study. Overall, for organizations that aim to become innovators, they need to invest in three areas which include skills, culture and training.

References

Aagaard, A. & Gertsen, F., 2011. Supporting Radical Front End Innovation: Perceived Key Factors of Pharmaceutical Innovation. *Creativity and Innovation Management*, 20(4), pp.330-46. Available at: https://doi.org/10.1111/j.1467-8691.2011.00609.x.

Ala-Mutka, K., 2011. *Mapping Digital Competence: Towards a Conceptual Understanding*. Seville: European Commission, Joint Research Centre Institute for Prospective Technological Studies.

Alban, S., 2016. *Modern Project Management: An Introduction*. [Online] Available at: https://blog.mavenlink.com/modern-project-management-an-introduction.

Andersen, E.S., Birchall, D., Jessen, S.A. & Money, A.H., 2006. Exploring project success. *Baltic Journal of Management*, 1(2), pp.127-47.

Andreeva, T. & Kianto, A., 2011. Knowledge processes, knowledge-intensity and innovation: A moderated mediation analysis. *Journal of Knowledge Management*, 15(6), pp.1016-34. Available at: https://doi.org/10.1108/13673271111179343.

Balsano, T.J. et al., 2008. Identify Your Innovation Enablers and Inhibitors. *Research Technology Management*, 51(6), pp.23-33. Available at: https://doi.org/10.1080/08956308.2008.11657534.

Bawden, D., 2001. Information and digital literacies: a review of concepts. *Journal of Documentation*, 57(2), pp.218-59.

Bawden, D., 2008. Origins and Concepts of Digital Literacy. *Digital literacies: Concepts, policies and practices*, 30(2008), pp.17-32.

Best, H. & Wolf, C., 2014. *The SAGE Handbook of Regression Analysis and Causal Inference*. SAGE Publications.

Boone, H.N. & Boone, D.A., 2012. Analyzing Likert Data. *Journal of Extension*, 50(2).

Bozic, N.Y., 2016. Integrated model of innovation competence. In *In: The 27th ISPIM Innovation*. Porto, Portugal, 2016.

Broadband Commission for Sustainable Development, 2017. *Working Group on Education: digital skills for life and work*. [Online] Available at: https://broadbandcommission.org/Documents/publications/WG-Education-Report2017.pdf.

Bryman, A., 2012. *Social Research Methods*. 4th ed. New Delhi: Oxford University Press.

Buckingham, D., 2010. Defining Digital Literacy. *Nordic Journal of Digital Literacy*, 4, pp.59-71.

Camisón, C. & López, A.V., 2014. Organizational innovation as an enabler of technological innovation capabilities and firm performance. *Journal of Business Research*, 67(1), pp.2891-902.

Catlin, T., Scanlan, J. & Willmott, P., 2015. *Raising your Digital Quotient*. [Online] Available at: https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/raising-your-digital-quotient#.

Cetindamara, D., Phaalb, R. & Probertb, D., 2009. Understanding technology management as a dynamic capability: A framework for technology management activities. *Technovation*, 29(4), pp.237-46.

Cooper, R.G., 2013. Where Are All the Breakthrough New Products? Using Portfolio Management to Boost Innovation. *Research-Technology Management*, 56(5), pp.25-33. Available at: https://doi.org/10.5437/08956308X5605123.

Crespell, P. & Hansen, E., 2008. Managing for innovation: Insights into a succesful company. *Forest Product Journal* , 58, pp.6-17.

Crespell, P. & Hansen, E., 2008. Managing for innovation: Insights into a successful company. *Forest Products Journal*, 58(9), pp.6-17.

Denti, L. & Hemlin, S., 2012. Leadership and innovation in organizations: A systematic review of factors that mediate or moderate the relationship. *International Journal of Innovation Management*, 16(3), Available at: https://doi.org/10.1142/S1363919612400075.

Department of eLearning, 2015. *Digital Literacy: 21st Century Competences for Our Age*. [Online] Available at: https://dge.mec.pt/sites/default/files/ERTE/Estudos_Tecnologias/elc_digital_literacy.pdf.

DeVellis, R.F., 2017. *Scale Development: Theory and Applications*. 4th ed. Los Angeles: Sage Publications.

Eich, D.J., 2018. *Innovation Skills for the Future: Insights from Research Reports*. [Online] Available at: https://www.innovationtraining.org/innovation-skills-for-the-future/.

Ekvall, G., 1996. Organizational climate for creativity and innovation. *European Journal of Work and Organizational Psychology*, 5(1), pp.105-23. Available at: https://doi.org/10.1080/13594329608414845.

El-Sabaa, S., 2001. The skills and career path of an effective project manager. *International Journal of Project Management*, 19(1), pp.1-7. Available at: https://doi.org/10.1016/S0263-7863(99)00034-4.

Ferrari, A., 2012. *Digital Competence in Practice: An Analysis of Frameworks*. Luxembourg: European Commission, Joint Research Centre Institute for Prospective Technological Studies .

Ferrari, A., 2013. *DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe*. Luxembourg: European Commission, Joint Research Centre Institute for Prospective Technological Studies.

Filippov, S. & Mooi, H., 2010. Innovation Project Management: A Research Agenda. 1.

Franzese, M. & Iuliano, A., 2019.

Frost, J., 2020. *Identifying the Most Important Independent Variables in Regression Models*. [Online] Available at: https://statisticsbyjim.com/regression/identifying-important-independent-variables/.

Gambatese, J. & Hallowell, M., 2011. Enabling and measuring innovation in the construction industry. *Construction Management and Economics*, 29(6), pp.553-67. Available at: https://doi.org/10.1080/01446193.2011.570357.

Ghaben, R. & Jaaron, A.A.M., 2015. Assessing Innovation Practices in Project Management: The case of Palestinian Construction Projects. *International Journal of Innovation and Scientific Research* , 17(2), pp.451-65.

Gilster, P., 1997. *Digital literacy*. New York: Wiley Computer Publication.

Gustin, J.F., 2010. *Disaster & Recovery Planning: A Guide for Facility Managers*. 5th ed. London: CRC Press.

Helsper, E., 2008. *Digital inclusion: an analysis of social disadvantage and the information society*. London: Department for Communities and Local Government Oxford Internet Institute.

Heng, G.M., 2009. *A Manager's Guide to Implement Your IT Disaster Recovery Plan*. Singapore: GMH Pte Ltd.

Hentenryck, P.V., Bent, R. & Coffrin, C., 2010. Strategic Planning for Disaster Recovery with Stochastic Last Mile Distribution. Berlin, 2010. Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems.

International Telecommunication Union, 2018. *Digital Skills Toolkit*. [Online] Available at: https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/ITU%20Digital%20Skills%20Toolkit.pdf.

Iordache, C., Baelden, D. & Mariën, I., 2016. *Reconsidering digital skills: A theoretical questioning of the skills that define e-inclusion*. [Online] Available at: https://doi.org/10.13140/RG.2.1.3229.4007.

Iordache, C., Mariën, I. & Baelden, D., 2017. Developing Digital Skills and Competences: A Quick-Scan Analysis of 13 Digital Literacy Models. *Italian Journal of Sociology of Education*, 9(1), pp.6-30.

Janahi, M.A., 2018. UAE is leading from the front on innovation. *Khaleej Times*, 29 January.

Johnsson, M., 2016. *Innovation Enablers and Their Importance for Innovation Teams*. Karlskrona: Blekinge Institute of Technology.

Katz, R.L., 1974. Skills of an effective administrator. *Harvard Business Review*, 52(5), pp.90-102.

Kerzner, H.R., 2009. *Project Management: A systems Approach to Planning, Scheduling, and Controlling*. 10th ed. New Jersey: John Wiley & Sons, Inc.

Khin, S. & Ho, T.C., 2018. Digital technology, digital capability and organizational performance: A mediating role of digital innovation. *International Journal of Innovation Science*.

Laar, E.v., Van Deursen, A.J.A.M., Van Dijk, J.A.G.M. & Haan, J.d., 2017. The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, 72, pp.577-88. Available at: https://doi.org/10.1016/j.chb.2017.03.010.

Lietz, P., 2010. Research into questionnaire design: A summary of the literature. *International Journal of Market Research*, 52(2).

lleris, K., 2013. *Kompetens*. Lund: Studentlitteratur.

López-Fernández, M.C., Serrano, A.M. & López, R.G., 2011. Factors Encouraging Innovation in Spanish Hospitality Firms. *Cornell Hospitality Quarterly*, 52(2), pp.144-52.

Manley, K. & Mcfallan, S., 2006. Exploring the drivers of firm-level innovation in the construction industry. *Construction Management and Economics*, 24(9), pp.911-20. Available at: https://doi.org/10.1080/01446190600799034.

Marsh, E., 2018. *The Digital Workplace Skills Framework: Ensuring the workforce is ready to work digitally*. [Online].

Martin, A. & Grudziecki, J., 2006. DigEuLit: Concepts and Tools for Digital Literacy Development. *Innovation in Teaching and Learning in Information and Computer Sciences*, 5(4), pp.249-67.

Milano, M., 2019. *The digital skills gap is widening fast. Here's how to bridge it*. [Online] Available at: https://www.weforum.org/agenda/2019/03/the-digital-skills-gap-is-widening-fast-heres-how-to-bridge-it/.

Munns, A. & Bjeirmi, B., 1996. The role of project management in achieving project success. *International Journal of Project Management*, 14(2), pp.81-87.

Olshansky, R.B., Hopkins, L.D. & Johnson, L.A., 2012. Disaster and recovery: Processes compressed in time. *Natural Hazards Review*, 13(3).

Omar, A., Alijani, D. & Mason, R., 2011. Information technology disaster recovery plan: Case study. *Academy of Strategic Management Journal*, 10(2), pp.127-41.

Orlik, J., 2018. *Four steps to define digital skills*. [Online] Available at: https://www.nesta.org.uk/blog/four-steps-to-define-digital-skills/.

Papke-Shields, K.E., Quan, J. & Beise, C., 2010. Do project managers practice what they preach, and does it matter to project success? *International Journal of Project Management*, 28(7), pp.650-62.

Patel, N., 2017. *Digital Skills -- The New Literacy Debate*. [Online] Available at: https://www.forbes.com/sites/lbsbusinessstrategyreview/2017/08/03/digital-skills-the-new-literacy-debate/#601b632d1c84.

Pokharel, M., Lee, S. & Park, J.S., 2010. Disaster Recovery for System Architecture Using Cloud Computing. Seoul, 2010. IEEE.

Project Management Institute, 2018. *The Project Manager of the Future: Developing Digital-age Project Management Skills to Thrive in Disruptive Times*. [Online] Available at: https://www.pmi.org/-/media/pmi/documents/public/pdf/learning/thought-leadership/pulse/digital-pm-skills.pdf?v=234f58d6-0d0b-4451-bc3f-19f7ddbb92da&sc_lang_temp=en.

Project Management Institute, 2019. *The Future of Work: Leading the Way with PMTQ*. [Online] Available at: https://www.pmi.org/learning/thought-leadership/pulse/pulse-of-the-profession-2019.

Räsänen, M., Putkonen, A. & Kairisto-Mertanen, L., 2015. Innovation process-competences. In *In: CINet conference*. Stockholm, Sweden, 2015.

Rodriguez, A.N., 2018. Disrupting Times:A pivotal opportunity for project managers and the project management profession. *PMI today*, October.

Ross, T., Mitchell, V.A. & May, A.J., 2012. Bottom-up grassroots innovation in transport: motivations, barriers and enablers. *Transportation Planning and Technology*, 35(4), pp.469-89. Available at: https://doi.org/10.1080/03081060.2012.680820.

