

Project Complexity, Project Managers' Knowledge Creation Styles, and Project Performance

أثر مستوى تعقيد المشروع وأنماط مديري المشروعات في بناء المعرفة الجديدة على نجاح أداء المشروع

by

RASHA MOHAMED NASER ABOU SAMRA

A thesis submitted in fulfilment

of the requirements for the degree of

DOCTOR OF PHILOSOPHY IN BUSINESS MANAGEMENT

at

The British University in Dubai

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ABSTRACT

The aim of this research is to find a generalized model of prediction and control of the project performance using the knowledge creation and considering the impact of project complexity on project performance. This research attempts to find knowledge creation constructs that measure the styles of knowledge creation within an Arab context. The research investigates four styles of knowledge creation in the field of project management, namely innovative style, experiential style, risk averse style, and specialized style. This is a mixed-method study of the knowledge creation styles of project managers and is applied to 402 projects from different Arab countries. The study systematically reviews the literature in the area of complexity, knowledge creation and project performance, and generates a conceptual model for a qualitative study followed by a quantitative hypothesized model for a quantitative study. This study quantifies the effect of each knowledge creation style at the level of the success of the project performance. This impact is measured in the light of these styles of knowledge creation as moderators of the impact of level of project complexity on the level of project success. The research conclusion is the significance of the mediation of risk averse knowledge creation and the significant moderation impact on the relationship between project complexity and the project performance. Also the research is providing new constructs for measuring the knowledge creation styles and in triangulating the results through quantitative study. Moreover, the research adopts an inductive approach to explain and predict the levels of success of project performance and concludes that there two levels of analysis; one is the level of the relationship between the main constructs of the study, and in this regard the RAKCS is the mediator and the IKCS is the moderator between the project complexity and the project performance. There is another level of analysis among the sub-constructs of the study. It concludes a sequence of relationships between KCSs and significant moderation impacts of these KCSs on the relationship between sub-constructs of complexity and sub-constructs of project performance.

ABSTRACT IN ARABIC

إن الهدف الرئيسي لهذه الدر اسة هو الوصول إلى نموذج قابل للتعميم و معتد به إحصتئياً للتنبؤ و التحكم في مستوى نجاح المشروع باستخدام أثر بناء المعرفة و مستوى التعقيد في بيئة المشروع. إن هذه الدراسة التحليلية تستهدف بناء نموذج لقياس أثر الأنماط المختلفة لخلق المعرفة لدى مديري المشروعات على مستوى نجاح أداء المشروع ، و يتضمن النموذج البحثي كذلك متغيراً مستقلاً آخر وهو مستوى تعقد المشروع ، و باستخدام المدخل المختلط كمياً و وصفياً تقوم الدر اسة ببناء نموذج تصوري من واقع تحليل المقابلات الشخصية مع 101 من مديري المشروعات ، ثم تقوم الدر اسة بعد ذلك بجمع عينة عشوائية من 402 من مديري المشروعات لقياس معنوية تطبيق هذا النموذج في التنبؤ بمستوى نجاح أداء المشروع كمتغير تابع لهذه الدراسة ، تبعاً للتغيرات التي تحدث في كل من مستوى تعقد المشروع و أنماط خلق المعرفة لدى مديريه. و تقدم هذه الدر اسة إسهاماً علمياً يخدم مديري المشروعات في التنبؤ ومن ثم التحكم في نجاح المشروع من خلال التعرف على محددات بناء المعلومات و كيفية تفاعلها مع مستوى تعقد مشروعاتهم و ما لهذا التفاعل من آثار إيجابية أو سلبية على تحقيق أهداف الأداء أو الانحراف عنها. إن أهم نتائج هذه الدراسة هي التوصل إلى الأثر الوسيط لكل من نمط تجنب المخاطر و نمط الابتكار في ا إدارة المشروع و ما لهذا الأثر الوسيط من دور في تغيير شكل و قوة العلاقة بين مستوى تعقد المشروع و مدى النجاح الذي يتححقق في أداء المشروع.

DEDICATION

To my parents for their endless support and encouragement. I must admit that during the course of producing this work, I experienced some bouts of depression and despair to the extent of giving up the entire pursuit, but their unwavering support, motivational vibes, and taking care of my children pulled me back and reinvigorated my endeavour to finish this work;

To my children to whom I wish to say, "This is what you will inherit from me. I do not care about how much wealth I will leave behind as much as I care about leaving knowledge and respect for you. I will do my best to continue seeking knowledge even after earning my PhD, because this the mission that I live for;

To my academic supervisors and project managers who have made this work possible through their insightful contributions and constructive criticism and feedback. Thank you all for the time and efforts you have expended to support me.

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List of Abbreviations

#	Abbreviation	Definition
1	PM	Project manager
2	PP	Project performance
3	PS	Performance stability
4	КС	Knowledge creation
5	CS	Cost stability
6	QS	Quality stability
7	Pros	Productivity stability
8	TS	Time stability
9	VC	Variety complexity
10	PC	Project complexity
11	IKCS	Innovative knowledge creation style
12	SKCS	Specialization knowledge creation style
13	RAKCS	Risk-averse knowledge creation style
14	EKCS	Experiential knowledge creation style
15	EC	Environmental complexity
16	PI	Project interdependency
17	KCS	Knowledge creation style
18	SC	Size complexity

Chapter One: Introduction

1.1 Introduction

When talking about the area of knowledge creation in the body of research, there is ambiguity in the definition and measurement of knowledge creation in projects (C. Wang et al., 2021). The knowledge creation has conceptualization understanding as well as operational contextual understanding in the literature (Amann & Rubinelli, 2017). This is due to the implications and purposes of creating knowledge in different contexts of research. This is representing an obstacle to the comparative analysis when there is no one unified definition of knowledge creation (C. Wang et al., 2021).

As a good start to resolve this discrepancy is to look at the methods of measuring knowledge creation because this sheds light on further understanding of what is knowledge creation within the domain of project management (Canonico et al., 2020). If we critically ask the following question; What is the purpose of creating new knowledge? We will find different answers to this question. One main purpose is related to the achievement of a competitive advantage over other competitors in the market and organizational continuous learning is another purpose for knowledge creation in project based organizations (De Toni & Pessot, 2021). These are not the only purposes for knowledge creation. Knowledge creation is found to be needed to innovate as well (Zare et al., 2019).

As a conclusion there are different purposes for creating knowledge in projects. The common factor found in all purposes of knowledge creation is that all these purposes are related directly or indirectly to the project performance (Yeh, 2008). Project performance is the planned performance as well as the implemented one as well and both are related to knowledge creation (Arumugam et al., 2013). This is justifying the choice of studying knowledge creation in

projects performance during planning and implementation periods and this is the scope of the current study within the MENA region and the area for which the study defines knowledge creation as it is critically related to its context and it is not perspectival correct to define the knowledge creation without justifying in which context and for what purpose it is defined. The contextual conceptualization and operationalization of the definition of the knowledge creation is important for the generalization of research results for many projects belonging to the same context which is the MENA region in the current study.

The reason behind the ambiguity and inability to unify the definition of knowledge creation is in one hand because of its contextual nature and in another hand because of its tacitness, subjectivity, and embeddedness nature which is personalized depending on the project manager and his or her team behaviours (Bibbes et al., 2017).

Research (Rusko, 2018) finds evidence on the significant connection and the personalization of the knowledge creation depending on the person who is creating the knowledge and mainly the project manager. The choices of project managers reveal the inputs to the knowledge creation process and how it differ from project to project and from time to time for the same project manager (Wu & Magnier Watanabe, 2010).

As a conclusion the knowledge creation is inseparable to the creator of this knowledge and the main decision maker about what inputs will lead to which outputs of project performance. This is the reason of having the project manager as the unit of research in this study.

There is a significant relationship between knowledge creation and project performance (Watanabe R., 2017) (Floricel, 2016) (Gorsky, Project management and leadership: Practical tips for medical school leaders, 2016) (Antoniadis, 2011) (Harbour, 2017) in the sense that knowledge creation is necessary for better performance because it is a source of achieving social

coping, solving problems, and building accrued experience (Arumugam, 2013) (Samra, 2016, July) (Heckmann, 2016). According to the relevant literature, knowledge creation is related to some behavioural styles such as situational leadership, transformational leadership, distributed versus centralized leadership, and transactional leadership (Klinger, 2018) (Ranjan, 2016) (Bryant, 2003). It is also related to the learning styles of managers. For example, the literature shows significant relationships between knowledge creation and adaptive learning style, generative learning style, transformative learning style, and reflective learning style (Ragnhild Nilsen, 2013) (Seitamaa-Hakkarainen et al., 2010) (Choo et al., 2007) (Kang et al., 2017). The body of knowledge in the area of knowledge management requires evidence on the classification of project managers' behaviours when creating purposeful and rational knowledge for project planning and implementation.

In their research, (North, Knowledge management: Value creation through organisational learning, 2018) found that managers cannot systemize the way they create new knowledge because it depends on the situation in which this knowledge is created. Situations vary in terms of convenience of time and information, and knowledge is a further step beyond information. In fact, knowledge is contextual and actionable and leads to a change in the ability of the project manager to control the success of the project (Mba & Agumba, 2018) (Adzmi & Hassan, 2018) (Li & Guo, 2011) (Makui et al., 2018). What determinants of performance success are related to the project and achieving its success goals? The dynamic and continuously changing environment in which the project manager operates adds to the level of complexity of the project (Hartono, 2019) (Thomas, 2008) (Maylor, 2008). According to the literature, the association that exists between knowledge creation and project performance needs further research that is related to the contextual complexity in its ability to determine the level of performance success

and also in its interaction with the knowledge creation behaviour of the project manager to direct his or her actions toward the achievement of the project goals.

1.2 Research Overview

The research attempts to measure the moderation and/or mediation impact of knowledge creation styles of project managers on the relationship between the project complexity and the project performance. The project complexity is measured using a tool adapted from the Vidal's model (Vidal, 2011) with respect to the changing of the structure of sampling in a way to include one project manager and one project from each organisation rather than all projects and all project managers in one organisation. The purpose of this change in the sampling has been to diversify the contexts and the environmental changes for which project managers create new knowledge and manager performance success. This proves to be more challenging and adds to the value of the research. The measurement of the knowledge creation styles of project managers depends on the outputs of the qualitative study and its adaptability from measurements of knowledge creation pertaining to previous studies. The measurement of the project performance and its success was another challenge because the research sample is diversified and includes projects from different industries and various sectors. Moreover, the measurement of success varies from one industry to another; therefore, the researcher used pilot judgment, along with adapting from the literature to find common measurements of project performance that match the measurement of the performance success of all sampled projects. The use of the mixed-method approach and several statistical analysis methods enabled the researcher to validate and generalize reliable and reproducible research results about the moderation and mediation impacts of the knowledge creation style. Furthermore, the mixedmethod approach provides reliable results about the sequence of using theses styles in predicting

and determining the change in the level of success in the project performance within different levels of complexities in various organisations.