Saleem, K. et al., 2008. Towards a business continuity information network for rapid disaster recovery. Montreal, 2008. Digital Government Society of North America.

Sena, P., 2019. *Top 20 Skills for a Digital Project Manager in 2020*. [Online] Available at: https://blog.hubspot.com/agency/top-20-skills-for-digital-project-managers.

Shenhar, A.J. & Dvir, D., 2007. *Reinventing Project Management: The Diamond Approach To Successful Growth And Innovation*. Harvard Business Review Press.

Sheskin, D.J., 2011. *Handbook of parametric and nonparametric statistical procedures*. 5th ed. Boca Raton, Florida: CRC Press.

Skillsoft, 2019. *7 critical elements of project management training for the digital age*. [Online] Available at: https://www.skillsoft.com/blog/2019/03/7-critical-elements-of-project-management-training-for-the-digital-age/.

Skulmoski, G.J. & Hartman, F.T., 2010. Information systems project manager soft competencies: a project-phase investigation. *Project Management Journal*, 41(1), pp.61–77.

Smith, M., Busi, M., Ball, P. & Meer, R.V.d., 2008. Factors influencing an organisation's ability to manage innovation: A structured literature review and conceptual model. *International Journal of Innovation Management*, 12(4), pp.655-76. Available at: https://doi.org/10.1142/S1363919608002138.

Snedaker, S. & Rima, C., 2013. *Business Continuity and Disaster Recovery Planning for IT Professionals*. 2nd ed. Waltham, MA: Elsevier.

Steyaert, 2002. Inequality and the digital divide: myths and realities. In S. Hick & McNutt, eds. *Advocacy, Activism, and the Internet*. Chicago: Lyceum Press.

The Scottish Council for Voluntary Organisations , 2018. *Understanding & Measuring Essential Digital Skills*. [Online] Available at: https://storage.googleapis.com/scvo-cms/wp-content/uploads/2018/10/SCV-05-Report-A4-Portrait-V5.pdf.

The UAE government, 2020. *Innovation*. [Online] Available at: https://u.ae/en/about-the-uae/the-uae-government/government-of-future/innovation-in-the-uae.

Tidd, J. & Bessant, J., 2013. *Managing Innovation*. 5th ed. John Wiley.

Toor, S.-u.-R. & Ogunlana, S., 2010. Beyond the ‘iron triangle’: Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects. *International Journal of Project Management*, 28(3), pp.228-36.

UNESCO, 2013. *Global Media and Information Literacy Assessment Framework: Country Readiness and Competencies*. [Online] Paris Available at: https://unesdoc.unesco.org/ark:/48223/pf0000224655.

Van Deursen, A.J.A.M., 2010. *Internet Skills: Vital Assets in an Information Society*. Thesis. Enschede: University of Twente.

Van Deursen, A.J.A.M. & Helsper, E.J., 2015. The Third Level Digital Divide: Who Benefits Most From Being Online. In L. Robinson et al., eds. *Communication and Information Technologies Annual: Digital Distinctions and Inequalities*. 10th ed. Emerald Group Publishing Limited. Ch. 2. pp.29-52.

Van Deursen, A.J.A.M., Helsper, E.J. & Eynon, R., 2014. *Measuring Digital skills: From Digital Skills to Tangible Outcomes project report*. [Online] Available at: www.oii.ox.ac.uk/research/projects/?id=112.

Van Deursen, A.J.A.M. & Van Dijk, J.A.G.M., 2009. Using the internet: skill related problems in users' online behavior. *Interacting with computers*, 21(5-6), pp.393-402.

Van Deursen, A.J.A.M. & Van Dijk, J.A.G.M., 2010. Measuring Internet Skills. *International Journal of Human–Computer Interaction*, 26(10), pp.891-916.

Van Deursen, A.J.A.M. & Van Dijk, J.A.G.M., 2014. *Digital Skills: Unlocking the information society*. 1st ed. Palgrave Macmillan US.

Van Deursen, A.J.A.M. & Van Dijk, J.A.G.M., 2014. The digital divide shifts to differences in usage. *New Media & Society*, 16(3), pp.507-26.

Van Dijk, J.A.G.M., 2005. *The Deepening Divide: Inequality in the Information Society*. London: Sage Publications.

Vuorikari, R., Punie, Y., Carretero Gomez, S. & Van den Brande, L., 2016. *DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model*. Luxembourg: Publication Office of the European Union.

Wallace, M. & Webber, L., 2010. *The Disaster Recovery Handbook*. 2nd ed. Chicago: AMACOM.

Watkins, K.E. & Marsick, V.J., 1997. *Dimensions of the learning organization questionnaire*. Warwick, RI: Partners for the learning Organization.

Watkins, K.E. & O'Neil, J., 2013. The Dimensions of the Learning Organization Questionnaire (the DLOQ): A Nontechnical Manual. 15(2), pp.133-47. Available at: https://doi.org/10.1177/1523422313475854.

Weisberg, S., 2014. *Applied linear regression*. 4th ed. New York: Wiley.

West, M., Hirst, G., Richter, A. & Shipton, H., 2004. Twelve Steps to Heaven: Successfully Managing Change through Developing Innovative Teams. *European Journal of Work and Organizational Psychology*, 13(2), pp.269–99.

Wrobel, L.A. & Wrobel, S.M., 2009. *Disaster Recovery Planning for Communications and Critical Infrastructure*. Boston: Artech House.

Yu, D. & Hang, C.C., 2010. A Reflective Review of Disruptive Innovation Theory. *International Journal of Management Review*, 12(4), pp.435-52.

Appendices

Appendix A: Survey Questionnaire Format

The Influence of PM Digital Skills on Project Innovation Success

Dear Participants

Greetings,

I am a student at the British University in Dubai (BUID), currently conducting a research study on the influence of project management digital skills on project innovation success.

Thank you for agreeing to take part in this questionnaire, kindly choose the answer that best represents your view and experience on the topic. Also, please note that all results will be anonymous and confidential.

The questionnaire is structured in three parts:
Part 1: General Information
Part 2: Project Management Digital Skills
Part 3: Project Innovation Success

Thank you in advance for taking part in this survey

Part one: General Information

Q1. What is your gender? *

- ◯ Male
- ◯ Female

Q2. What is your educational level? *

- ◯ Less than High School
- ◯ High School graduate
- ◯ High Diploma
- ◯ Bachelor
- ◯ Master or PhD

Q3. What field or sector do you work in *

- ◯ Construction & Manufacturing
- ◯ Consulting
- ◯ Education
- ◯ Finance/Banking
- ◯ Government
- ◯ Healthcare
- ◯ IT services
- ◯ Other

Q4. What is your primary role within your organization? *

- ◯ General manager
- ◯ Project Manager
- ◯ Project Team Member
- ◯ Innovation manager/Chef Innovation Officer
- ◯ Innovation Team Member
- ◯ Consultant
- ◯ IT Expert
- ◯ Innovation Expert
- ◯ Other

Q5. Years of experience? *

- ◯ One year or less
- ◯ 2-5 years
- ◯ 6-10 years
- ◯ 11-15 years
- ◯ More than 15 years

Q6. Years of experience in managing projects? *

- ◯ None
- ◯ One year or less
- ◯ 2-5 years
- ◯ 6-10 years
- ◯ 11-15 years
- ◯ More than 15 years

Q7. Do you think there is interplay between the three disciplines of project management, innovation management and digital skills (literacy)? *

- ◯ Yes
- ◯ No
- ◯ Do not know

Q8. How effective have you found digital-age skills when applied to projects (i.e. innovation projects)? *

- ◯ Very effective
- ◯ Effective
- ◯ Satisfactory
- ◯ Ineffective
- ◯ Very Ineffective

Part two: Project Management Digital skills

Digital skills is defined as "the collection of skills and abilities to determine information needs from digital technology sources, and to appropriately use digital tools and facilities to input, access, organize, integrate and assess digital resources as well as to construct new knowledge, create media expressions and communicate with others".

Q9. To what extent do you agree that one of the downfalls of the traditional project management skills that it lacks proper digital skills which can be applied through project functions and process to deliver successful projects in today's digital environment? *

- ◯ Strongly agree
- ◯ Agree
- ◯ neutral
- ◯ Disagree
- ◯ Strongly disagree

Q10. To what extent do you agree that applying digital skills through project functions and process is significant for the following? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
10.1 Project management effectiveness	◯	◯	◯	◯	◯
10.2 Influencing project success	◯	◯	◯	◯	◯
10.3 Influencing innovation success	◯	◯	◯	◯	◯

Q11. Please indicate the level of importance of the following PM digital skills in influencing project innovation success? *

	Very Important	Important	Neutral	Not important	Not important at all
11.1 **Technical Skills** (i.e. operational and core skills for using digital devices)	◯	◯	◯	◯	◯
11.2 **Information Skills** (i.e. skills to search, analyze and evaluate data, information and digital content)	◯	◯	◯	◯	◯
11.3 **Digital Communication & Collaboration Skills** (i.e. skills to interact and collaborate through digital technologies).	◯	◯	◯	◯	◯
11.4 **Digital Content-Creation skills** (i.e. skills to develop digital content or integrate existing content through digital means)	◯	◯	◯	◯	◯
11.5 **Digital Problem-Solving skills** (i.e. skills to identify digital needs and solve technical problems)	◯	◯	◯	◯	◯

Q12. From your experience, to what extent do you agree that the following are describing "Technical Skills" as a cluster of PM digital skills? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
12.1 Ability to use hardware	◯	◯	◯	◯	◯
12.2 Ability to understand and use digital systems, tools and software	◯	◯	◯	◯	◯
12.3 Ability to use the internet	◯	◯	◯	◯	◯
12.4 Ability to handle digital structures	◯	◯	◯	◯	◯

Q13. From your experience, to what extent do you agree that the following are describing "Information Skills" as a cluster of PM digital skills? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
13.1 Ability to search, identify, and locate data, information and digital content	◯	◯	◯	◯	◯
13.2 Ability to analyze and critically evaluate the credibility and reliability of sources of data, information and digital content	◯	◯	◯	◯	◯
13.3 Ability to analyze, interpret and critically evaluate the data, information and digital content	◯	◯	◯	◯	◯
13.4 Ability to store and retrieve data, information and content in digital environments.	◯	◯	◯	◯	◯
13.5 Ability to organize and manage data, information and digital content	◯	◯	◯	◯	◯

Q14. From your experience, to what extent do you agree that the following are describing "Digital Communication and Collaboration Skills" as a cluster of PM digital skills? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
14.1 Ability to share data, information and digital content with others through digital technologies	◯	◯	◯	◯	◯
14.2 Ability to use digital technologies for collaborative processes (i.e. interact & collaborate with others)	◯	◯	◯	◯	◯
14.3 Ability to deal with the data that one produces through several digital tools, environments and services	◯	◯	◯	◯	◯
14.4 Ability to create and manage digital identities	◯	◯	◯	◯	◯

Q15. From your experience, to what extent do you agree that the following are describing "Digital Content-Creation Skills" as a cluster of PM digital skills? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
15.1 Ability to create new digital content or knowledge through digital means.	◯	◯	◯	◯	◯
15.2 Ability to modify, re-elaborate, and integrate existing digital content to create something new and original	◯	◯	◯	◯	◯
15.3 Ability to produce creative expressions through digital means	◯	◯	◯	◯	◯
15.4 Understanding how to deal with intellectual property rights and license	◯	◯	◯	◯	◯
15.5 Programming (Ability to develop a sequence of understandable instructions for a computing system to perform a specific task)	◯	◯	◯	◯	◯

Q16. From your experience, to what extent do you agree that the following are describing "Digital Problem Solving Skills" as a cluster of PM digital skills? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
16.1 Ability to solve technical problems when using digital devices	◯	◯	◯	◯	◯
16.2 Ability to make decisions regarding digital needs	◯	◯	◯	◯	◯
16.3 Creatively use and innovate with technologies	◯	◯	◯	◯	◯
16.4 Ability to identify digital skills gaps	◯	◯	◯	◯	◯

Part Three: Project Innovation Success

Q17. From your experience, please indicate the level of importance of the following innovation factors in influencing project innovation success *

	Very important	important	Neutral	Not important	Not important at all
17.1 **Climate** (i.e. a climate that stimulate creativity in workplace, and encourage innovative, the mentality to try and do things)	◯	◯	◯	◯	◯
17.2 **Culture** (i.e. create an innovative culture within the organization and outline how innovation work is supported by the invisible norms & rules)	◯	◯	◯	◯	◯
17.3 **Collaboration** (i.e. internal collaboration between departments or functional teams, and external collaboration with users, suppliers, networks, etc.)	◯	◯	◯	◯	◯

17.4 **Knowledge** (i.e. innovation-related knowledge on how to execute innovation work)	◯	◯	◯	◯	◯
17.5 **Competence** (i.e. skills and experience that support innovation work)	◯	◯	◯	◯	◯
17.6 **Management** (i.e. Leadership and support for innovation work by upper management and project managers)	◯	◯	◯	◯	◯

Q18. From your experience, to what extent do you agree that the following are describing "Climate" as an innovation factor for achieving successful innovation in projects? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
18.1 Create innovative climate that stimulate creativity and innovation in the workplace (i.e. empowerment, innovation support, etc)	◯	◯	◯	◯	◯
18.2 Encourage team members to embrace and support innovation within teams (i.e. team cohesion, team-learning support, etc.)	◯	◯	◯	◯	◯

Q19. From your experience, to what extent do you agree that the following are describing "Culture" as an innovation factor for achieving successful innovation in projects? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
19.1 Create innovative culture within an organization (i.e. leadership, trust, entrepreneurial spirit, etc)	◯	◯	◯	◯	◯
19.2 Promote creativity within an organization (i.e. creative environment, creative approaches in solving problems, etc.)	◯	◯	◯	◯	◯
19.3 Openness towards change and innovation (i.e. openness to new ideas, willingness to listen, transparency and inclusiveness)	◯	◯	◯	◯	◯

Q20. From your experience, to what extent do you agree that the following are describing "Collaboration" as an innovation factor for achieving successful innovation in projects? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
20.1 Collaborative skills to engage successfully in stakeholder management and strategic planning	◯	◯	◯	◯	◯
20.2 An organization's set up that ease internal collaboration between departments, and encourages cross-functional communications.	◯	◯	◯	◯	◯
20.3 A team that creates networks with other knowledgeable persons or suppliers for innovation purposes (i.e. to gather knowledge of new technologies)	◯	◯	◯	◯	◯

Q21. From your experience, to what extent do you agree that the following are describing "Knowledge" as an innovation factor for achieving successful innovation in projects? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
21.1 Innovation-related knowledge regarding how to execute innovation work					
21.2 Understanding of innovation process					
21.3 knowledge on how to deal with the involved stakeholders during an innovation project					

Q22. From your experience, to what extent do you agree that the following are describing "Competence" as an innovation factor for achieving successful innovation in projects? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
22.1 General skills and experience (i.e. personal profile)					
22.2 Innovation-related skills (i.e. innovation proficiencies and skills such as creating idea)					
22.3 Digital skills (i.e. technical skills, information skills, communication and collaboration skills, content-creation skills and problem-solving skills)					

Q23. From your experience, to what extent do you agree that the following are describing "Management" as an innovation factor for achieving successful innovation in projects? *

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
23.1 Leadership and management support for innovation work					
23.2 Team leadership or project management for innovation work					
23.3 Strategic management (i.e. establishing a clear vision that embrace innovation, setting SMART objectives and formulating strategies)					

In addition to the above mentioned innovation factors, is there any other major factors that you believe influences project innovation success? If yes, please specify

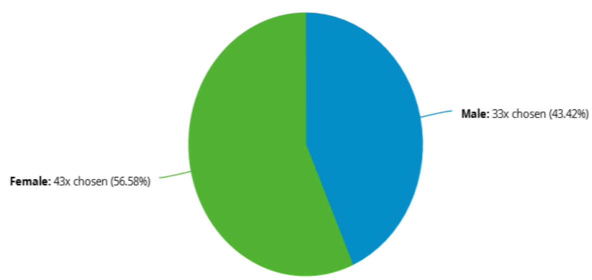
Please state any improvements or comments you feel could be useful in relation to this research?

Thank you again for taking part in this questionnaire

Appendices B: Survey Questionnaire results from the survey website

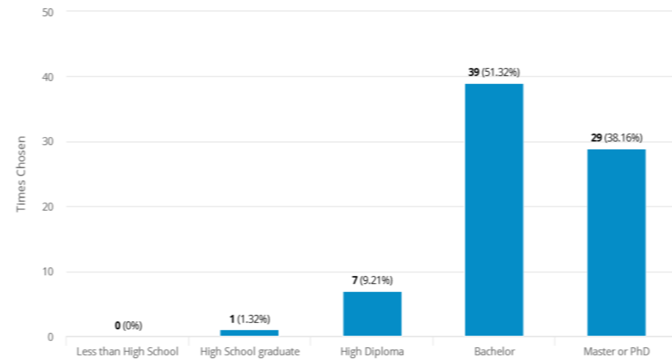
Q1. What is your gender?

Number of responses: 76



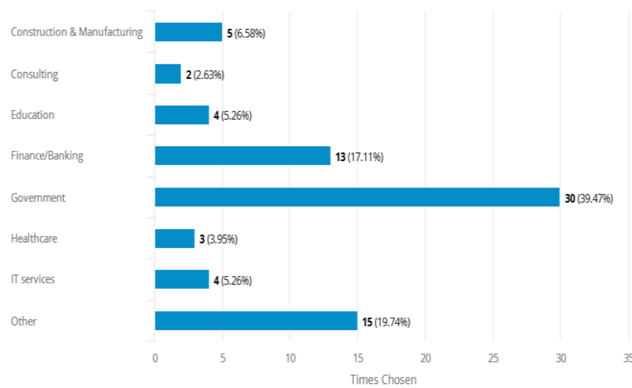
Q2. What is your educational level?

Number of responses: 76



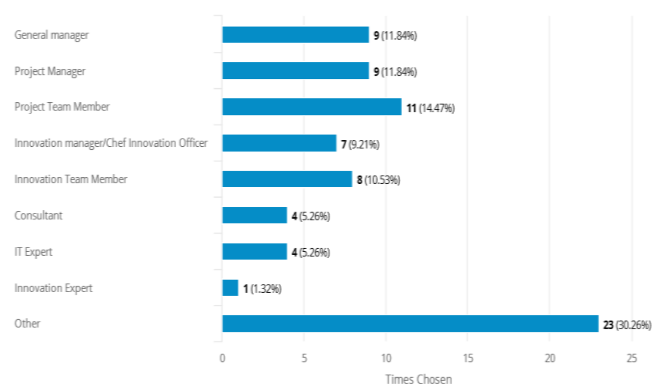
Q3. What field or sector do you work in

Number of responses: 76



Q4. What is your primary role within your organization?

Number of responses: 76



"Other" text answers:

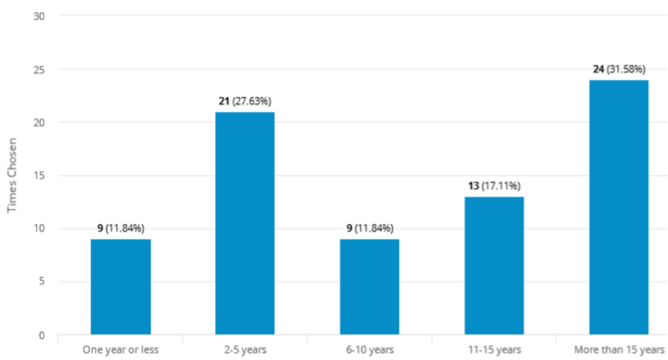
Real Estate.	
Logistics	Insurance
Corporate Marketing Communications	Insurance
Aviation	Insurance
Semi-Government	Design
Federal Authority	
hospitality	
Agriculture	
Real estate	
Insurance	
Insurance	

"Other" text answers:

Accountant	Assistant Manager
Section Manager	HR senior officer
Director of Marketing Communications	Accountant
Admin	Engineer
Head of media section	Team leader credit control
Operation Team leader	senior account executive
Inspector- Engineering Safety	Medical service
Other	Business Development manager
HSE Engineer	Senior manager
executive	Sales Director
Documentir	Assistant manager & team member
	Accountat

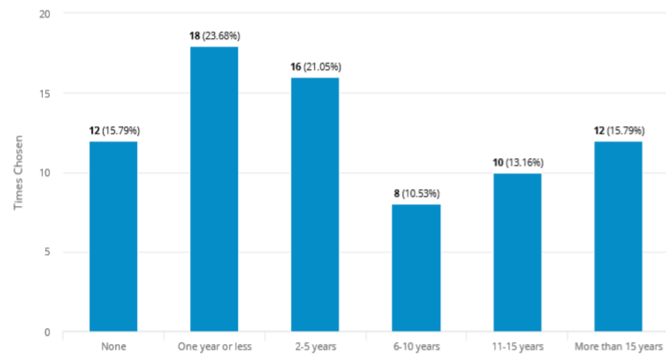
Q5. Years of experience?

Number of responses: 76



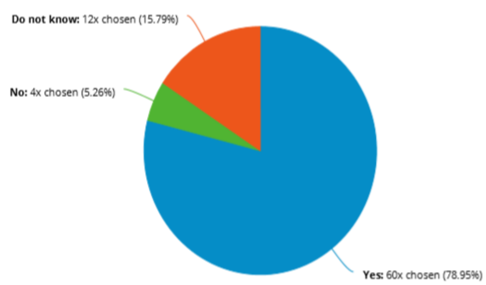
Q6. Years of experience in managing projects?

Number of responses: 76



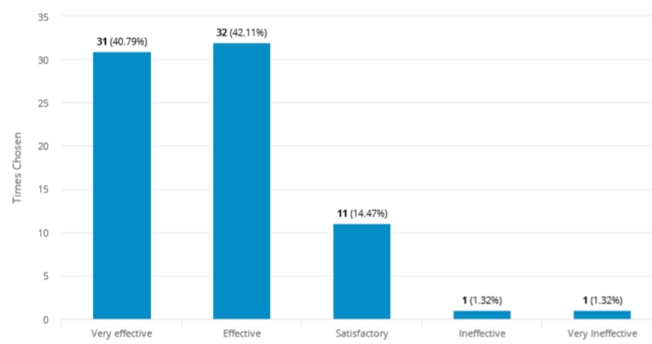
Q7. Do you think there is interplay between the three disciplines of project management, innovation management and digital skills (literacy)?

Number of responses: 76



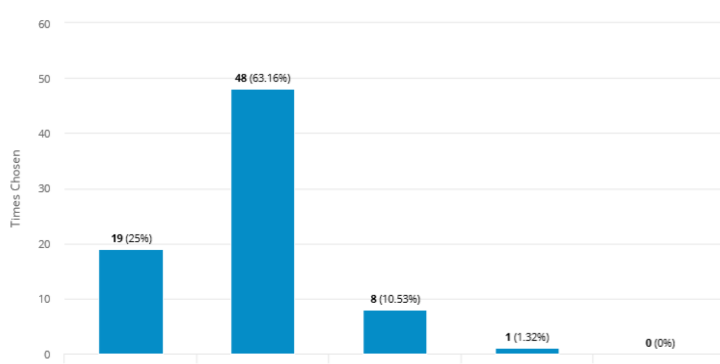
Q8. How effective have you found digital-age skills when applied to projects (i.e. innovation projects)?