1.3 Exploratory research

Exploratory research was conducted to identify the research problem. The purpose of this exploratory study is to investigate what resources are used by project managers when they create knowledge for their performance success. It also judgementally classifies these resources into categories that are different from each other in their characteristics to prepare for the qualitative and quantitative study and to check the applicability of the research in the MENA region. The researcher explored the concept of what managers do when they want to create new knowledge by using the following interview points:

1- The resource of information that is preferable when having out-of-control performance results.

2- The dependence on experience, specialization, innovation, and precautions when dealing with irregular variation in the profit, number of customers or sales volume, or when having irregularity in performance indicators in general.

3- Reasons for having irregular changes in performance results and whether there are unexplained irregular variations in performance indicators.

The exploratory sample of interviewees consisted of 1 project manager for training programs, 1 project manager for IT soft-ware consultation, 3 project managers in the construction sector, and 5 project managers in small women projects under the sponsorship of Sheikha Jowaher Bent Mohammed Al Qasimi.

The 10 project managers interviewed were from different countries, namely Egypt, Palestine, the UAE, and here are the results of the telephone interviews:

- The most preferred reference when dealing with irregular variations in performance results is the experience of the project manager and then the experience of other consultants in the field.

- Most of the project managers are affected by the impact of the irregular variation on their project's success when they choose the source of information that they can rely on in dealing with irregular variation. If the effect is trivial, and the risk is low, then they tend to ignore or use their own tacit knowledge.

- If the effect is damaging and strong, they seek explicit knowledge resources.

- Project managers are not the same when they speak about the source they use and how they manage irregular variation

- Most project managers consider the irregular variation as an indicator of the errors that exist in the implementation process of the plan or are caused by unexpected changes in the environment that were not included from the beginning in the plan.

- Most project managers are indifferent towards seeking the exact reasons of the previous planning irregular results. They start from scratch and design a new plan by setting new performance targets, especially if they are new project managers.

With the foregoing, it may be concluded that project managers differ in calculating the risks associated with chaotic performance "irregular performance", in depending on plans, and in accepting violating plans. They may also differ in using different sources of knowledge. This is evidenced by the results found through the critical analysis of the literature about the existence of different styles of knowledge creation to deal with chaotic performance. As a conclusion, there is a potential construct validity for the knowledge creation styles that will be further explored by this study.

According to the results of the exploratory research, the research problem can be defined as follows: "In the MENA region, project managers may or may not be classified based on their style of knowledge creation for the purpose of achieving better performance success indicators"

1.4 Contextual background of research concepts

The current research is applied on the field of small and medium projects in the MENA region. Based on the literature review as well as the contextual exploratory interviews the research is contextually defining the concepts described qualitatively or measured quantitatively to achieve the purpose of the study.

A project manager is the person who is the decision maker who signs and approves the final plan and budget of the project before it goes to the implementation process. He is also the one who receives the reports of implementation teams and takes the decision of end of work on the project as well as decides on the conformance of the implemented work to the planned one. He sometimes in some projects creates the final report of the project and lists the points of improvement for the future performance of the team after delivering the project to its targeted customer.

Project performance is the consisting of two parts, the first one is the planned performance and the second one is the implemented performance and both are considered to be under control if the implementation is conforming to the plan. The role of the project manager is to make sure of this conformance to achieve success.

Performance stability means contextually the ability to implement the project as planned without deviations. This is coping with what is meant by stability versus instability of project performance and this is explained in details in the literature review chapter on project performance. The project manager considers the project performance as a stable one if he perceives the disruptions in the project as resistible and if not resistible then the project performance is perceived to be unstable by the project manager.

Knowledge creation is the process for which the project manager takes the decision of resourcing to be able to reach the conformance between the planned performance and the implemented one. The resourcing of knowledge creation process is strongly linked to the project manager as a person who has his or her subjectivity in taking the final decision of the chosen resources and assets from which the knowledge will be created and for a certain output which is project performance success.

Project performance is contextually measured and defined by four sub-constructs which are the conformance between the planned performance and the implemented one for project cost, project time, project quality, and project productivity. As mentioned earlier, if the manager is controlling this conformance, then the project is classified and perceived having stable performance and if not, the project has relatively less or unstable performance.

The knowledge creation style is the behaviour of the project manager in choosing input knowledge assets for the knowledge creation that is purposefully created to achieve performance success. This behaviour is found contextually revealing four different types of project managers. This behaviour is not the only behaviour for the project manager, but it is the dominant one when knowledge creation process starts in the project from time to time and from project to project. The project manager was asked to think of one project at the time of data collection to memorize precise behaviour and occasionally the project chosen by the project manager was asked to be the one implemented during the current period of time so that both planning and implementation processes are completed to the measurement of the performance success stage but before the submission of the final product to the end customer. During the qualitative research interviews four constructs were inductively built to indicate the innovative

choices for the innovative knowledge creation style, the risk-averse choices for the risk-averse knowledge creation style, the experiential choices for the experiential knowledge creation style, and the specialization choices for the specialized knowledge creation style.

Project complexity is contextually understood by the increase or decrease in the number of project components as well as the increase or decrease in the number of interrelationships among these components. This understanding reveals that the project has higher level of complexity when it has more components and more interrelationships among these components. The project is less complex when the number of project components is less and the interrelationships among these components is less as well. During the qualitative investigations of the research there are four constructs developed under project complexity in the light of the contribution of research in the area of project complexity (Eriksson et al., 2017). The four constructs used to measure project complexity in the current research are the size complexity which refers mainly to the number of workers in the project, the variety complexity which refers to the components of the project system, the interdependency complexity; which refers to the dependency of some project components on other project components whether internally or externally, and finally, the environmental complexity which refers to the uncontrollable changes in the context and environment of the project during planning and implementation and this is known to be changing dynamically and is not a static environment. The more is the size of the project, its variety, is dependency, and the dynamic changes in its environment, means the higher is its complexity and vice versa.

These contextual comprehensions of the terminologies used in this research are derived from over 100 interviews with project managers and in light of the contribution and findings of the literature and body of research in the areas of knowledge creation, project performance, and project complexity. Furtherly, the following chapters shed more light on the theoretical start of conducting this study by reviewing the literature before creating the constructs as a requirement for triangulation and to increase the accuracy of research findings.

1.5 Spotting the gap of the research:

knowledge perspective in IT projects there is an evidence that knowledge resources lead to the knowledge creation and that some of created knowledge is lost before it affects the project performance. This is significantly accepted in this research in the field of IT projects, however; it is raising a question about the resources of knowledge creation, what are they and if they differ from manager to another or if they differ from sector of industry to another or not? The current research agrees on the use of knowledge creation resources by project managers but takes a further step to the classification of project managers into different categories based on their choices of using certain resources to create knowledge for the purpose of achieving project performance success as the same as what is evidenced in the research of Reich, Gemino, and Sauer 2008 (Reich et al., 2008).

If we want to classify the project managers into categories based on how do they create new knowledge for the purpose of achieving performance success for their projects, we can refer to the study of Vikalpa and Watanabe (Magnier-Watanabe et al., 2011) in which they investigated that the knowledge creation is an interaction between complex cognitive processing done by the project manager to transfer information into contextual actionable knowledge and the learning mode of this project manager; however, this is not showing which knowledge resource is chosen by the project manager. In our pilot study we explored the differences among project managers in using resources of knowledge creation and that they are not frequently using the same resources to create knowledge when the purpose of creating this knowledge is to achieve performance success for the project. In the study of Magnier – Watanabe et al., 2011 – the cognitive process exists inside the brain of the project manager

and is accompanied with a behavioural organizational process or processes that makes the knowledge creation a complex activity that may not be easily accurately measured by research. The external behaviour of choosing certain resources and assets to create knowledge is relatively easier to be measured and used to classify managers styles of knowledge creation. The active knowledge not the dormant one is the one used during the implementation and chosen during the planning process of the project life for one purpose in the current research which is the performance control to minimize the gap between the planned performance and the actual one.

Same research of (Magnier-Watanabe et al., 2011) highlights the importance of the role of the project leader in creating knowledge and that for achieving organizational control, there is a need to study the work style on SECI model and this was studied in many countries like Japan, United States, France, and China, but there is no such research conducted on the MINA region to show any contextual differences and this is another gap to be targeted by the current research.

In another research (Samra & Shaalan, 2016) focusing on the performance of the project it is found that the irregularity of performance is frequently happening in projects during different life cycles however; this deviation in performance control is sometimes accepted by project managers who have different prioritizations of using knowledge assets from which they create new knowledge and that the creation of knowledge during stability is not as the same as the creation of knowledge during instability of project performance. The study also shows that contextual factors may impact the choosing of sources of knowledge creation and that managers have different tendencies to innovate new knowledge. The results of this study enhance the need to study grouping and classification of project managers in categories based on the assets they tend to use when they want to create knowledge for the purpose of

controlling their project performance and to bring it back to conformance with the planned performance. The current research is targeting this gap of classification of project managers when choosing knowledge assets. In the research of Abousamra and Shaalan (2016) an exploratory investigation is illustrated about knowledge creation styles but without quantification of its impacts and how to measure each style. This is another gap in the body of literature, and the current study is a try to build constructs to measure the styles of knowledge creation in the MENA region and to measure its impact on the project performance control.

1.6 Study motivation / rationale

The motivation behind this research is the evidence in the literature that the full control over conformance between planned performance of the project and the actual implemented one is still under research and is subjected to chaotic contextual changes that are impacting project managers differently. The role of the project manager to choose the type of the asset of knowledge that is better able to control the project performance is what motivates the researcher to conduct this research. The question is when to use innovative resources to create knowledge and when is it better to use risk-averse ones. When to use specialized sources of knowledge and when to use the experiential sources for controlling project performance. In this research it is quantifiable that the impact of different classifications of managers on controlling project performance in the MENA region have significant difference but this is not the main purpose of the research. It is beyond quantifying the impacts of classifications of project managers when they create new knowledge and beyond measuring the impact of these classifications or styles on the project performance to the measurement of interaction of contextual complexity of projects and how this interaction then will impact the control over project performance and its success. It is by definition of knowledge which is focusing on the
contextuality of the knowledge and actionability of its nature the project managers are creating knowledge for different contexts of complexity and this is considered in the current study. In the literature there is evidence that the project complexity is having negative significant impact on the project performance, however; in the current study this impact is better and further explained qualitatively and quantitatively by the intervening of classifications of managers into behavioural choices of assets of knowledge for the purpose of creating new knowledge. It is simply by asking managers when they want to create knowledge for having better control over their project performance which resources do managers often depend on more than the other. Behaviourally, there are different responses of project managers to this main question. The researcher is using the knowledge resources in the SECI model as a source of classification and then tests if this new classification is able to moderate and / or mediate the impact found in the literature of project complexity on project performance or not.