Number of responses: 76



Q9. To what extent do you agree that one of the downfalls of the traditional project management skills that it lacks proper digital skills which can be applied through project functions and process to deliver successful projects in today's digital environment?

Number of responses: 76



Q10. To what extent do you agree that applying digital skills through project functions and process is significant for the following?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
10.1 Project management effectiveness	32	42.11%	38	50%	5	6.58%	0	0%	1	1.32%	1.68	0.71
10.2 Influencing project success	31	40.79%	37	48.68%	7	9.21%	0	0%	1	1.32%	1.72	0.74
10.3 Influencing innovation success	36	47.37%	34	44.74%	4	5.26%	1	1.32%	1	1.32%	1.64	0.76

Q11. Please indicate the level of importance of the following PM digital skills in influencing project innovation success?

Number of responses: 76

	Very Important 1		Important 2		Neutral 3		Not important 4		Not important at all 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
11.1 Technical Skills (i.e. operational and core skills for using digital devices)	36	47.37%	32	42.11%	6	7.89%	2	2.63%	0	0%	1.66	0.74
11.2 Information Skills (i.e. skills to search, analyze and evaluate data, information and digital content)	39	51.32%	26	34.21%	10	13.16%	0	0%	1	1.32%	1.66	0.8
11.3 Digital Communication & Collaboration Skills (i.e. skills to interact and collaborate through digital technologies).	32	42.11%	37	48.68%	6	7.89%	1	1.32%	0	0%	1.68	0.67
11.4 Digital Content-Creation skills (i.e. skills to develop digital content or integrate existing content through digital means)	23	30.26%	41	53.95%	10	13.16%	2	2.63%	0	0%	1.88	0.72
11.5 Digital Problem-Solving skills (i.e. skills to identify digital needs and solve technical problems)	34	44.74%	35	46.05%	7	9.21%	0	0%	0	0%	1.64	0.64

Q12. From your experience, to what extent do you agree that the following are describing "Technical Skills" as a cluster of PM digital skills?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
12.1 Ability to use hardware	15	19.74%	50	65.79%	10	13.16%	1	1.32%	0	0%	1.96	0.62
12.2 Ability to understand and use digital systems, tools and software	31	40.79%	38	50%	7	9.21%	0	0%	0	0%	1.68	0.63
12.3 Ability to use the internet	39	51.32%	27	35.53%	9	11.84%	1	1.32%	0	0%	1.63	0.74
12.4 Ability to handle digital structures	29	38.16%	36	47.37%	10	13.16%	1	1.32%	0	0%	1.78	0.72

Q13. From your experience, to what extent do you agree that the following are describing "Information Skills" as a cluster of PM digital skills?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
13.1 Ability to search, identify, and locate data, information and digital content	32	42.11%	38	50%	5	6.58%	1	1.32%	0	0%	1.67	0.66
13.2 Ability to analyze and critically evaluate the credibility and reliability of sources of data, information and digital content	30	39.47%	40	52.63%	5	6.58%	1	1.32%	0	0%	1.7	0.65
13.3 Ability to analyze, interpret and critically evaluate the data, information and digital content	32	42.11%	34	44.74%	9	11.84%	1	1.32%	0	0%	1.72	0.72
13.4 Ability to store and retrieve data, information and content in digital environments.	28	36.84%	38	50%	9	11.84%	1	1.32%	0	0%	1.78	0.7
13.5 Ability to organize and manage data, information and digital content	36	47.37%	33	43.42%	6	7.89%	0	0%	1	1.32%	1.64	0.74

Q14. From your experience, to what extent do you agree that the following are describing "Digital Communication and Collaboration Skills" as a cluster of PM digital skills?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
14.1 Ability to share data, information and digital content with others through digital technologies	35	46.05%	36	47.37%	5	6.58%	0	0%	0	0%	1.61	0.61
14.2 Ability to use digital technologies for collaborative processes (i.e. interact & collaborate with others)	35	46.05%	34	44.74%	7	9.21%	0	0%	0	0%	1.63	0.65
14.3 Ability to deal with the data that one produces through several digital tools, environments and services	28	36.84%	41	53.95%	7	9.21%	0	0%	0	0%	1.72	0.62
14.4 Ability to create and manage digital identities	22	28.95%	41	53.95%	11	14.47%	2	2.63%	0	0%	1.91	0.73

Q15. From your experience, to what extent do you agree that the following are describing "Digital Content-Creation Skills" as a cluster of PM digital skills?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
15.1 Ability to create new digital content or knowledge through digital means.	25	32.89%	38	50%	12	15.79%	1	1.32%	0	0%	1.86	0.72
15.2 Ability to modify, re-elaborate, and integrate existing digital content to create something new and original	23	30.26%	42	55.26%	9	11.84%	2	2.63%	0	0%	1.87	0.71
15.3 Ability to produce creative expressions through digital means	24	31.58%	42	55.26%	10	13.16%	0	0%	0	0%	1.82	0.64
15.4 Understanding how to deal with intellectual property rights and license	21	27.63%	38	50%	13	17.11%	4	5.26%	0	0%	2	0.81
15.5 Programming (Ability to develop a sequence of understandable instructions for a computing system to perform a specific task)	22	28.95%	44	57.89%	9	11.84%	1	1.32%	0	0%	1.86	0.66

Q16. From your experience, to what extent do you agree that the following are describing "Digital Problem Solving Skills" as a cluster of PM digital skills?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
16.1 Ability to solve technical problems when using digital devices	29	38.16%	35	46.05%	9	11.84%	2	2.63%	1	1.32%	1.83	0.83
16.2 Ability to make decisions regarding digital needs	33	43.42%	34	44.74%	8	10.53%	1	1.32%	0	0%	1.7	0.71
16.3 Creatively use and innovate with technologies	30	39.47%	34	44.74%	12	15.79%	0	0%	0	0%	1.76	0.7
16.4 Ability to identify digital skills gaps	25	32.89%	39	51.32%	10	13.16%	2	2.63%	0	0%	1.86	0.74

Q17. From your experience, please indicate the level of importance of the following innovation factors in influencing project innovation success

Number of responses: 76

	Very important 1		important 2		Neutral 3		Not important 4		Not important at all 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
17.1 Climate (i.e. a climate that stimulate creativity in workplace, and encourage innovative, the mentality to try and do things)	29	38.16%	38	50%	8	10.53%	1	1.32%	0	0%	1.75	0.69
17.2 Culture (i.e. create an innovative culture within the organization and outline how innovation work is supported by the invisible norms & rules)	32	42.11%	35	46.05%	9	11.84%	0	0%	0	0%	1.7	0.67

	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
17.3 Collaboration (i.e. internal collaboration between departments or functional teams, and external collaboration with users, suppliers, networks, etc.)	37	48.68%	31	40.79%	8	10.53%	0	0%	0	0%	1.62	0.67
17.4 Knowledge (i.e. innovation-related knowledge on how to execute innovation work)	33	43.42%	33	43.42%	10	13.16%	0	0%	0	0%	1.7	0.69
17.5 Competence (i.e. skills and experience that support innovation work)	34	44.74%	29	38.16%	11	14.47%	1	1.32%	1	1.32%	1.76	0.84
17.6 Management (i.e. Leadership and support for innovation work by upper management and project managers)	39	51.32%	30	39.47%	6	7.89%	0	0%	1	1.32%	1.61	0.74

Q18. From your experience, to what extent do you agree that the following are describing "Climate" as an innovation factor for achieving successful innovation in projects?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
18.1 Create innovative climate that stimulate creativity and innovation in the workplace (i.e. empowerment, innovation support, etc)	33	43.42%	38	50%	4	5.26%	1	1.32%	0	0%	1.64	0.64
18.2 Encourage team members to embrace and support innovation within teams (i.e. team cohesion, team-learning support, etc.)	34	44.74%	34	44.74%	8	10.53%	0	0%	0	0%	1.66	0.66

Q19. From your experience, to what extent do you agree that the following are describing "Culture" as an innovation factor for achieving successful innovation in projects?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
19.1 Create innovative culture within an organization (i.e. leadership, trust, entrepreneurial spirit, etc)	35	46.05%	31	40.79%	7	9.21%	2	2.63%	1	1.32%	1.72	0.84
19.2 Promote creativity within an organization (i.e. creative environment, creative approaches in solving problems, etc.)	33	43.42%	34	44.74%	8	10.53%	1	1.32%	0	0%	1.7	0.71
19.3 Openness towards change and innovation (i.e. openness to new ideas, willingness to listen, transparency and inclusiveness)	33	43.42%	35	46.05%	6	7.89%	1	1.32%	1	1.32%	1.71	0.77

Q20. From your experience, to what extent do you agree that the following are describing "Collaboration" as an innovation factor for achieving successful innovation in projects?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
20.1 Collaborative skills to engage successfully in stakeholder management and strategic planning	31	40.79%	38	50%	7	9.21%	0	0%	0	0%	1.68	0.63
20.2 An organization's set up that ease internal collaboration between departments, and encourages cross-functional communications.	35	46.05%	33	43.42%	5	6.58%	3	3.95%	0	0%	1.68	0.76
20.3 A team that creates networks with other knowledgeable persons or suppliers for innovation purposes (i.e. to gather knowledge of new technologies)	34	44.74%	36	47.37%	5	6.58%	1	1.32%	0	0%	1.64	0.66

Q21. From your experience, to what extent do you agree that the following are describing "Knowledge" as an innovation factor for achieving successful innovation in projects?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
21.1 Innovation-related knowledge regarding how to execute innovation work	26	34.21%	37	48.68%	12	15.79%	1	1.32%	0	0%	1.84	0.73
21.2 Understanding of innovation process	31	40.79%	38	50%	7	9.21%	0	0%	0	0%	1.68	0.63
21.3 knowledge on how to deal with the involved stakeholders during an innovation project	26	34.21%	39	51.32%	9	11.84%	1	1.32%	1	1.32%	1.84	0.78

Q22. From your experience, to what extent do you agree that the following are describing "Competence" as an innovation factor for achieving successful innovation in projects?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
22.1 General skills and experience (i.e. personal profile)	27	35.53%	37	48.68%	11	14.47%	1	1.32%	0	0%	1.82	0.72
22.2 Innovation-related skills (i.e. innovation proficiencies and skills such as creating idea)	29	38.16%	35	46.05%	11	14.47%	0	0%	1	1.32%	1.8	0.78
22.3 Digital skills (i.e. technical skills, information skills, communication and collaboration skills, content-creation skills and problem-solving skills)	31	40.79%	35	46.05%	10	13.16%	0	0%	0	0%	1.72	0.68

Q23. From your experience, to what extent do you agree that the following are describing "Management" as an innovation factor for achieving successful innovation in projects?

Number of responses: 76

	Strongly agree 1		Agree 2		Neutral 3		Disagree 4		Strongly disagree 5			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	ø	±
23.1 Leadership and management support for innovation work	32	42.11%	36	47.37%	7	9.21%	1	1.32%	0	0%	1.7	0.69
23.2 Team leadership or project management for innovation work	30	39.47%	40	52.63%	5	6.58%	1	1.32%	0	0%	1.7	0.65
23.3 Strategic management (i.e. establishing a clear vision that embrace innovation, setting SMART objectives and formulating strategies)	30	39.47%	39	51.32%	5	6.58%	0	0%	2	2.63%	1.75	0.8

In addition to the above mentioned innovation factors, is there any other major factors that you believe influences project innovation success? If yes, please specify

Number of responses: 12

Text answers:

- Innovation and management leadership are essential in project coordinations and success.
- Passion for what you hope to achieve.
- No
- -
- Cross functional projects.
  Standardized cohesive work between departments.
  Standard inputs to be set up to lessen human risk in work. (Rules and systems)
- Clear goals
  Stakeholder view and management to agree.
- Teamwork
- No
- Team building exercises , trust and respect
  As we all know for any system people are the core and rest come with people
- Team drive to and focus on taking initiative to improve and find better ways to do things.
- The recognition from top management maintain innovation.
- None
- Creating competitive environment among team members
  Tolerance for mistakes and failures

Please state any improvements or comments you feel could be useful in relation to this research?