1.7 Context definition and its compatibility with the primary motivation of the thesis

This inductive research is a motivational study to reach contextual moderation and mediation impacts to give further significant explanation and description of the impact of project complexity on the performance success. This research closes the gap of the measurement of the static impact of complexity on the project performance in general, without going deeper into the sub-constructs' relationships among the main research variables which are the project complexity, the project knowledge creation, and the project performance. Detailed steps of creating sub constructs qualitatively and measuring them quantitatively will lead to a contribution in the area of better understanding of the mediation and moderation and this gives better control over the project performance and its conformance to the planned performance which is the focal point of the study.

As a conclusion the creation of contextual definitions for the study constructs and subconstructs is compatible with the motivation behind conducting this study because it copes with the achievement of significantly deeper understanding of contextual moderation and mediation impacts on project managers choices and dominant behaviours when creating knowledge only for the purpose of achieving performance success and within different levels of project complexities.

1.8 The difference between knowledge creation behaviour and knowledge creation style

The knowledge creation behaviour can be explicitly measured or implicitly experienced with an extent of difficulty of measuring the implicit cognitive behaviour of the knowledge creation according to the results of the research in the area of the knowledge creation (Lindner, 2011). The choices of knowledge assets indicate this implicit cognitive behaviour and is related to it. For example, when the project manager is a risk averse style he or she may tend to avoid taking risks of trying solutions for the first time in their projects (López-Nicolás, 2011). These managers may refuse to use innovative sources and assets while implementation because of the precautions of not exceeding the planned budget of their project and maybe to stabilize the performance of these projects and to submit its final deliverables and products on time as promised to their customers (Martín-de Castro, 2011). Maybe they give priority to assets like ceilings of costs that are limitations to keep in mind during implementation. If we think of the choice of the project manager and how it differs from one manager to another, it may significantly create a classification of different styles of cognitive behaviours of project managers (Nonaka I. a., 2001). This cognitive behaviour and action are what can be constructed as a knowledge creation style. It is important to know the difference between the proposed knowledge creation style and the knowledge

creation behaviour provided by the literature (Nadayama, 2010). The knowledge creation behaviour is mainly the internalization and the externalization of knowledge and the moving between explicit and implicit knowledge by individuals and groups in the spiral process proposed by Nonaka and his colleagues (Nonaka I. a., 1995). Tacit to tacit, tacit to explicit, explicit to explicit, and explicit to tacit are possible behaviours of knowledge transfer and creation in the organization (Paavola, 2005) (Politis, 2001). On the individual level, there is a need to study which assets tend to be more fitting with the cognitive choices made by project managers and why do they choose this knowledge asset and leave another one? This is representing a gap in the body of science that is tackled by this research and to be followed by further research in the future (Thalmann, 2012, September).

1.9 Difference between knowledge creation as a process and knowledge creation as a style

Knowledge creation is a system of inputs, processing, and outputs (Frantzeskaki, 2016) which is existing within the project context in our scope of research for the study at hand. The inputs to the process are chosen by the project manager and are processed the way the project manager believes it would lead to the desired outputs of knowledge creation processing (Girdauskiene, 2013) (Gasik, 2011) (Heinsch, 2016). The decisions of the project manager are represented by the dependency on higher safety assets from which new knowledge can be created like for example the cumulated experience over the years about similar projects (Hislop, 2018) (Hossain, 2013, March). The project manager is exerting a cognitive behaviour to do so and is behaving implicitly (Hussain, 2004) (Hwang, Project management knowledge and skills for green construction: Overcoming challenges, 2013) (Kanapeckiene, 2010) (Kodama, 2006). Consequently, there is a need to distinguish between the process of knowledge creation that has its inputs to it and its consequent outputs and the choices of the project managers that are based on the cognitive behaviour of choosing which inputs are used to lead to the right processing and to the achievement of the right outputs and managers may differ from each other in their choices and cognitive implicit behaviours (Lin, 2011) (Lin Y. W., 2015). spotting this gap in the literature requires a research contribution on the measurement of knowledge creation styles of the project managers and which reveals that they are not all conducting the systems of knowledge creation using the same cognitive behavioural actions and styles.

1.10 The main research question of the study

The current study aims at answering the following main research question:

"What are the differences among managers in creating knowledge for controlling project performance and how do these differences moderate and mediate the impact of project complexity on project performance?"

The categorizing of project managers reveals new constructs which are referred to as knowledge creation styles. A separate section explains the new terminology and its relationship to the literature.

1.11 Research Scope

According to research, there is a relatively high percentage of failure in projects management and the ability to have a successful performance in projects (You et al., 2016), and this is increasingly important considering the increase of complexity and its related cost. In fact, (Mirza & Ehsan, 2017) found that large projects that have more than 10 million labor content can have a performance success percentage of 10% only, while the remaining mega projects are failures. Complexity of projects means that projects nowadays consist of multiple subsystems

with interactive components therein, and most of the time, these complex projects have multiple geographical locations and subprojects that are running at the same time with high levels of interdependency among them (Vick & Nagano, 2018). This interdependency of goals, logistics, tasks, and other components entail a constant need for knowledge creation by project managers to be able to achieve the project goals. According to (You et al., 2016), team knowledge is conducive to performance; however, he believed that the decision-making processes are related to structured strategies to deal with a project complexity and performance success. This view contradicts the nature of the rapidly changing nature of project complexity and the alarmingly increasing percentage of project failure (Adzmi & Hassan, 2018). (Dixit & Saurabh, 2019) found that dependency on an external memory storage for better knowledge creation by project team of decision makers is a step towards better project performance. However, stored information and external memories are not the only source of knowledge creation for decision makers. Depending on limited sources of knowledge creation or on the choice of which source to use may or may not be related to the style of the knowledge creator who, in this study, is the project manager. (Magnier-Watanabe et al., 2011) used the interaction and communication processes among project managers as a source of knowledge creation. This means that they were trying to find sources of knowledge creation without classifying the process of knowledge creation into styles of action that represent categories of knowledge creation in projects. This is a gap in the literature that this study is trying to fill. By definition, projects are time-limited executions, and this is a challenge against stability and success in achieving its goals (Kermanshachi et al., 2020) because the manipulation of project goals to fit in with the rapid changes may minimize the ability of structured plans and strategies to lead to successful projects (Kashiwagi, 2018). The reason is that continuous modifications are related to changes in cognitive structures of project managers (Kermanshachi & Safapour, 2019). The continuous change in the project goals to fit in with the rapid changes has been found to be related to low levels of performance (C. Wang et al., 2021), and this largely necessitates a shift from strategies to styles of knowledge creation where project managers can easily move from one source of knowledge creation to another, and members of project management teams can activate one behaviour and deactivate another according to the required degree of coping with the level of complexity of the project in question. Based on the literature review, the research gap identified is as follows:

There is a deviation between the planned level of performance and the existing one in the project implementation stage. Furthermore, there is not enough evidence in the literature about the categorization of knowledge creators into styles and the impact of the knowledge creation style of the project manager on the level of success in the project performance.

There is evidence in the literature that complexity of projects has an impact on the project performance, but there is not enough evidence that the knowledge creation style may moderate or mediate this impact.

1.12 Research Aim and Objectives

The aim of the research is specifying the research problem and research outcomes.

The research aim is to examine knowledge creation style ans ascertain the moderation and / or mediation impacts on the relationship between project complexity and project performance. The research proposed a moderation model comprising of innovative knowledge creation style, risk averse knowledge creation style, experiential knowledge creation style, and specialized knowledge creation style.

According to the conceptual model, the research objectives are as follows:

- Appraise project performance in the MENA region and identify the key differences in project delivery practices;
- 2- Ascertain the effect of knowledge creation styles on project performance success in MENA region;
- 3- Ascertain the difference between project complexity, project performance, and the impact of knowledge creation styles;
- 4- The research proposed a moderation model and a mediation model compromising of innovative knowledge creation style, risk averse knowledge creation style, experiential knowledge creation style, and specialized knowledge creation style.

1.13 Research Assumptions

The assumptions of the current research are:

- every project has a temporary life to be completed, and this completion for both small and medium size projects exists in the short run;
- the responses of project managers on KCS items represent their common behaviour most of the time not the only behaviour all the time due to the contextual changes in each project; and
- each project manager had only one project in mind during the response to the research interviews and questionnaires.

1.14 The Relationship Between Research Aim, Objectives, and Research Questions

The following graph illustrates the number of hypotheses and interview questions that have been analysed to address each research question and the link of theses research questions to the achievement of research objectives:



The above figure indicates the link between the main purpose of the study, the objectives, and the research questions. To be able to answer the research questions, a mixed-method approach has been adopted to answer questions quantitatively and qualitatively. The following table indicates the number of quantitative hypotheses tested and the number of interview questions answered to find the answer to the current research questions:

Figure 1.2 The link between research main questions, research approach, interview points, and hypotheses

Research main questions	Approach to answer research	# Interview	# Hypotheses
	questions	points	tested
		analysed	
What is the comparative importance and	Qualitative approach Critical	1-5	
preferences of using knowledge creation	case study analysis		
assets for achieving performance success?			
What are the reasons behind deviations in	Qualitative approach Critical	6-11	
project performance?	case study analysis		
What are the characteristics of the	Qualitative approach Critical	12-14	
stability or instability of project	case study analysis		
performance?			
How does knowledge creation associate	Qualitative approach Critical	15-20	
with project performance?	case study analysis		
How does project complexity associate		21-22	
with project performance?			

Source: Created by the researcher

Which knowledge creation styles mediate the relationship between the project complexity and the project performance?	Quantitative approach: EFA, CFA, SEM, Regression, Hayes (2013)	Н1-Н2-Н3
Which knowledge creation styles moderate the relationship between the project complexity and the project performance?	Regression analysis, Hayes Process (2013) analysis, SEM	H4-H5
Which knowledge creation styles	Regression analysis, Hayes	Н6-Н7-Н8-Н9-
moderate the relationships between the	Process (2013) analysis, SEM	H10-H11-H12-
complexity sub-constructs and the		H13-H14-H15-
performance sub-constructs?		H16-H17-H18-
		H19-H20
Which knowledge creation styles	Regression analysis, Hayes	H21-H22-H23
mediate the relationships between the	Process (2013) analysis, SEM	
complexity sub-constructs and the		
performance sub-constructs?		
What independent factors predict what	Regression analysis	H24-H25-H26
dependent factors of the study?		
Does the prediction power significantly change after adding the knowledge creation style variables to the prediction model?	Hierarchical analysis	H27-H28-H29
What knowledge creation styles predict	SEM and regression analysis	H30-H31
the project performance?		
What hierarchical relationships between	Hierarchical regression analysis	Н32-Н33
KCSs significantly exist to determine		
the change in the project performance?		
How do KCSs impact the relationship	Hierarchical regression	H34-H35-H36-
between complexity and performance?		H37

1.15 Research Strategy

This study adopts an inductive and deductive research approach to fulfill the ontological and epistemological requirements of this study. For the contextual investigation of individual behavior of the project manager when creating new knowledge, the qualitative critical case study analysis method is used in a qualitative research methodology (Kermanshachi & Safapour, 2019). Then, to investigate the objective reality and to triangulate results of qualitative research, the qualitative study is followed by a quantitative one (Miterev, 2012).

The qualitative study is designed to answer the following research main questions:

- 1- How do project managers interpret their preferences of using different styles of knowledge creation to control their project performance?
- 2- How and why do performance deviations occur in the MENA region?
- 3- How are knowledge creation styles associated with the level of complexity and the project performance?
- 4- Why is complexity associated with project performance?

Inductive research is used to investigate the answers to these questions. The conclusion of the qualitative study is then an input to a deductive research based on quantitative approach and using survey method of data collection to find the objective answers to the following main research questions:

- 1- Are there different styles of project managers in creating new knowledge?
- 2- Are there significant impacts of the knowledge creation styles on project performance?
- 3- Are their significant differences in the impact of project complexity on the project performance due to the style of the project manager?

The deductive research is getting an input from the systematic literature review that came up with the theoretical framework as well as the outputs and conclusions of the qualitative study. It is fed with the input of how to measure the research constructs and subconstructs and a comparison with methodologies of semi-similar studies in the literature.

1.16 Propositions of the Qualitative Study

The study proposes that the dimensions of the project complexity may or may not have a qualitative association with the project performance dimensions, namely cost, productivity, time, and quality. The study also proposes that project managers can be classified into four knowledge creation styles qualitatively, meaning that these styles have a qualitative association with the project performance dimensions.

The purpose of the research is to analyse these associations among research variables and analyse relationships among the same variables in the same directions quantitatively. This is the reason why this research adopts a mixed-method approach, especially that the amount of mixed-method research in the field of the relationship between project complexity and project performance is relatively small. This has been observed after examining the literature in the *International Journal of Project Management* and the *Project Management Journal* across a five-year span (2014-2018). The following graph shows the derived relationships in the propositional framework of this research based on the previous conceptual framework:



Figure 1.3 Propositional framework of proposed associations among research variables

In this propositional framework, there are four proposed styles of project managers when describing how project managers create new knowledge. The propositional framework, which is related to the qualitative part of this study, suggests that there are qualitative differences between knowledge creation styles as indicated from the respondents of the research sample. Next, the propositional framework relates the level of project complexity to the project performance using the knowledge creation styles as a moderator for this relationship. The purpose of this propositional framework is to address the main research questions qualitatively. The following table reveals the propositions of the qualitative study and the questions used to test these propositions:

Figure 1.4 Linking qualitative propositions to interview questions for the qualitative study

Source: Created by the researcher.

Project managers tend to prefer certain KCS over another one.	Project managers deal with deviations between planned performance and actual one	Projects in the MENA region vary in their level of stability and instability	There is association between PP and KC	There is association between PP and PC
What is the comparative importance of each style of knowledge creation from the point of view of project managers?	How did you deal with unexpected problems in your project?	Do you consider the performance of the current project a stable one and why?	When do you prefer to create new knowledge; during stability or during instability of your project performance?	Do you believe that the level of complexity of the project affects its performance? Why?
Why do you think that experience is more important than the education for the success of the project?	What are the reasons behind deviations between actual and planned performance indicators	What are the main reasons behind the instability of the project performance?	How does the new knowledge creation affect your project performance?	Do you believe that the level of complexity does not affect its performance? Why?
Why do you think that education is more important than the experience for the success of the project?	Why does the actual cost exceed the expected one?	In which aspects of the project performance do you as a project manager accept instability?	How does your personal experience affect your project performance?	
Is it more important to have low risk project performance than	Why does the actual profit become less than the planned one?		How does risk management and taking possible precautions affect	

to have innovative project performance?		your project performance?	
Is it more important to have innovative project performance than having low risk project performance?	What are the reasons behind deviation between the planned time of the project and the actual one?	How does specialization a certification in project manage affect your proj performance?	nd ment ject
	Do you expect the real time needed to implement the current project will be longer or shorter than planned? And why?	How does innovating idea affect your proj performance?	is ject

1.17 Hypotheses of the Quantitative Study

Project stability is the purpose that is planned at the beginning of any project, and instability is represented by the deviation between the planned performance and the actual one (Eriksson et al., 2017). Eriksson concluded that achieving early stability in the project performance is not necessarily "good" and that achieving late stability in the project performance is not necessarily "bad". In this study, the aim is not about when to achieve stability; rather, it is about finding how stability is decided by determining a cross-sectional analysis of conformance between the planned performance and the actual one (Otra-Aho et al., 2018). This means that the ability of the project manager's knowledge creation style to minimize instability (non-conformance) in the project performance stability (Assaad et al., 2020). In this respect, a qualitative research was adopted to analyse this propositional framework. The propositional model is followed by a hypothetical model of directional and quantitative hypothesized relationships, and a quantitative research approach is used to test this hypothetical model as shown below:



Figure 1.5 Hypothetical model of the moderation and mediation impacts of KCS

The hypothetical model tests whether or not there is a significant change in the strength of the impact of the level of project complexity on the level of project performance, and the quantitative study is designed to answer few research questions by testing few research hypotheses. The following table links the research questions to the research hypotheses:

Figure 1.6: Linking the research questions to the research hypotheses for the quantitative study

Source: Created by the researcher

#	Research question	Hypothesis (s)
1	Which knowledge creation	H1: Complexity has a significant impact on performance
	styles mediate the relationship	H2: complexity has significant impact on RAKCS
	between the project complexity	H3: RAKCS has a significant impact on performance
	and the project performance?	
2	Which knowledge creation	H4: IKCS has a significant impact on performance
	styles moderate the	H5: interaction between IKCS and complexity has a significant impact
	relationship between the	on performance
	project complexity and the	
	project performance?	
3	Which knowledge creation	H6: As the value of the IKCS increases the relationship between the
	styles moderate the	interdependency and the productivity increases.

	relationships between the complexity sub-constructs and the performance sub-constructs	 H7: As the value of the IKCS increases the relationship between the environmental complexity and the cost performance increases. H8: As the value of the IKCS increases the relationship between the environmental complexity and the time performance increases. H9: As the value of the EKCS increases the relationship between environmental complexity and cost performance increases. H10: As the value of the EKCS increases the relationship between project variety and quality performance decreases. H11: As the value of the EKCS increases the relationship between the project size and the quality performance increases. H12: As the value of the RAKCS increases the relationship between the project size and the quality performance increases. H13: As the value of the SKCS increases the relationship between the size of the project and the cost performance H14: As the value of the SKCS increases the relationship between project variety and time performance decreases. H15: As the value of the SKCS increases the relationship between environmental complexity and time complexity increases. H16: As the value of the EKCS (1) increases the relationship between variety and quality performance decreases H17: As the value of the EKCS (1) increases the relationship between variety and quality performance decreases. H18: As the value of the EKCS (1) increases the relationship between variety and quality performance decreases. H18: As the value of the EKCS (1) increases the relationship between project size and time performance decreases. H19: As the value of the EKCS (2) increases the relationship between interdependency and quality performance decreases. H19: As the value of the EKCS (2) increases the relationship between project size and time performance decreases. H21: As the value of the EKCS (2) increases the relationship between interdependency and quality performance decreases.
4	Which knowledge creation styles moderate the relationships between the complexity sub-constructs and the performance sub-constructs	 H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn lessened the cost performance of the project. H23: The interdependency has indirect effect on quality performance through the SKCS. That is the increase in the level of interdependency leads to increase in the SKCS which in turn lessened the quality performance through the SKCS which in turn lessened the quality performance of the project.
5	What independent factors predict what dependent factors of the study?	 H24: Quality performance is significantly affected by the size and variety of the project H25: Quality performance is significantly predicted by the variety of the project H26: Quality performance is significantly predicted by the size complexity of the project.
6	Does the prediction power significantly change after adding the knowledge creation style variables to the prediction model?	H27: Adding change in the RAKCS to the change in the variety of the project to predict the change in the quality performance increases the ratio of explanation of the model significantly H28: Adding the change in the RAKCS to the change in the size complexity of the project to predict the quality performance of the project increases the ratio of the explanation of the model significantly H29: Adding the change in the SKCS to the change in both the variety and the size of the project to predict the change in the quality performance of the project increases the ratio of explanation of the model significantly

7	What knowledge creation	H30: SKCS significantly predicts the change in the quality performance
	styles predict the project	of the project
	performance?	H31: IKCS significantly predicts the change in the quality performance
8	What hierarchical relationships	H32: Adding the change in the level of IKCS to the change in the level of
	between KCSs significantly	SKCS to predict the change in the quality performance significantly
	exist to determine the change	increases the ratio of explanation of the prediction model
	in the project performance?	H33: Adding the change in the level RAKCS to the change in the level of
		IKCS to predict the quality performance significantly increases the ratio
		of explanation of the prediction model
9	How do KCSs impact the	H34: The increase in the value of complexity leads to increase in the
	relationship between	value of RAKCS
	complexity and performance?	H35: The increase in the value of RAKCS leads to a decrease in the
		value of EKCS.
		H36: The increase in the value of EKCS leads to an increase in the value
		of IKCS.
		H37: an increase in the value of IKCS leads to an increase in the value of
		project performance

1.18 Significance of the Study

This is a significant study because it investigates the moderation and mediation role of knowledge creation in the relationship between the project complexity and the project performance in the MENA region. The implications of the research results impact the project performance and its control for the purpose of achieving better results and gaining higher profits. The instability of the environments and markets nowadays attach higher importance to the current study in the body of knowledge of project performance. The gap in the knowledge about the inability to put the behaviours of knowledge creation into styles because they are situational (Nonaka I. a., 2001) is dealt with in this research to find the actionability and contextuality of knowledge creation and to measure its determination of the level of conformance of the project performance and its interaction with the components of the project system complexities. The measurement of the knowledge creation styles and the adaptation of the measurements of project complexity and the project performance to the context of small-and medium-sized projects in the MENA region is another significant contribution of the current research to the field of application. Moreover, this research is not only significant for the body of knowledge and the field of application but also for the researcher's personal objectives. In

fact, the researcher has published academic papers in the fields of knowledge management and project complexity and is specialized in the academic teaching of innovation and knowledge creation and project management areas. Therefore, this research adds to the potential of increasing the amount and quality of research in this area and continuing the testing of knowledge creation styles in longitudinal and multi-cross-sectional studies for each field of industries separately in the MENA region.