Number of responses: 6

Text answers:

- Look at course structure in a selection of universities to see the common midules. E.g. decision making, visualization and mapping, process innovation etc. Good luck
- Nil
- -
- Thanks
- Need to wire in the thought of digitalization all across the organization
- Based on my experience digital skills reduce the Project period, & save time.

Appendix C: Descriptive Statistics (SPSS)

Statistics

		Gender	Educational Level	Job Field/ Sector	Primary Role	Years of Experience	Years of Experience in Managing Projects	Interplay between 3 disciplines	Effectiveness of digital-age skills
N	Valid	76	76	76	76	76	76	76	76
	Missing	0	0	0	0	0	0	0	0
Mean		1.57	4.26	5.12	5.20	3.29	2.29	1.37	4.20
Median		2.00	4.00	5.00	5.00	3.00	2.00	1.00	4.00
Mode		2	4	5	9	5	1	1	4
Std. Deviation		.499	.681	1.932	2.989	1.459	1.696	.746	.833
Range		1	3	7	8	4	5	2	4
Minimum		1	2	1	1	1	0	1	1
Maximum		2	5	8	9	5	5	3	5

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	33	43.4	43.4	43.4
	Female	43	56.6	56.6	100.0
	Total	76	100.0	100.0	

Educational Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High School graduate	1	1.3	1.3	1.3
	High Diploma	7	9.2	9.2	10.5
	Bachelor	39	51.3	51.3	61.8
	Master or PhD	29	38.2	38.2	100.0
	Total	76	100.0	100.0	

Job Field or Sector

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Construction & Manufacturing	5	6.6	6.6	6.6
	Consulting	2	2.6	2.6	9.2
	Education	4	5.3	5.3	14.5

	Finance/banking	13	17.1	17.1	31.6
	Government	30	39.5	39.5	71.1
	Healthcare	3	3.9	3.9	75.0
	IT services	4	5.3	5.3	80.3
	Other	15	19.7	19.7	100.0
	Total	76	100.0	100.0	

Primary Job Role

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	General manager	9	11.8	11.8	11.8
	Project manager	9	11.8	11.8	23.7
	Innovation manager/Chef innovation officer	7	9.2	9.2	47.4
	Innovation expert	1	1.3	1.3	69.7
	IT expert	4	5.3	5.3	68.4
	Consultant	4	5.3	5.3	63.2
	Project team member	11	14.5	14.5	38.2
	Innovation team member	8	10.5	10.5	57.9
	Other	23	30.3	30.3	100.0
	Total	76	100.0	100.0	

Years of Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	One year or less	9	11.8	11.8	11.8
	2-5 years	21	27.6	27.6	39.5
	6-10 years	9	11.8	11.8	51.3
	11-15 years	13	17.1	17.1	68.4
	More than 15 years	24	31.6	31.6	100.0
	Total	76	100.0	100.0	

Years of Experience in Managing Projects

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	12	15.8	15.8	15.8
	One year or less	18	23.7	23.7	39.5
	2-5 years	16	21.1	21.1	60.5
	6-10 years	8	10.5	10.5	71.1

	11-15 years	10	13.2	13.2	84.2
	More than 15 years	12	15.8	15.8	100.0
	Total	76	100.0	100.0	

Interplay between the three disciplines

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Yes	60	78.9	78.9	78.9
	2 No	4	5.3	5.3	84.2
	3 Do not know	12	15.8	15.8	100.0
	Total	76	100.0	100.0	

Effectiveness of digital-age skills when applied to projects

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Very Inefective	1	1.3	1.3	1.3
	2 Ineffective	1	1.3	1.3	2.6
	3 Satisfactory	11	14.5	14.5	17.1
	4 Effective	32	42.1	42.1	59.2
	5 Very effective	31	40.8	40.8	100.0
	Total	76	100.0	100.0	

Appendix D: Cronbach's Alpha Test Results (SPSS)

D1. All items (both independent and dependent variables)

		N	%
Cases	Valid	76	100.0
	Excluded[a]	0	.0
	Total	76	100.0

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.962	.962	39

	Mean	Std. Deviation	N
Q12.1TechSkills1	4.04	.621	76
Q12.2TechSkills2	4.32	.637	76
Q12.3TechSkills3	4.37	.746	76
Q12.4TechSkills4	4.22	.723	76
Q13.1InfoSkills1	4.33	.661	76
Q13.2InfoSkills2	4.30	.654	76
Q13.3InfoSkills3	4.28	.723	76
Q13.4InfoSkills4	4.22	.704	76
Q13.5InfoSkills5	4.36	.743	76
Q14.1CommandCollabSkills1	4.39	.613	76
Q14.2CommandCollabSkills2	4.37	.650	76
Q14.3CommandCollabSkills3	4.28	.624	76
Q14.4CommandCollabSkills4	4.09	.734	76
Q15.1ContentCreationSkills1	4.14	.725	76
Q15.2ContentCreationSkills2	4.13	.718	76
Q15.3ContentCreationSkills3	4.18	.647	76
Q15.4ContentCreationSkills4	4.00	.816	76
Q15.5ContentCreationSkills5	4.14	.667	76

Q16.1ProblemSolvingSkills1	4.17	.839	76
Q16.2ProblemSolvingSkills2	4.30	.712	76
Q16.3ProblemSolvingSkills3	4.24	.709	76
Q16.4ProblemSolvingSkills4	4.14	.743	76
Q18.1Climate1	4.36	.647	76
Q18.2Climate2	4.34	.664	76
Q19.1Culture1	4.28	.842	76
Q19.2Culture2	4.30	.712	76
Q19.3Culture3	4.29	.780	76
Q20.1Collaboration1	4.32	.637	76
Q20.2Collaboration1	4.32	.770	76
Q20.3Collaboration3	4.36	.667	76
Q21.1Knowledge1	4.16	.731	76
Q21.2Knowledge2	4.32	.637	76
Q21.3Knowledge3	4.16	.784	76
Q22.1Competence1	4.18	.725	76
Q22.2Competence2	4.20	.783	76
Q22.3Competence3	4.28	.685	76
Q23.1Management1	4.30	.693	76
Q23.2Management2	4.30	.654	76
Q23.3Management3	4.25	.802	76

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q12.1TechSkills1	161.68	305.206	.418	.	.962
Q12.2TechSkills2	161.41	301.391	.582	.	.961
Q12.3TechSkills3	161.36	304.792	.358	.	.962
Q12.4TechSkills4	161.50	298.280	.635	.	.961
Q13.1InfoSkills1	161.39	303.362	.471	.	.962
Q13.2InfoSkills2	161.42	298.567	.693	.	.961
Q13.3InfoSkills3	161.45	296.251	.719	.	.961
Q13.4InfoSkills4	161.50	299.107	.618	.	.961
Q13.5InfoSkills5	161.37	295.169	.742	.	.960

Q14.1CommandCollabSkills1	161.33	301.477	.602	.	.961
Q14.2CommandCollabSkills2	161.36	300.285	.619	.	.961
Q14.3CommandCollabSkills3	161.45	302.091	.561	.	.961
Q14.4CommandCollabSkills4	161.63	298.956	.598	.	.961
Q15.1ContentCreationSkills1	161.58	297.554	.663	.	.961
Q15.2ContentCreationSkills2	161.59	294.351	.803	.	.960
Q15.3ContentCreationSkills3	161.54	300.892	.594	.	.961
Q15.4ContentCreationSkills4	161.72	299.216	.523	.	.962
Q15.5ContentCreationSkills5	161.58	300.967	.572	.	.961
Q16.1ProblemSolvingSkills1	161.55	297.424	.571	.	.961
Q16.2ProblemSolvingSkills2	161.42	299.100	.611	.	.961
Q16.3ProblemSolvingSkills3	161.49	297.213	.693	.	.961
Q16.4ProblemSolvingSkills4	161.58	295.554	.726	.	.960
Q18.1Climate1	161.37	301.276	.577	.	.961
Q18.2Climate2	161.38	301.386	.556	.	.961
Q19.1Culture1	161.45	293.691	.702	.	.961
Q19.2Culture2	161.42	298.674	.629	.	.961
Q19.3Culture3	161.43	293.902	.753	.	.960
Q20.1Collaboration1	161.41	300.965	.601	.	.961
Q20.2Collaboration1	161.41	295.658	.695	.	.961
Q20.3Collaboration3	161.37	299.996	.615	.	.961

Q21.1Knowledge1	161.57	297.582	.656	.	.961
Q21.2Knowledge2	161.41	303.898	.466	.	.962
Q21.3Knowledge3	161.57	298.249	.583	.	.961
Q22.1Competence 1	161.54	300.572	.539	.	.961
Q22.2Competence 2	161.53	295.319	.695	.	.961
Q22.3Competence 3	161.45	298.571	.660	.	.961
Q23.1Management 1	161.42	300.007	.590	.	.961
Q23.2Management 2	161.42	299.607	.646	.	.961
Q23.3Management 3	161.47	295.426	.674	.	.961

D2. Independent variables (Digital skills clusters)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.939	.940	22

	Mean	Std. Deviation	N
Q12.1TechSkills1	4.04	.621	76
Q12.2TechSkills2	4.32	.637	76
Q12.3TechSkills3	4.37	.746	76
Q12.4TechSkills4	4.22	.723	76
Q13.1InfoSkills1	4.33	.661	76
Q13.2InfoSkills2	4.30	.654	76
Q13.3InfoSkills3	4.28	.723	76
Q13.4InfoSkills4	4.22	.704	76
Q13.5InfoSkills5	4.36	.743	76

Q14.1CommandCollabSkills1	4.39	.613	76
Q14.2CommandCollabSkills2	4.37	.650	76
Q14.3CommandCollabSkills3	4.28	.624	76
Q14.4CommandCollabSkills4	4.09	.734	76
Q15.1ContentCreationSkills1	4.14	.725	76
Q15.2ContentCreationSkills2	4.13	.718	76
Q15.3ContentCreationSkills3	4.18	.647	76
Q15.4ContentCreationSkills4	4.00	.816	76
Q15.5ContentCreationSkills5	4.14	.667	76
Q16.1ProblemSolvingSkills1	4.17	.839	76
Q16.2ProblemSolvingSkills2	4.30	.712	76
Q16.3ProblemSolvingSkills3	4.24	.709	76
Q16.4ProblemSolvingSkills4	4.14	.743	76

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q12.1TechSkills1	88.99	99.186	.451	.	.939
Q12.2TechSkills2	88.71	97.222	.599	.	.937
Q12.3TechSkills3	88.66	98.948	.380	.	.941
Q12.4TechSkills4	88.80	95.494	.646	.	.936
Q13.1InfoSkills1	88.70	98.214	.496	.	.938
Q13.2InfoSkills2	88.72	95.483	.723	.	.935
Q13.3InfoSkills3	88.75	94.190	.744	.	.935
Q13.4InfoSkills4	88.80	95.361	.675	.	.936
Q13.5InfoSkills5	88.67	94.090	.729	.	.935
Q14.1CommandCollabSkills1	88.63	96.929	.650	.	.936
Q14.2CommandCollabSkills2	88.66	96.388	.653	.	.936
Q14.3CommandCollabSkills3	88.75	97.177	.616	.	.937
Q14.4CommandCollabSkills4	88.93	94.702	.694	.	.935
Q15.1ContentCreationSkills1	88.88	94.772	.698	.	.935
Q15.2ContentCreationSkills2	88.89	93.775	.780	.	.934
Q15.3ContentCreationSkills3	88.84	96.348	.659	.	.936