1.19 Research Limitations

When assessing the value of the study, its results, and contributions, the following points need to be considered:

- The data was collected during the period of cross-sectional sampling, not before or after that period;
- all psychological, economic, political, social, cultural, aspects of the project managers' personalities and contexts changes that have relationship with the research variables are excluded from this study and are considered as constants to facilitate the interpretation of the moderation and mediation impacts of the KCSs on the relationship between the project complexity and the project performance;
- the projects in question are managed by one person and excluded the impacts of project teams or other members with less responsibilities in the team of project management; and
- the projects in question involve small- and medium-sized projects in the MENA region.

1.20 Structure of the Thesis

Chapter One: It introduces the problem and the gap in the body of knowledge and summarizes the research aim, objectives, questions, propositions, hypotheses, the conceptual framework, strategy, and significance of the study. This chapter also deals with the links among the different parts and limitations of the research. Finally, the structure of the chapters of this study is summarized at the end of this chapter.

Chapter Two: It explains the different definitions of the knowledge creation in the literature, discusses the evolution of the different theories on the knowledge creation, the nature of classifications in the knowledge creation process and then examines the relationship between knowledge creation and complexity in the light of previous research. After, the chapter analyses the relationship between knowledge creation and project performance in the literature and the main contributions found in this area. Finally, it evaluates the possible styles of knowledge creation, highlights the previous methods of measuring knowledge creation, and concludes by assessing its objectivity and subjectivity and presenting its contribution to the value proposition of this study.

Chapter Three: It reviews several definitions in project management and discusses the different roles played by the project manager during a project life. It also explores the demographic factors measured for the project manager in the literature. It includes a review of the definitions of the project performance in the literature and then explains the factors affecting the measurement of the project performance in previous research and benchmarking measurement methods. The chapter also evaluates and analyses the extent of stability versus instability of project performance, explains the relationship between complexity and project performance, and conceptualizes the project uncertainty and societal complexity, demonstrating how complexity and uncertainty are related to each other and explaining the effect of this relationship and its consequences on the project performance. This chapter introduces a detailed review of different methodologies of measuring project performance in the literature and discusses the theories of performance and control and performance

management. Finally, the chapter concludes by explaining reflections on the measures of performance and project control.

Chapter Four: It deals with the research methodology and research strategy that fit in with the purpose of the research. The chapter describes the population, how the sample was collected for the quantitative study, and how the interview points were set for the qualitative study. The chapter justifies the need for using the mixed-method approach to achieve the main purpose and objectives of the research. The chapter explains the measurement of research variables and how constructs are built, defines the sampling units and its characteristics, and then explains in details the pilot studies that were conducted prior to the main study of the research and its main conclusions that fit in with the conclusions of the present study. Finally, the chapter concludes with a time frame of the implementation of the study, limitations, and ethical considerations.

Chapter Five: It first explains the interview questions and the analysis of the feedback collected from the project managers. Next, it classifies answers into groups of thoughts and justifies the possible reasons behind these classifications using the interviewees thoughts. The purpose of these interviews was to build an inductive research methodology for the purpose of devising new constructs and justifiable associations among those constructs to verify the conceptual framework of the study. The conclusion of the qualitative analysis extended to the discussion of a group of emerging constructs which represent a contribution to the body of knowledge, but it is indirectly related to the achievement of the present research objectives. Chapter Six: It is a quantitative analysis chapter. It begins with the description of the

population and study and the importance of the field of application of the current study. Next, it removes the creation of measurements of research variables and the deriving of measurements from the results of the qualitative study and the literature. Then, it tests these measurements and justifies their validity and reliability. After, it presents the protocol sought in collecting the sample and the preparation of the data for hypotheses testing followed by the interpretation and summary of results.

Chapter Seven: It discusses the research results and justifies the contradictions found between the findings of the current study and those of previous research; compares the similarities and consistency of the findings of the current studies and those of previous ones; presents the triangulation of the results of qualitative study using the results of the quantitative study; discusses the nature of the knowledge creation and the impacts of knowledge creation styles and the direct and indirect predictions of the change in the project performance; and finally presents concluding remarks.

Chapter Eight: It is the concluding chapter and summarizes the entire thesis, namely the originality of its contributions to the body of knowledge, its practical implication, and its limitations and suggestions for further research. This chapter also explains how the research fills the gap and how it attains the aim and objectives of the study. Furthermore, it presents recommendations to project managers in the field of small- and medium-sized projects in the MENA region, which will, for ethical consideration, be shared with the respondents in the sample of this research. The chapter is followed by the list of references, appendices, a copy of the quantitative and qualitative data collection instruments, a copy of an interview manuscript, and the approval of conducting this thesis formally as a significant ethical consideration.

Chapter Two: Literature Review - Knowledge Creation and Project Performance

This chapter first explains the different definitions of the knowledge creation in the literature. Next, it discusses the evolution of the different theories on the knowledge creation in the literature. After, it explores the nature of classifications in the knowledge creation process. Then, it analyses the relationship between knowledge creation and complexity in the light of previous research in this area and the relationship between knowledge creation and project performance in the literature and the main contributions in this area. Finally, the chapter evaluates the possible styles of knowledge creation and highlights the previous methods of measuring knowledge creation, and concludes with an assessment of its objectivity and subjectivity and its contribution to the value proposition of this study.

2.1 Cognitive style of knowledge creation

In the study of Wu, C., Kao, S., & Shih, C. (2017) the researchers are testing the cognitive behavioural style of the leader as a determinant of knowledge creation performance. They define this cognitive behavioural style as a manner in which individuals intrinsically favour responses and information processing behaviours according to their human cognitive behavioural style. This evidences that leaders are not the same when they choose how to process information and how to create responses to it; however, the study of Wu and his colleagues is not revealing the style of the leader covering all aspects of the processes needed to create knowledge. The project manager according to Nonaka (1990) chooses which assets of information are the inputs of processing and this is totally avoided in Wu research. A study is needed to fill the gap in studying the cognitive behavioural style of the knowledge creator especially in the area of project management. The cognitive behavioural style of the studied in Wu's research were the

intuitive style and the analytical style (ChienHsing Wu, 2018). There are two questions upon which investigations may be structured; The first question is about why project managers want to create the new knowledge. The second one is about how knowledge is created based on the cognitive behavioural style. Focusing on the second question is related to getting this question partially answered by research contributions related to the intuitive and the analytical cognitive behavioural styles, but are there any possible new styles to get a better answer to this question in the field of project management?

Further investigations are needed to understand how innovative is the cognitive behavioural style of the project manager, or how risk averse is it for example.

Another point of discussion is about the use of the cognitive behavioural style as a determinant of the knowledge creation performance in research; however, treating cognitive style and knowledge creation as two separate variables may be misleading because there maybe a probability of a significant cognitive behavioural classification of project managers during knowledge creation process not to predict it. The concept of knowledge creation as a process starts with knowledge creation inputs and to answer the question of how knowledge is created, this may start logically with how inputs of knowledge creation are selected.

2.2 Definition of Knowledge Creation

According to Ikujiro Nonaka and Noboru Konno (Ikujiro Nonaka, 1998), the term 'knowledge creation' refers to the ability to form new knowledge that can give a competitive advantage to a business undertaking. The ability to create new knowledge according to Nonaka's contribution is interacting with the contextual 'Ba' which is defined as a physical or virtual setting where individuals feel safe and comfortable to exchange their knowledge and insights on various subjects (Ikujiro Nonaka, 1998, p. 1). The contextual interactional project setting of knowledge

creation includes affecting and being affected by the level of project complexity which needs more in-depth research focusing on the project manager as a knowledge creator who may have a cognitive behavioural style that affects the 'how' of knowledge creation in light of the contextual interactions with project complexity. This is an area of research that is not yet researched relatively enough in the MENA region. The contribution of Nonaka to the body of knowledge in the area of knowledge creation finds evidence that the separation of knowledge from its 'Ba' means the creation of information not of knowledge (Ikujiro Nonaka, 1998, p. 2). So, as a conclusion knowledge is a contextual product of the interaction between the knowledge creator who will be the project manager in the current study and his contextual choices as well as contextual influencers that may determine the predicted project performance and its success. The choice of the project manager of resource concentration of knowledge assets and capabilities that are discussed in Nonaka's research may be affected by the project manager's cognitive behavioural research and this is another gap in the body of knowledge to be researched. How do we interpret the differences in these choices among project managers? This is one question that needs research, and how does the choice of the project manager of the knowledge asset impact the project performance consequently? This is another question that is not fully answered by previous research in the MENA region.

The reflection of the project manager according to his or her experience is mentioned in the explanation of the interaction with the 'Ba' for the purpose of knowledge creation ((Ikujiro Nonaka, 1998). The spaces of the 'Ba' are physical. Virtual, and mental ones. Logically and in light of Nonaka's research efforts the experience of the project manager and the dependency on the experiences of other team members in the project are all existing in these Ba spaces. Consequently, choosing experience as a cognitive behavioural style of knowledge creation by project managers is a gap in the knowledge that needs further research. The literature uncovers

the participation in the 'Ba' by two cognitive activities; the analytical rational and the intuitive experiential activities; and those two cognitive activities are determining creativity. This is raising a question about how cognitive behaviour is classified for project managers in the MENA region. Are there other more significant classifications of the project manager's cognitive behavioural activities when they create new knowledge? Further investigation may reveal new contribution to the body of knowledge (Tomomitsu, The evolution of the relationship between project management and knowledge management: a bibliometric study, 2018) (Brennan, Customer brand co-creation: a conceptual model, 2015) (Dayan, 2017).

To created knowledge, is to create a dynamic, boundaryless, and intangible contextual variable. The relative value of the created knowledge is mainly linked to the time and place of using it, which is focused on the project as a place, and the stages of planning and implementation as a time frame in the current study. The reason of this specification of time and space is also derived from the contextual feature of knowledge creation in the literature.

The conduction and employability of in-depth research in the area of cognitive dimension of the tacit knowledge is still foggy and is in need of further research in the MENA region.

On the level of individual knowledge creation by the project manager, it could be created by the existential aspect of face-to-face co-location of the project manager with another team member, or by the reflective relationship between this manager and another peer in the same project. The domain of creating knowledge here is related to human existence in a 'Ba' or reflection on a 'Ba', but how does the project manager cognitively behave during existence and reflection? The answer given to this question is relatively narrow in the scope and is scientifically insufficient to explain all the possible cognitive behavioural styles of the project manager to create new knowledge. The solution provided by the research of Nonaka is limited to intuitive cognitive activities and analytical ones and these two cognitive behavioural styles are representing

shortage of explanation and are shedding light on the need to search for more cognitive behavioural styles. What is the rationale behind the mental models processed by project managers? Does the answer include intuition and analysis only? Are there any other reasons like innovation or risk averse for example? Which knowledge assets are of higher value as inputs to the knowledge creation process? This question is a frequent question asked by project managers, but we still need further research to know how different are project managers in answering this significant question. This raising of such a question is explained by the relationship between the use of existing knowledge to create the knowing of things (JS, 1999). The dynamism of knowledge creation copes with the dynamism of the project environment and this creates a complexity level in this environment (Catalfo, 2015).

The project manager is found to depend on his or her education as well as experiential practice to create new knowledge (Hajric, 2019). The personal quality of codification of knowledge into better actionable knowledge is the main area of concern in the current study. How does this personal quality interact with the project environmental complexity? Consequently how personal choices determine the level of project performance and its success?(Songkram & Chootongchai, 2020). The ambiguity related to the tendency to choose certain sources and assets of knowledge needs further research. Not only that, but also the impact of this choice on the achievement of the purpose of knowledge creation is also another area of deep research that is still in need of further research.

For example, it is difficult to ascertain accurately the role of the knowledge that is created from experiential sources in the stability of the organisational performance (Hartono, Sulistyo, & Umam, 2019). Similarly, it is daunting to state how the knowledge that is created from experience is different from the knowledge that is created from specialization or innovation and

not from prior experience (Zare et al., 2019). This may represent a gap in the body of knowledge and needs further investigation.

The creation of new concepts and notions is an individualized production in the first level of the Nonaka spiral of knowledge creation. It is created in the mind of project managers and it is about a kind of interaction between the explicit and the implicit knowledge he or she has. (Kodama, 2006). According to Bente Lowendah and Siw Fosstenlokken (Løwendahl, 2001), the level of inspiration or creative kicks is significant in the knowledge creation process. This may depend on the personal cognitive behaviour of the project manager and needs further research as well. This does not mean that there is only one cognitive style that is used all the time by the project manager. There may be two or more cognitive styles used by the same manager as well a change in the cognitive style from context to context and from level of complexity to another level of complexity in the project at hand and this is an area of research that is dealt with in the current research.

The four processes of knowledge creation discovered by the Nonaka model (Rusko, 2018)start with the management of tacit knowledge in the process of socialization, which gives greater relative importance to the individual knowledge management cognitive style at the beginning of knowledge creation. Then moving to the process of externalization lays an emphasis on the association that exists between the tacit and explicit knowledge in which the individual cognitive style is existing as well. Even talking about the conversion of explicit knowledge to explicit one in the combination process or about seeking tacit knowledge to create an explicit one by internalization process, all shed a light on the role of the cognitive behaviour of the project manager during all of these processes of knowledge creation (Allkm, 2019).

These processes are interconnected to create a valuable knowledge to the project in a level of complexity for each project. The prediction of this interaction between the cognitive

behavioural style of knowledge creation and the level of project complexity may predict the level of project success and its performance stability (Zhou et al., 2017). The literature shows that this area of research is relatively ambiguous especially in the area of knowledge creation measurement (Paraponaris, 2015). The current research is an attempt to reach classified definition and taxonomic measurement of knowledge creation process among project managers.

2.3 Nature of Classification in Knowledge Creation Process

The project management in the MENA region is a context of knowledge creation for the purpose of survival in a dynamic market and the importance of the interaction between KM and PM is increasing every day (Kouvaritakis, 2016.) Looking into the types of knowledge assets used by project managers as contributed by Nonaka (Rusko, 2018) reveals conceptual assets, experiential assets, routine assets, and systematic assets that are used differently by knowledge creators. For instance, feelings and skills refer to tacit experiential knowledge assets; routine operational practice refers to tacit routine knowledge assets; and images, symbols and languages refer to explicit conceptual knowledge assets. All other systemized packaged sources of knowledge such as documents, databases, and patents are explicit. The research did not specify why and how these differences among knowledge creators in the use of knowledge assets exist. This is a gap in the literature that the current research is addressing. During chaotic situations, the importance of understanding how and why do project managers choose certain assets to create purposeful knowledge is increasing (Gorsky, 2016). This raises another research question about how do project managers bring the project performance back from instability to stability and increase the conformance between the planned performance and the implemented one especially during the chaotic situation? Do they believe that certain assets are better than other ones during chaos? Do they use iterative approach that depends on the use of available

knowledge assets in the organization or use the adaptive approach that depends on novelty and agility to respond to nonconformance in project performance? (De Carvalho, 2015). Choosing the approach of knowledge creation and choices of knowledge assets are found to be affected by the personal characteristics of the project manager (De Moura, 2018). The literature finds evidence on a significant relationship between the project performance and the cognitive behavioural style of the project manager (Demirkesen, 2017) (Dias, 2017), especially in the use of agility and innovative approaches of creating new knowledge (Donate, 2015). The conclusion is that the project managers do not create new knowledge using the same manner of choosing knowledge assets and inputs. It is not only the matter of which source to use; rather, it is also the criteria of why this source is used (Sumedrea, 2013).

This may depend on the purpose of knowledge creation. As a conclusion, the researcher suggests that project managers have different styles for creating new knowledge. In the following argument, more light is shed on the possible classifications of knowledge creation styles.

2.3.1 Interplay between knowledge creation and innovation of project managers

The significance of knowledge with respect to the success of an organisation is clearly established because of its nature as a key resource and a necessary requirement for driving business performance and as a competitive advantage (Oluikpe, 2015). The conventional paradigms, which were enormously associated with a focus on information processing, have been replaced by novel ideas related to the relationship between knowledge and innovation (Amann & Rubinelli, 2017).

It is clearly implied in recent research that organisations undertake innovation are not vested solely with information processing but also with the creation of new information and knowledge

from the internal domain in order to view problems from novel perspectives and develop reasonable solutions in the course of the process to recreate the environment (Alegre, 2013). The interaction between the innovation and the knowledge creation is reinforced again in the small and the medium sized projects and they both represent the scope of application in the current research (Alexis, 2018). The reason behind this interaction is found to be significantly related to the performance success of projects in recent researches (Andrés, 2015) and in the recent literature (Ansoff, 2018); however, The role of knowledge creation in the optimization of a firm's capacity in development and implementation of new knowledge that can foster organisational innovation has also known some limitations and ambiguity in terms of research (Brix, 2017). A research gap may exist in the area of measurement of the interaction between the innovation cognitive behavioural activities and the knowledge creation cognitive behavioural activities as both processes need a cognitive behaviour to be exerted by the project manager (Task-Technology Fit in Knowledge Creation: The Moderating Role of Cognitive Style, n.d.) (Camelo-Ordaz, 2011). The importance of studying the innovation alongside the knowledge creation as a cognitive activity is reinforced by previous researches (Capaldo, 2017) (Mathews, 2012).

Both processes; knowledge creation and innovation are learning processes (Brix, 2017). The organizational learning as Jocob Brix sees is a mean to achieve a strategic renewal for the business entity, it is dynamic and continuous, and can exist on an individual level (Brix, 2017). The findings of Brix increase the significance of studying the shared cognitive behavioural activities of project managers when they create innovative knowledge for their projects. The knowledge creation can come into play and help a project undertaking to strengthen its innovative model especially for the purpose of improving the survival rate in the a competitive dynamic and complex market place (C. Wang et al., 2021). According to Lina Girdauskiene,

there are several factors involved that connect the implementation of creativity and knowledge creation in a business setting (Girdauskiene, 2013). The creation of a balance between running the business activities as planned and the creation of new and innovative knowledge is a challenge of project management that needs further research and investigation (Geraldi, 2009) (Cegarra-Navarro, 2016)

The innovation of project managers

In the last part it is relatively clear that there is a fundamental relationship between knowledge creation and innovation in the body of knowledge and this relationship is impacting the project performance (Watanabe R., 2017). Innovative new knowledge is a purposeful cognitive activity to create new products (Wang, 2018). The dependency on certain knowledge assets may or may not impact the innovative knowledge creation more than other types of assets and may or may not lead to different impacts on the project performance (Wang Z. a., 2012). This represents a need for further in-depth research especially in the small and medium sized projects in the MENA region. This further research is scoped in the duration of the planning and the implementation of the plans of projects by project managers and before delivering the final product to the end customer (Mahr, 2012).

Differences of projects that affect innovative knowledge creation

While knowledge is created through either conversion or modification, innovation is clearly associated with the extent of change in the knowledge structures of project managers. Therefore, project managers are most likely to deal with innovation in the planning stage and implementation stage of the project (Mudambi, 2015) (Maurer, 2011).

The tasks in the planning phase for project managers are generally associated with the creation of a project management plan defining the project scope, determining the budget, procurement,

communication and risk management, activity resources and duration estimates, work breakdown structure, plan of quality and human resources (Mosavi, 2012)

The tasks in the implementation stage are largely associated with the execution of the project, development of project team, distributing information, conducting procurement, managing stakeholder expectations, directions for project execution, quality assurance, and management of the project team. Based on these differences in the planning and implementation stages of projects, project managers could experience disparate dynamics of interplay between knowledge creation and innovation.

Innovation in different stages

The specific differences between the two crucial phases of the project could be reviewed for a clear impression of the relation between knowledge creation and innovation for project managers. In terms of the level of conduct, project managers would be limited to the planning phase that implies the use of existing information to apply and develop new plans for the project, and this means innovation. Group discussions and brainstorming sessions with the team can also be counted as prominent determinants of knowledge creation that are driven by the innovation of project managers (O Riordan 2013). The use of experiential knowledge by project managers to devise new solutions to roadblocks in the implementation stage of the project could also be counted as an example of the relationship between knowledge creation and innovation (North, 2018).

In this case, project managers can utilize the experience earned from other projects to develop a new solution (innovation) to the problem, thus contributing again to knowledge creation (Sultan 2013). Therefore, the relation between knowledge creation and innovation for project managers could be observed as cyclic in nature or as interactive as well. As a conclusion, project managers who have relatively suitable amount of related experience may be more disposed

towards innovating, and such innovation is an added value to the project performance. This reveals that experience and innovation are somehow related to each other rather than each being an independent entity, but we need to discover which of the two aspects; innovation or experience has more impact on the project performance as an interactive variable with the cognitive behaviour of knowledge creation for project managers.

nIn the following part we will shed some light on the interaction between the experience and the knowledge creation as we did in the last part related to the interactive relationship between innovation and knowledge creation (DONG, 2012) (Du Plessis, 2007)

2.3.2 Relationship between knowledge creation and experience of project managers

The development of new knowledge by project managers through the use of existing knowledge in new projects contributes to their experience in dealing with similar projects (Wu & Magnier Watanabe, 2010) (Andersen & Broberg, 2017)

Based on the principle of modification, project managers should be able to implement their existing set of skills and knowledge in different new situations encountered in various projects to create new knowledge that can be applied effectively in new projects and resolving any potential dilemmas or roadblocks that may pose during the course of a project. When the experience of project managers about the culture and environment and operational approaches for ensuring project success in different projects is leveraged in new projects, it is largely responsible for the creation of new knowledge (Dias, Performance and Leadership Style: When Do Leaders and Followers Disagree? RAM., 2017). This raises a research question about how and to what extent does the experience of the project manager impact the achievement of the purpose of knowledge creation and do project managers tend to choose specific assets of knowledge when they want to create experiential knowledge for the achievement of the purpose of project success?