Q15.4ContentCreationSkills4	89.03	95.893	.537	.	.938
Q15.5ContentCreationSkills5	88.88	97.119	.576	.	.937
Q16.1ProblemSolvingSkills1	88.86	95.005	.577	.	.938
Q16.2ProblemSolvingSkills2	88.72	96.896	.552	.	.938
Q16.3ProblemSolvingSkills3	88.79	95.662	.647	.	.936
Q16.4ProblemSolvingSkills4	88.88	94.932	.667	.	.936

D3. Dependent variables (project innovation success factors)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.935	.935	17

	Mean	Std. Deviation	N
Q18.1Climate1	4.36	.647	76
Q18.2Climate2	4.34	.664	76
Q19.1Culture1	4.28	.842	76
Q19.2Culture2	4.30	.712	76
Q19.3Culture3	4.29	.780	76
Q20.1Collaboration1	4.32	.637	76
Q20.2Collaboration1	4.32	.770	76
Q20.3Collaboration3	4.36	.667	76
Q21.1Knowledge1	4.16	.731	76
Q21.2Knowledge2	4.32	.637	76
Q21.3Knowledge3	4.16	.784	76
Q22.1Competence1	4.18	.725	76
Q22.2Competence2	4.20	.783	76
Q22.3Competence3	4.28	.685	76
Q23.1Management1	4.30	.693	76
Q23.2Management2	4.30	.654	76
Q23.3Management3	4.25	.802	76

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q18.1Climate1	68.34	67.215	.572	.933
Q18.2Climate2	68.36	66.499	.625	.932
Q19.1Culture1	68.42	63.100	.740	.929
Q19.2Culture2	68.39	65.629	.656	.931
Q19.3Culture3	68.41	63.231	.795	.928
Q20.1Collaboration1	68.38	66.746	.630	.932
Q20.2Collaboration1	68.38	64.479	.699	.930
Q20.3Collaboration3	68.34	66.201	.650	.931
Q21.1Knowledge1	68.54	64.892	.703	.930
Q21.2Knowledge2	68.38	68.292	.476	.935
Q21.3Knowledge3	68.54	64.945	.645	.932
Q22.1Competence1	68.51	65.800	.628	.932
Q22.2Competence2	68.50	64.387	.692	.930
Q22.3Competence3	68.42	66.114	.639	.932
Q23.1Management1	68.39	65.975	.644	.931
Q23.2Management2	68.39	66.135	.672	.931
Q23.3Management3	68.45	64.811	.639	.932

D4. Technical skills (independent variable)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.701	.706	4

D5. Information skills (independent variable)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.840	.839	5

D6. Communication and collaboration skills (independent variable)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.815	.820	4

D7. Content-creation skills (independent variable)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.821	.827	5

D8. Content-creation skills (independent variable)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.793	.797	4

Appendix E: Tests of Normality

E1. Normality test between digital skills clusters and project innovation success factors

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Digital_skills_clusters	.112	76	.019	.961	76	.019
Innovation_success_factors	.090	76	.199	.943	76	.002

E2. Normality test between technical skills and project innovation success factors

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Technical_Skills	.121	76	.008	.937	76	.001
Innovation_success_factors	.090	76	.199	.943	76	.002

E3. Normality test between information skills and project innovation success factors

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Information_skills	.135	76	.002	.919	76	.000
Innovation_success_factors	.090	76	.199	.943	76	.002

E4. Normality test between communication & collaboration skills and project innovation success factors

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CommandCollab_Skills	.178	76	.000	.921	76	.000
Innovation_success_factors	.090	76	.199	.943	76	.002

E5. Normality test between content-creation skills and project innovation success factors

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Contentcreation_Skills	.127	76	.004	.949	76	.004
Innovation_success_factors	.090	76	.199	.943	76	.002

E6. Normality test between problem-solving skills and project innovation success factors

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Problemsolving_skills	.135	76	.002	.925	76	.000
Innovation_success_factors	.090	76	.199	.943	76	.002

Appendix F: Spearman's correlation test

F1. Spearman's correlation test between all items (variables)

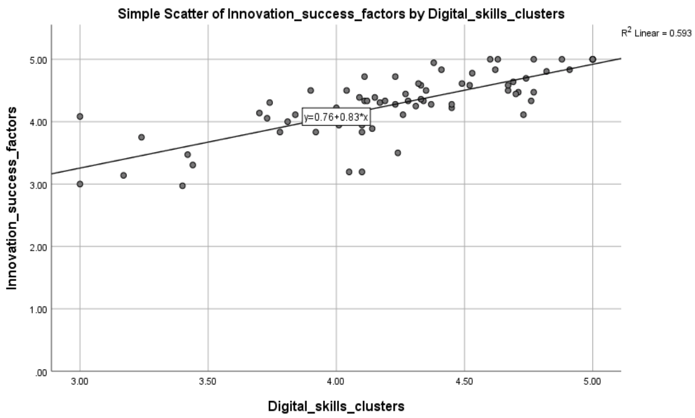
Correlations

			Technical_skills	Information_skills	Command Collab_Skills	Contentcreation_Skills	Problemsolving_skills	Climate_variables	Culture_variables	Collaboration_variables	Knowledge_variables	Competence_variables	Management_variables	Digital_skills_clusters	Innovation_success_factors
Spearman's rho	Technical_skills	Correlation Coefficient	1.000	.614**	.490**	.564**	.428**	.402**	.502**	.385**	.314**	.476**	.506**	.722**	.501**
		Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.006	0.000	0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Information_skills	Correlation Coefficient	.614**	1.000	.729**	.709**	.642**	.465**	.704**	.596**	.499**	.632**	.636**	.884**	.715**
		Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Command Collab_Skills	Correlation Coefficient	.490**	.729**	1.000	.735**	.593**	.434**	.574**	.562**	.463**	.469**	.489**	.842**	.605**
		Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Contentcreation_Skills	Correlation Coefficient	.564**	.709**	.735**	1.000	.666**	.569**	.605**	.590**	.560**	.657**	.453**	.867**	.677**
		Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Problemsolving_skills	Correlation Coefficient	.428**	.642**	.593**	.666**	1.000	.583**	.600**	.660**	.663**	.611**	.646**	.804**	.733**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Climate_variables	Correlation Coefficient	.402**	.465**	.434**	.569**	.583**	1.000	.703**	.626**	.557**	.536**	.575**	.602**	.792**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Culture_variables	Correlation Coefficient	.502**	.704**	.574**	.605**	.600**	.703**	1.000	.711**	.642**	.674**	.700**	.717**	.897**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Collaboration_variables	Correlation Coefficient	.385**	.596**	.562**	.590**	.660**	.626**	.711**	1.000	.550**	.573**	.631**	.673**	.806**
		Sig. (2-tailed)	0.001	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Knowledge_variables	Correlation Coefficient	.314**	.499**	.463**	.560**	.663**	.557**	.642**	.550**	1.000	.722**	.586**	.594**	.811**
		Sig. (2-tailed)	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Competence_variables	Correlation Coefficient	.476**	.632**	.469**	.657**	.611**	.536**	.674**	.573**	.722**	1.000	.603**	.676**	.816**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Management_variables	Correlation Coefficient	.506**	.636**	.489**	.453**	.646**	.575**	.700**	.631**	.586**	.603**	1.000	.662**	.798**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Digital_skills_clusters	Correlation Coefficient	.722**	.884**	.842**	.867**	.804**	.602**	.717**	.673**	.594**	.676**	.662**	1.000	.781**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
		N	76	76	76	76	76	76	76	76	76	76	76	76	76
	Innovation_success_factors	Correlation Coefficient	.501**	.715**	.605**	.677**	.733**	.792**	.897**	.806**	.811**	.816**	.798**	.781**	1.000
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
		N	76	76	76	76	76	76	76	76	76	76	76	76	76

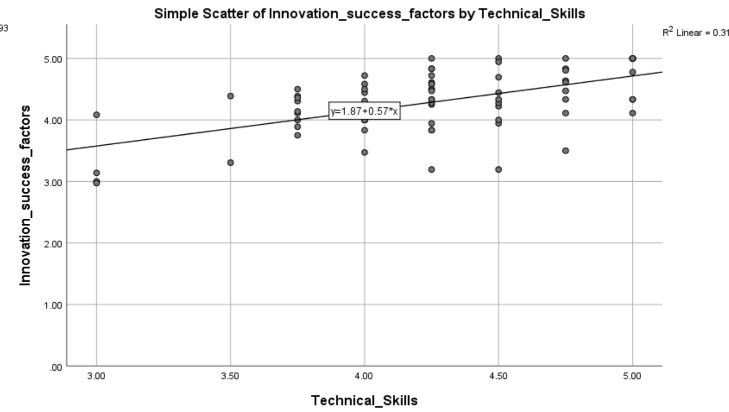
**. Correlation is significant at the 0.01 level (2-tailed).

Appendix G: Scatter Plot

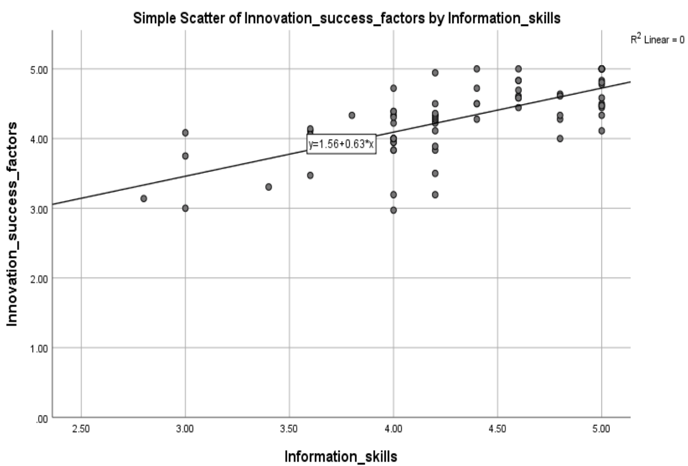
G1. Digital skills clusters & project innovation success



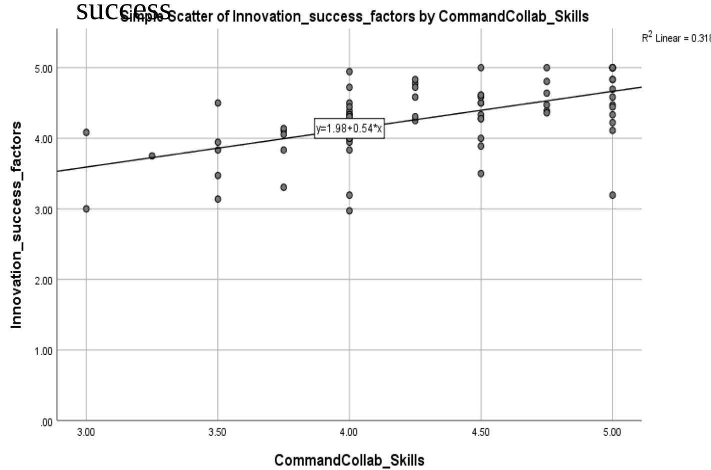
G2. Tech skills & project innovation success