Experience of project managers

According to the literature on the role of project managers in knowledge creation in the context of project management, managers reuse knowledge, especially knowledge in software projects (Donate, The role of knowledge-oriented leadership in knowledge management practices and innovation, 2015). The model for exchanging experiences has to be built with ease of use that can allow for sharing, implementation, and reuse of knowledge that is created using the design principles that are identified in literature related to knowledge reuse.

The formidable challenge posed in the implementation of such an approach is that all project managers would not have the experience required to handle such projects. The setbacks that arise in the course of developing experience of project managers and its subsequent as well as interactive influence on knowledge creation are found at certain instances, especially when the project managers alternate between the planning and the implementation processes (Hwang, 2013).

The importance of the experiential knowledge creation is evidenced by the empirical evidence on the loss of knowledge that is observed in many projects if a project manager working on the planning stage of the project is substituted in the final implementation stage (Kerzner, 2017). The experience of project managers is also characterized by their competences in establishing, managing and dismissing teams within the organisation for different projects. The activities of project managers in the formation of teams, understanding of the needs of team members and their perspectives on different aspects of specific projects are significant contributors to the experience of project managers.

The importance of team knowledge could be considered at this instance in the review to suggest that project managers undergo a comprehensive learning experience by focusing on the attributes and opinions of different members of the project team (Kanapeckiene, 2010).

The ability of project managers to create an appropriate environment for team members to ensure the development of new ideas for completion of projects or new product development operations is also improved along the course of their involvement in the project. As a conclusion we can find two dimensions of experiential knowledge creation; one is depending on internal experiential knowledge assets like when project manager uses his or her own experience of success and failure in previous similar or semi-similar projects, and another one is depending on external experiential knowledge assets like the use of the experiential knowledge assets available from the team members who work with the project manager. This classification needs a research on measurement to quantify which of the two experiential knowledge assets has a significant impact on the project success and performance conformity.

Knowledge creation and the role of project manager experience

For example, a project manager with these specialities would be able to refine their socialization phase of knowledge creation based on their experience in earlier projects. The abilities for situational analysis and risk assessment could also be largely helpful for project managers in combination phase of knowledge creation where they can use the existing explicit information to derive newer, complex, and relevant data sets (Samra & Shaalan, 2016).

In a project management, the planning phase is essentially associated with queries about preparation for developing plans for action (Mazdeh et al., 2015). The different forms of information that are used in this stage include statistical information related to the project, financial information, information related to statutory authority, general environment information and technical information. Hence, it can be observed that the planning phase relies on knowledge created through the principles of conversion, i.e., using existing data for representation in another format relevant to the project (Nicholas, 2017).

Project managers could also implement creative inputs in the planning stage through the modification of their existing knowledge structures. Thus, it can be noted that the experience of project managers is improved gradually over time, making them aware of the specific areas in which they could make modifications and reduce irrelevant data. For example, the requirements of resources identified for a particular project in the planning stage could be found in surplus. The outcomes of the project could be considered by project managers for determining the precise requirements of resources in forthcoming similar projects (Nicholas, 2017).

The design phase is largely associated with the conduct of planned duties by each team or individual. It can be prominently associated with the creation of knowledge through the principle of conversion such as the use of information technology for calculation analysis and leverage unique inputs such as market information for presenting the desired plans for implementation.

The implementation phase relies prominently on the cognitive abilities of project managers to translate the ideas into actions. This stage is prominently associated with the capability of managers to learn through the course of different projects about the culture and environment to be developed for knowledge creation, sharing, implementation and reuse (Songkram & Chootongchai, 2020). Therefore, it is essential to maintain minimal discrepancies in the project managers handling the different stages of a project.

Even though the allocation of a single manager is not possible in most cases, it is essential to consider the training of project managers for efficiency in the utilization of the experience exchange model (Tomomitsu, 2018). The objectives, values, and goals established by project managers are also refined across the span of different projects, which should be sustained throughout the project cycle to limit any disparities in the creation of knowledge (Todorović, 2015). Hence, it can be observed that project managers should be involved in the complete
project lifecycle and different stages of team formation in projects to ensure the precision and relevance of their experiential knowledge creation.

2.3.3 The relationship between knowledge creation and the specialty of the project manager

The first aspect that should be reviewed in the context of knowledge creation is identified as knowledge management, which is the umbrella term used to describe the flow of knowledge, its implementation, and the observation of outcomes to create new knowledge (Kazadi, 2016) There are several meanings of the term knowledge management in the relevant literature, and the reason for this is the variation in context. Knowledge management could be considered as an administrative process involved in running an organisation or an art or even a science or discipline in its own concern (Frantzeskaki, 2016). The two common themes that are related to the definition of knowledge management are related to its consideration as an administrative process in an organisation or as a discipline. The prominent characteristics identified in most literature related to knowledge management imply that people and their learning issues are crucial aspects of knowledge management (Kerzner, 2017). The potentials of an individual that are associated with the knowledge management process have substantial influence on the knowledge creation process. Therefore, it can be inferred that the specialty of project managers as an indicator of their skills and capabilities are important entities in knowledge management. The different activities included in the knowledge management process include knowledge acquisition, acquiring and articulation of knowledge, assembly of knowledge, knowledge sharing, integration, leveraging knowledge and its application, and exploring knowledge further (North, Knowledge management: Value creation through organisational learning, 2018).

The knowledge management process could thus be counted as a comprehensive domain that works in unison or in a flow across an organisation in order to realize sustainable competitive advantage. Knowledge creation is the focus of this research; therefore, it is essential to reflect on the literature about knowledge creation in order to derive reliable conclusions regarding the influence of project managers' specialty and how does it interact with the knowledge creation process (Keller, 2015) (Kelly, 2015).

Specialty of project managers

It is essential to note that the specialty of project managers is a clear indicator of their expertise in a specific area of project management (Biscaro & Comacchio, 2018), however, certification for specialty of a project manager is prominently associated with an individual's inclination towards professional development. This factor is also reflective of the involvement of project managers in complex project assignments that require their comprehensive association with the knowledge creation process (Frantzeskaki, 2016).

The specialty also enables project managers to have a wider base of tacit and explicit knowledge from the certification courses for specialty in project management. For example, a certified agile project manager would have a comprehensive knowledge base and experience in management of agile projects (Keller, 2015).

On the other hand, advanced specialties of project managers including situation analysis, problem solving, action planning, risk assessment and decision-making could also be productive tools in different stages of the knowledge creation process.

Hence, it can be clearly noted that the specialty of project managers is profoundly responsible for dictating their competences and, thus, contributing explicitly to the abilities of project managers to deal with different stages of knowledge creation. (North, Knowledge management: Value creation through organisational learning, 2018). This illustrates the possibility of interactive cognitive behavioural activities in processing specialized knowledge and creation of new purposeful knowledge (Oluikpe, 2015).

2.3.4 Relationship between knowledge creation and risk averse

Project managers are required to obviously take on risks in the contemporary dynamics of competition in the business environment (Girardi et al., 2018). The decision to take on risks is completely dependent on the managerial style, and many project managers like to play it safe by averting risks (R. Gao et al., 2018). After keeping this aspect in consideration, it is inevitably observed that risk aversion could not only be promoted by the personal traits and existing knowledge base of an individual but also by bureaucratic rigidities (Baehler, 2018). This, as a result, prompts the following question. What is the kind of interactive cognitive behavioural activity of these factors on the creation of knowledge in an organisation, especially when the emphasis is on project managers? The answer to this query could be obtained through a detailed reflection on the literature pertaining to knowledge creation and its utilization, followed by the implications of risk aversion and bureaucratic rigidities for the achievement of the same purposes. Knowledge is considered as a promising asset for business organisations because of its influence on improving the effectiveness of decision-making, policy formulation, risk prevention and problem solving (Chang, The role of organisational culture in the knowledge management process., 2015). However, the challenges of risk aversion and bureaucratic rigidities continue to plague many business sectors, especially the public sector. Therefore, the primary objective in this context could be identified as the recognition of a suitable approach for ensuring the co-existence of knowledge creation and utilization in unison with the challenges of risk aversion among project managers and bureaucratic rigidities noted in many organisational management structures.

Risk aversion and knowledge creation

In terms of service delivery, organisations which are inclined towards dealing with risks are most likely to end up providing substandard services, and thus the failure of organisations to take risks could prove to be a massive risk in its own. The implications of risk aversion could be noted in the case of modern business organisations with evidence related to characteristics of risk-averse organisations (Suorsa et al., 2019). The performance management in the case of risk-averse organisations is found to be limited according to duties and responsibilities and outputs by employees, other than the ones mentioned in their employment contract would be neglected. The institutional and legal regulations and policies are profoundly stringent in the case of organisations with risk aversion, and the measurement of success in risk-aversion organisations is not subject to the implementation of specific criteria and relies on the legal and procedural provisions outlined by the organisation (Rahman & Adnan, 2020). This could restrict innovative and productive activities, such as knowledge creation because bureaucracy is rampant in risk-averse organisations where employees are guided to work in a specific manner within a routine environment without innovation opportunities (Tomomitsu, 2018). The interactive relationship between the risk averse and the knowledge creation for these projects and organizations is still in need of further research. The question is about the differences in the cognitive behaviour when creating risk averse knowledge for the purpose of achieving performance success. Another look into the interaction between the risk averse and the innovation and creativity may show differences in the mediation or moderation of knowledge creation type and hence significant difference in the impacts of knowledge creation on the project performance.