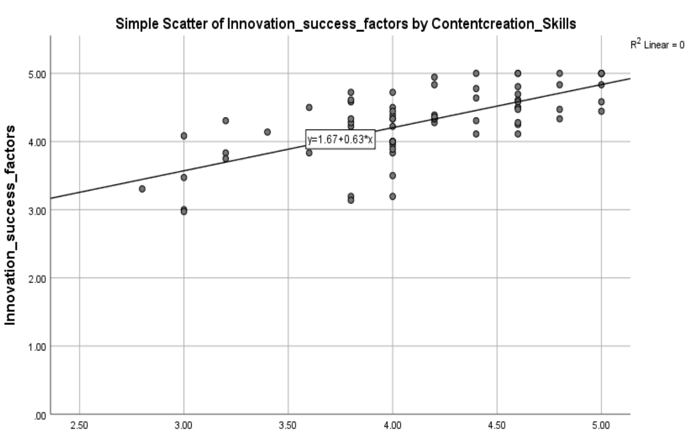
G3. Info skills & project innovation success



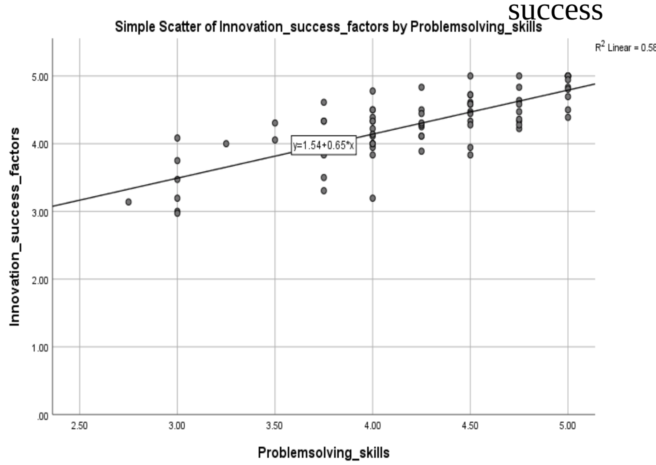
G4. Comm&collab skills & innovation success



G5. Content skills & project innovation success

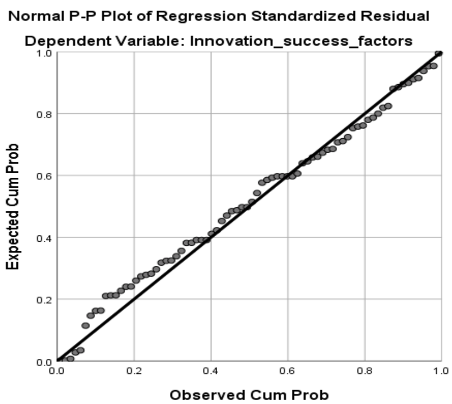


G5. Problem-solv skills & innovation success

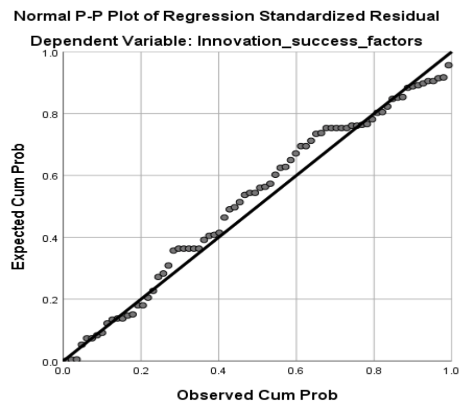


Appendix H: Normal P-P Plot

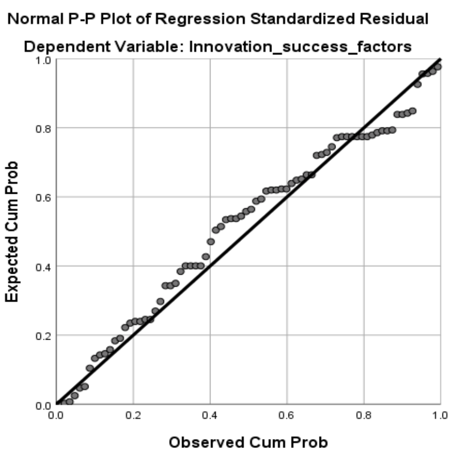
H1. Digital skills cluster & DV



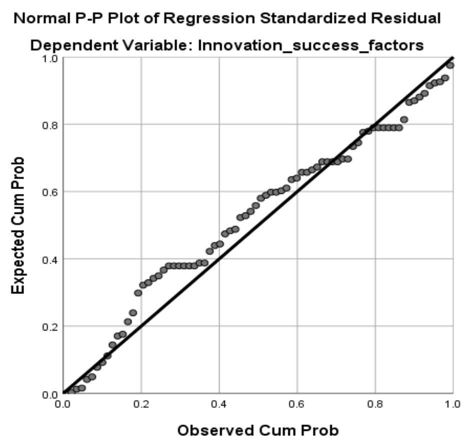
H2. Technical skills & DV



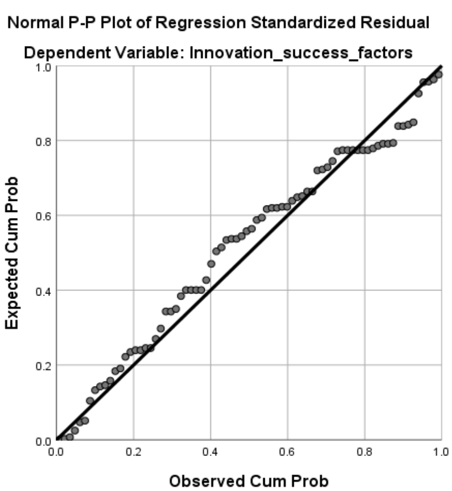
H3. information skills & DV



H4. Comm and collab skills & DV

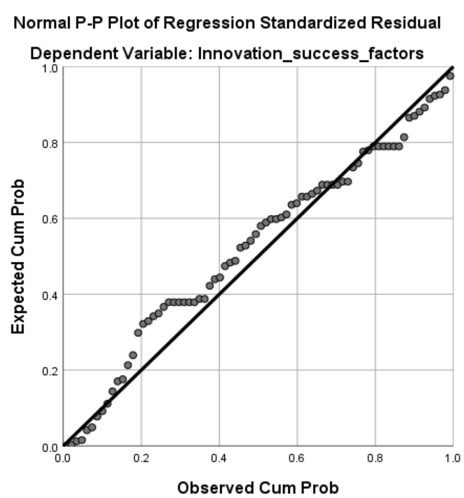


H5. Content-creation skills & DV



sts

H6. Problem-solving skills & DV



I1. Betweem digital skills clusters (varibale group) & project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Digital_skills_clusters[b]	.	Enter

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.770[a]	.593	.587	.32179	1.977

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.153	1	11.153	107.704	.000[b]
	Residual	7.663	74	.104		
	Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.761	.341		2.230	.029	.081	1.441
	Digital_skills_clusters	.832	.080	.770	10.378	.000	.672	.992

I2. Betweem technical skills & project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Technical_Skills[b]	.	Enter

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.564[a]	.318	.309	.41630	2.172

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.990	1	5.990	34.565	.000[b]
	Residual	12.825	74	.173		
	Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.869	.413		4.524	.000	1.046	2.691
	Technical_Skills	.569	.097	.564	5.879	.000	.376	.762

I3. Betweem information skills & project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Information_skills[b]	.	Enter

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.688[a]	.473	.466	.36592	1.849

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.907	1	8.907	66.517	.000[b]
	Residual	9.909	74	.134		
	Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.563	.336		4.656	.000	.894	2.232
	Information_skills	.632	.078	.688	8.156	.000	.478	.787

I4. Betweem communication and collaboration skills & project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	CommandCollab_Skills[b]	.	Enter

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.564[a]	.318	.309	.41643	1.979

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.983	1	5.983	34.500	.000[b]
	Residual	12.832	74	.173		
	Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.983	.394		5.032	.000	1.198	2.768
	CommandCollab_Skills	.536	.091	.564	5.874	.000	.354	.718

I5. Betweem content-creation skills & project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Contentcreation_Skills[b]	.	Enter

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.691[a]	.478	.471	.36431	1.699

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.994	1	8.994	67.763	.000[b]
	Residual	9.821	74	.133		
	Total	18.815	75			

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	1.674	.319		5.242	.000	1.038	2.310
Contentcreation_Skills	.632	.077	.691	8.232	.000	.479	.786

I6. Betweem problem-solving skills & project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Problemsolving_skills[b]	.	Enter

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.767[a]	.589	.583	.32332	1.910

ANOVA[a]

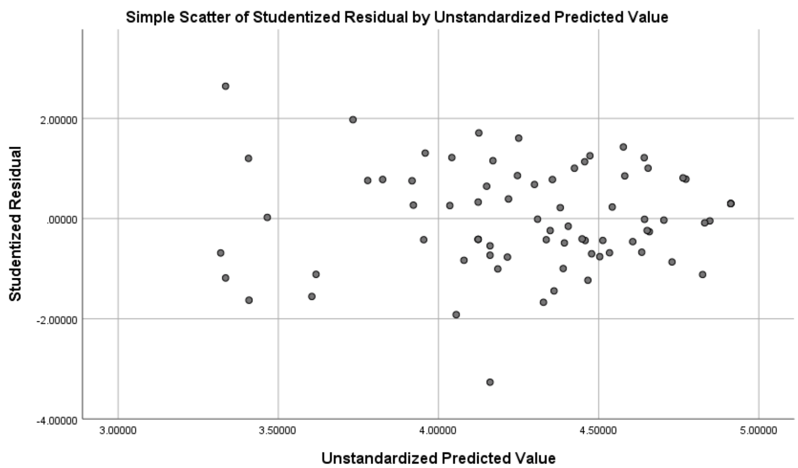
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.079	1	11.079	105.984	.000[b]
	Residual	7.736	74	.105		
	Total	18.815	75			

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	1.541	.269		5.735	.000	1.005	2.076
Problemsolving_skills	.650	.063	.767	10.295	.000	.524	.776

Appendix J: Multiple Regression test

J1. Scatter plot between studentized residual and unstandarized predicted value



J2. Stepwise Regression of digital skills clusters against project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Problemsolving_skills	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Contentcreation_Skills	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.767[a]	.589	.583	.32332	
2	.799[b]	.638	.628	.30556	1.735

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.079	1	11.079	105.984	.000[b]
	Residual	7.736	74	.105		
	Total	18.815	75			
2	Regression	11.999	2	6.000	64.257	.000[c]
	Residual	6.816	73	.093		
	Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.541	.269		5.735	.000	1.005	2.076					
	Problemsolving_skills	.650	.063	.767	10.295	.000	.524	.776	.767	.767	.767	1.000	1.000
2	(Constant)	1.144	.284		4.031	.000	.578	1.709					
	Problemsolving_skills	.470	.083	.555	5.674	.000	.305	.635	.767	.553	.400	.519	1.926
	Contentcreation_Skills	.281	.089	.307	3.139	.002	.102	.459	.691	.345	.221	.519	1.926

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Technical_Skills	.211[b]	2.462	.016	.277	.708	1.413	.708
	Information_skills	.297[b]	3.006	.004	.332	.513	1.950	.513
	CommandCollab_Skills	.149[b]	1.589	.116	.183	.623	1.606	.623
	Contentcreation_Skills	.307[b]	3.139	.002	.345	.519	1.926	.519
2	Technical_Skills	.127[c]	1.404	.165	.163	.597	1.674	.438
	Information_skills	.193[c]	1.749	.085	.202	.394	2.536	.394
	CommandCollab_Skills	-.029[c]	-.258	.797	-.030	.401	2.494	.334

J3. Stepwise Regression of technical skills variables against project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Q12.4TechSkills4	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Q12.2TechSkills2	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.539[a]	.291	.281	.42457	
2	.606[b]	.368	.350	.40373	2.058

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.476	1	5.476	30.380	.000[b]
	Residual	13.339	74	.180		
	Total	18.815	75			
2	Regression	6.916	2	3.458	21.215	.000[c]
	Residual	11.899	73	.163		
	Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95.0% Confidence Interval for B Lower Bound	Upper Bound	Correlations Zero-order	Partial	Part	Collinearity Statistics Tolerance	VIF
1	(Constant)	2.702	.291		9.299	.000	2.123	3.281					
	Q12.4TechSkills4	.374	.068	.539	5.512	.000	.239	.509	.539	.539	.539	1.000	1.000
2	(Constant)	2.060	.351		5.873	.000	1.361	2.759					
	Q12.4TechSkills4	.276	.072	.399	3.823	.000	.132	.421	.539	.408	.356	.795	1.258
	Q12.2TechSkills2	.244	.082	.310	2.972	.004	.080	.408	.491	.329	.277	.795	1.258

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance	VIF	Minimum Tolerance
1	Q12.1TechSkills1	.119[b]	1.104	.273	.128	.819	1.222	.819
	Q12.2TechSkills2	.310[b]	2.972	.004	.329	.795	1.258	.795
	Q12.3TechSkills3	.105[b]	1.003	.319	.117	.867	1.153	.867
2	Q12.1TechSkills1	.041[c]	.383	.703	.045	.761	1.314	.725
	Q12.3TechSkills3	.054[c]	.529	.598	.062	.839	1.191	.740

J4. Stepwise Regression of information skills variables against project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Q13.5InfoSkills5	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Q13.2InfoSkills2	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.654[a]	.428	.420	.38130	
2	.695[b]	.483	.469	.36496	1.714

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.056	1	8.056	55.409	.000[b]
	Residual	10.759	74	.145		
	Total	18.815	75			
2	Regression	9.092	2	4.546	34.130	.000[c]
	Residual	9.723	73	.133		
	Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collin Stat
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Toleranc
1	(Constant)	2.359	.262		9.013	.000	1.838	2.881				
	Q13.5InfoSkills5	.441	.059	.654	7.444	.000	.323	.559	.654	.654	.654	1.0
2	(Constant)	1.896	.301		6.310	.000	1.297	2.495				
	Q13.5InfoSkills5	.331	.069	.491	4.785	.000	.193	.469	.654	.489	.403	.6
	Q13.2InfoSkills2	.219	.079	.286	2.789	.007	.063	.376	.567	.310	.235	.6

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance	VIF	Minimum Tolerance
1	Q13.1InfoSkills1	.042[b]	.396	.693	.046	.702	1.425	.702
	Q13.2InfoSkills2	.286[b]	2.789	.007	.310	.673	1.486	.673
	Q13.3InfoSkills3	.243[b]	1.916	.059	.219	.462	2.163	.462
	Q13.4InfoSkills4	.250[b]	2.711	.008	.302	.835	1.198	.835
2	Q13.1InfoSkills1	.025[c]	.251	.803	.030	.699	1.430	.538
	Q13.3InfoSkills3	.127[c]	.944	.348	.111	.391	2.560	.391
	Q13.4InfoSkills4	.168[c]	1.642	.105	.190	.660	1.515	.532

J5. Stepwise Regression of comm&collab skills variables against project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Q14.2CommandCollabSkills2	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Q14.1CommandCollabSkills1	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.503[a]	.253	.243	.43571	
2	.556[b]	.309	.290	.42196	1.980

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.767	1	4.767	25.109	.000[b]
	Residual	14.048	74	.190		
	Total	18.815	75			
2	Regression	5.817	2	2.909	16.336	.000[c]
	Residual	12.998	73	.178		
	Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95.0% Confidence Interval for B Lower Bound	Upper Bound	Correlations Zero-order	Partial	Part	Collinearity Statistics Tolerance	VIF
1	(Constant)	2.586	.342		7.565	.000	1.905	3.267					
	Q14.2CommandCollabSkills2	.388	.077	.503	5.011	.000	.234	.542	.503	.503	.503	1.000	1.000
2	(Constant)	2.084	.390		5.342	.000	1.307	2.862					
	Q14.2CommandCollabSkills2	.273	.089	.354	3.078	.003	.096	.450	.503	.339	.299	.715	1.399
	Q14.1CommandCollabSkills1	.228	.094	.279	2.429	.018	.041	.416	.469	.273	.236	.715	1.399

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance	VIF	Minimum Tolerance
1	Q14.1CommandCollabSkills1	.279[b]	2.429	.018	.273	.715	1.399	.715
	Q14.3CommandCollabSkills3	.215[b]	1.789	.078	.205	.678	1.475	.678
	Q14.4CommandCollabSkills4	.233[b]	2.104	.039	.239	.789	1.267	.789
2	Q14.3CommandCollabSkills3	.081[c]	.572	.569	.067	.471	2.122	.471
	Q14.4CommandCollabSkills4	.188[c]	1.701	.093	.197	.759	1.318	.641

J6. Stepwise Regression of content-creation skills variables against project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Q15.2ContentCreationSkills2	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Q15.5ContentCreationSkills5	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.722[a]	.521	.515	.34896	
2	.740[b]	.547	.535	.34154	1.949

ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	9.804	1	9.804	80.508	.000[b]
Residual	9.011	74	.122		
Total	18.815	75			
Regression	10.300	2	5.150	44.149	.000[c]
Residual	8.515	73	.117		
Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.200	.235		9.354	.000	1.732	2.669					
	Q15.2ContentCreationSkills2	.503	.056	.722	8.973	.000	.392	.615	.722	.722	.722	1.000	1.00
2	(Constant)	1.883	.277		6.804	.000	1.332	2.435					
	Q15.2ContentCreationSkills2	.440	.063	.631	6.994	.000	.315	.565	.722	.633	.551	.762	1.31
	Q15.5ContentCreationSkills5	.140	.068	.186	2.062	.043	.005	.275	.494	.235	.162	.762	1.31

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Q15.1ContentCreationSkills1	.189[b]	1.951	.055	.223	.666	1.501	.666
	Q15.3ContentCreationSkills3	.073[b]	.754	.453	.088	.698	1.433	.698
	Q15.4ContentCreationSkills4	.127[b]	1.398	.166	.161	.772	1.295	.772
	Q15.5ContentCreationSkills5	.186[b]	2.062	.043	.235	.762	1.313	.762
2	Q15.1ContentCreationSkills1	.140[c]	1.383	.171	.161	.600	1.667	.600
	Q15.3ContentCreationSkills3	-.004[c]	-.040	.968	-.005	.590	1.694	.590
	Q15.4ContentCreationSkills4	.150[c]	1.683	.097	.195	.762	1.312	.593

J7. Stepwise Regression of problem-solving skills variables against project innovation success

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Q16.4ProblemSolvingSkills4	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Q16.3ProblemSolvingSkills3	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3	Q16.2ProblemSolvingSkills2	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.692[a]	.478	.471	.36418	
2	.745[b]	.556	.544	.33840	
3	.773[c]	.598	.581	.32417	1.845

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.000	1	9.000	67.861	.000[b]
	Residual	9.815	74	.133		
	Total	18.815	75			
2	Regression	10.455	2	5.228	45.651	.000[c]
	Residual	8.360	73	.115		
	Total	18.815	75			
3	Regression	11.249	3	3.750	35.681	.000[d]
	Residual	7.566	72	.105		
	Total	18.815	75			

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95.0% Confidence Interval for B Lower Bound	95.0% Confidence Interval for B Upper Bound	Correlations Zero-order	Correlations Partial	Correlations Part	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	2.348	.238		9.855	.000	1.873	2.823					
	Q16.4ProblemSolvingSkills4	.466	.057	.692	8.238	.000	.353	.579	.692	.692	.692	1.000	1.000
2	(Constant)	1.900	.255		7.464	.000	1.393	2.407					
	Q16.4ProblemSolvingSkills4	.319	.067	.474	4.776	.000	.186	.452	.692	.488	.373	.619	1.615
	Q16.3ProblemSolvingSkills3	.250	.070	.353	3.565	.001	.110	.389	.646	.385	.278	.619	1.615
3	(Constant)	1.601	.267		5.993	.000	1.068	2.133					
	Q16.4ProblemSolvingSkills4	.252	.068	.374	3.684	.000	.116	.389	.692	.398	.275	.541	1.849
	Q16.3ProblemSolvingSkills3	.206	.069	.291	2.983	.004	.068	.343	.646	.332	.223	.586	1.707
	Q16.2ProblemSolvingSkills2	.177	.064	.252	2.748	.008	.049	.306	.599	.308	.205	.664	1.506

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance	Collinearity Statistics VIF	Collinearity Statistics Minimum Tolerance
1	Q16.1ProblemSolvingSkills1	.175[b]	1.784	.079	.204	.711	1.406	.711
	Q16.2ProblemSolvingSkills2	.315[b]	3.358	.001	.366	.702	1.425	.702
	Q16.3ProblemSolvingSkills3	.353[b]	3.565	.001	.385	.619	1.615	.619
2	Q16.1ProblemSolvingSkills1	.174[c]	1.911	.060	.220	.711	1.406	.496
	Q16.2ProblemSolvingSkills2	.252[c]	2.748	.008	.308	.664	1.506	.541
3	Q16.1ProblemSolvingSkills1	.125[d]	1.389	.169	.163	.676	1.480	.467

Appendix K: Ranking Digital Skills Clusters Importance in Regression

K1. Standardized Coefficient Beta & Part Correlation

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95.0% Confidence Interval for B Lower Bound	95.0% Confidence Interval for B Upper Bound	Correlations Zero-order	Correlations Partial	Correlations Part
1	(Constant)	.970	.335		2.895	.005	.302	1.638			
	Technical_Skills	.074	.099	.073	.750	.456	-.123	.271	.564	.089	.052
	Information_skills	.196	.121	.213	1.619	.110	-.045	.437	.688	.190	.113
	CommandCollab_Skills	-.122	.115	-.129	-1.063	.292	-.352	.107	.564	-.126	-.074
	Contentcreation_Skills	.234	.115	.255	2.036	.046	.005	.463	.691	.236	.142
	Problemsolving_skills	.408	.089	.481	4.587	.000	.230	.585	.767	.481	.319

K2. Stepwise Regression (variables entered/removed)

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Problemsolving_skills	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Contentcreation_Skills	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

K3. Changes in R^2

K3.1 Regression test for all digital skills clusters

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.813[a]	.661	.637	.30184

K3.2 Regression test for tech, info, comm and content-creation skills

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.748[a]	.559	.534	.34179

K3.3 Regression test for tech, info, comm and problem-solv skills

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.801[a]	.641	.621	.30845

K3.4 Regression test for tech, info, content-creation and problem-solv skills

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.810[a]	.656	.636	.30211

K3.5 Regression test for tech, comm, content-creation and problem-solv skills

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.805[a]	.648	.629	.30526

K3.6 Regression test for info, comm, content-creation and problem-solv skills

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.811[a]	.658	.639	.30090

K3.7 change in R^2

In order to compute the changes in R square, a regression test was conducted to compute R^2 for all digital skills clusters (Tech-info-comm-content-problem) is 0.661.

Digital skills clusters	**R^2**	**Change in R^2**	**IV**	**Rank**
tech-info-comm-content	0.559	0.102	Problem-solving skills	1
tech-info-comm-problem	0.641	0.02	Content-creation skills	2
tech-info-content-problem	0.656	0.005	Comm & Collab skills	4
tech-comm-content-problem	0.648	0.013	Information skills	3
info-comm-content-problem	0.658	0.003	Technical skills	5