The culture of risk aversion influences creativity, and knowledge generation is difficult irrespective of the need for innovation to ensure efficiency and competitive advantage of an organisation in its respective sector. Sources in the relevant literature also indicate that public sector organisations are the most affected by bureaucracy and risk aversion although there is no clear evidence of the relationship between knowledge creation and risk aversion. This risk

averse knowledge creator and how does it impact the project performance. Another prominent theme that can be identified in literature pertaining to the knowledge creation and risk aversion is the perception of risk and failure by the organisation (M. N. Ibrahim et al., 2019). This leads to the observation of risk tolerance levels in an organisation; for instance, public sector organisations are found to be intolerant to failure and impose penalties for taking risks (Adzmi & Hassan, 2018). Therefore, the lack of clear metrics for success in the public sector could restrict the commitment of project managers and employees to engage in initiatives for knowledge creation in organisational aspects other than the ones mentioned in their employment contract. This restriction may create a new style of cognitive behaviour of choosing safer knowledge assets to create new knowledge for such organizations. Researchers have also observed that organisational size and maturity could also play substantial roles in determining the persistence of risk aversion in an organisation (M. N. Ibrahim et al., 2019). The lack of prominent influence on behalf of regulatory agencies for maintaining balance between innovation and risk approaches has also been found as a notable factor for promoting risk aversion (M. N. Ibrahim et al., 2019). This conflict between the innovative knowledge creation and the risk aversion one represents a gap in the body of knowledge that needs further research qualitatively and quantitatively. This need is reinforced by the limitations in the research pertaining to the ways in which these innovation and risk averse assets and factors are related to knowledge creation and utilization (Baehler, Governance for adaptive capacity and resilience in the US water sector., 2018) (Chandrasekaran, Managing Knowledge Creation in High-Tech R&D Projects: A Multimethod Study., 2015).

Contradiction between risk averse and innovative knowledge creation

The observation of the different sources of secondary information considered for this review suggests that risk aversion imposes formidable obstacles for knowledge creation by restricting

the scope for creativity and innovation (Boateng et al., 2020). It can also be noted from the literature review that organisations with larger size and complex risk management approaches can also have persistent culture of risk aversion (Vick et al., 2015), thereby inhibiting knowledge creation. The recommendations to address the influence of risk aversion on the creation of knowledge have to be directed towards possible remedies and towards establishing the scope for future research in this context and its implications for managers, organisations and researchers. The most favourable remedy that can be provided in this case would the implementation of regulatory agencies which could assist in maintaining a balance between risk and innovation, and could thus result in to a good proportion of innovation that is conducive to knowledge creation (Samra & Shaalan, 2016). When talking about research contribution, it is relatively and importantly clear that the study of the risk averse and the innovation as commonly implemented as knowledge creation cognitive processes is critically needed for better understanding of differences and different impacts on project performance.

2.4 The Relationship Between Knowledge Creation and Complexity in the Literature

According to the literature, knowledge creation is a broad concept that is linked to various elements that exist in an organisational setting. For instance, knowledge creation and leadership approach share a strong relationship in the sense that leaders and top management teams can play a vital role to shape new knowledge and make suitable changes in the existing pieces of knowledge (Hartono, Sulistyo, & Umam, 2019). Similarly, if a business entity intends to strengthen the learning process, it is extremely vital to focus on knowledge management and the knowledge creation process (Alashwal et al., 2009) (Arumugam et al., 2013). Put differently, knowledge acts as the key pillar that can strengthen the learning process at the individual level and at the organisational level. In the 21st century, most business undertakings try to operate in

an innovative manner so that they can have an edge over rivals operating in the same market setting. In order to expand the degree of innovation in the organisational setting, it is extremely important for a business entity to have a strong control over the knowledge that it possesses. In addition to this, it is important for the business undertaking to focus on knowledge creation process so that the existing knowledge can be re-defined and new knowledge can be created in the process (Vick & Nagano, 2018).

The wide range of research articles and journal papers that have been referred to highlight the concept of knowledge creation and its link to various other organisational elements. This body of research succeeded in dealing with the degree of complexity that exists in the knowledge creation process in the organisational setting. In the last decade, many researchers have tied to highlight how knowledge comes into play in each layer of the business concern and influences its survival and sustainability (De Toni & Pessot, 2021). Knowledge creation is a broad subject that has a major impact on various elements that exist in the organisational setting such as the innovative approach, the implementation of creative ideas, the leadership model and the organisational learning process (Kess & Haapasalo, 2002). Knowledge creation has a major implication on a business entity that exists in the current times and is a fundamental element in promoting new ideas. The vastness of the concept makes it highly complex in nature (Tan & Tan, 2014 p 2), and many researchers have tried to demonstrate this complexity. This is clearly showing the significance of the relationship between the project complexity and the knowledge creation and a need to investigate the direction and strength of this relationship in the MENA region in the study at hand.

2.5 The Relationship Between Knowledge Creation and Project Performance in the Literature

The knowledge creation process has a major implication on various activities and functions that exist in a business setting. This section of the review explores the relationship between the knowledge creation process and project performance (Hartono, Sulistyo, Chai, et al., 2019). Carmeli and Stephens stated that every business organisation is built around departments and teams that are responsible for various kinds of project work (Carmeli, 2014) In a technologically-driven era, many business entities have to work on technological projects that might give rise to challenging and complex issues before the respective teams. In order to manage such kinds of complexities in the unpredictable business setting effectively, there is a need for project teams to have access to new knowledge (Ranf & Herman, 2018). In fact, the proper interaction of the project members is of paramount importance for the success of the project work because it may allow for the proper exchange and sharing of knowledge and ideas.

Carmel revealed that when employees in a business context openly express their negative emotions, there arises a positive relationship between the knowledge creation capacity and the project team performance (Carmeli, 2014). As all the team members need to work in a collaborative manner, there is the need to have openness among them. Once the negative emotions are dissipated, a free and effective flow of knowledge is possible at the project level. In a fierce competitive business setting, knowledge acts as the dominating factor which can have a significant level of impact on the overall project performance and the final project outcome (Oluikpe, 2015). The research highlights the fact that it is extremely crucial in a business setting to make the best possible use of tacit knowledge which must be properly and clearly translated while working on a project work so that he same can be optimally utilized to influence the project performance constructively (Navimipour, 2016). The knowledge that is used in a business setting or a project setting is interrelated in nature. Thus, the proper application of knowledge and the implementation of knowledge creation can favourably impact the project performance in the organisational context (Todorović, 2015). In the study, the authors presented the inter-relational nature that exists between tacit knowledge or intangible knowledge and the project work of an entity. Therefore, the optimum use of knowledge can help a project to be a success (Oluikpe, 2015).

Over the last few years, several studies have been conducted and aim to explore the association that exists between knowledge creation and project performance in a business setting (Mburia & Bett, 2020). For example, in a journal article, Arumugam, Antony and Kumar tried to establish the link between knowledge creation and the successful project performance in Six Sigma project activities (Arumugam, 2013). They found that the relevance of knowledge creation and learning is extremely high when it comes to the projects that implement the Six Sigma Improvement Model. New kinds of knowledge act as core assets that can help to streamline the project work (Choo, 2011). This highlights the evidence in the literature that there is a relationship between groups and individuals as a source of knowledge creation in the project and project performance.

Knowledge is an intangible element; however, it acts as a major asset that can give a business undertaking a competitive advantage in an aggressively competitive business setting (Khamaksorn, 2020). Similarly, at the project level, the knowledge creation process plays a vital role, as it ensures that the team members make use of the existing knowledge and new knowledge to achieve the ultimate projective goals and objectives (Choo, 2011).

Over the years, the relationship that exists between knowledge management, knowledge creation, project management and project performance has evolved so much, so that there is a solid intersection between knowledge creation and project performance (Tomomitsu, 2018),

and the knowledge that project managers and leaders possess can help the team members to work effectively and reach the ultimate project objective (Todorović, 2015). Hence, the importance of knowledge in the project setting cannot be overlooked since it acts as the very foundation on which the project is established. The synergy that exists between these components is of critical importance as it can have a major implication on the project outcome and the overall performance of the organisation (Arafa, 2015).

Thus, it can be said that there exists a key link between knowledge creation and project performance (Vrontis, 2017), and it is vital for business undertakings to employ suitable knowledge management models and knowledge creation theories so that constructive and successful outcome can be eventually attained (Hartono, Sulistyo, Chai, et al., 2019). In a technological era, the projects that are undertaken by business concerns rely on knowledge creation (Arafa, 2015) in the sense that the new forms of knowledge and existing knowledge act as the core assets that help the project managers and project team members to achieve the desired project objective by positively influencing the project performance. This review of the literature illustrates the importance of choosing the scope of the study at hand and its contribution to a better understanding of the relationship between the knowledge creation and the project performance and its success.

2.6 Styles of Knowledge Creation

The following part explores evidence from the literature that there are links between the knowledge creation process and the classification of project managers when they create new knowledge. This is in line with the purpose of the study, which is contributing to the body of knowledge through studying the possible styles of project managers' knowledge creation.

2.6.1 Experiential knowledge creation style

Past performance is an input to knowledge creation (Arumugam, 2013). Experience is not only chronological, for some project managers can use experimentation to find out patterns of relationships during its occurrence not before (Canonico et al., 2020). Pieces of knowledge are connected through the use of the experience of people (Akther, 2019) because experience is a source of individual knowledge creation (Abdou et al., 2016), and project managers' experience is controlling the effect of knowing-what and knowing-how on performance (Arumugam, 2013). Experience and social networks which is representing learning from the experience of others are sources for creating new knowledge (Ahmad & An, 2008).

(Grantcharov, 2003) found that experience leads to familiarization which, in turn, increases the level of performance. (Haleblian, 2006) found that previous experience and recent performance feedback are two main sources of learning (Fusari, 2016), (Garcia-Palao, 2019). As a conclusion, the researcher suggests that there may be a style of creating new knowledge known as experiential knowledge creation style and this hypothesis needs further research to find an evidence on it (Kerzner, 2017).

2.6.2 Specialized knowledge creation style

According to (Layton, 2020) pushing the process of creating new patterns of knowledge to the lower levels in the organisation leads to using more diversified specializations during the knowledge creation. This shows that managers need to depend on more specializations to overcome the chaotic situation successfully (Biscaro & Comacchio, 2018). (Austin, 2003) identified a positive relationship between knowledge specialization and goal achieving performance. (Bonaccorsi, 2007) conducted a research on universities and knowledge creation and concluded that there is a positive relationship between the specialization of faculty members and university performance, and this specialized education may, according to (Thomas, 2008),

lead to innovative solutions and to complexity and instability performance. As a conclusion there is a need to study specialization as a knowledge creation style (Klinger, 2018) (Kolb, 2005)

2.6.3 Risk averse "Anti-risk" knowledge creation style

(Mäkilouko, 2004) found that managers prefer to depend on processed knowledge that is stored explicitly in their containers such as documents, manuals, and patents, etc. This is known as the actionable knowledge zone that leads to ordinary performance (Nonaka, 2014). Project managers tend to keep contingency reserve for dealing with expected risks (Rahman & Adnan, 2020), but they need to know about the existence of the risk and its effect on the project performance because expected risks are not the same as identified ones (Hartono, Wijaya, et al., 2019), and it is necessary to know if some managers have the tendency toward risk antagonism even if they do not know what and how risks affect their project performance (Liu et al., 2016). Those who are risk controllers seek high levels of control over their projects as a goal (Assaad et al., 2020). This may be related to psychological safety, which affects both knowing-how and performance (Arumugam, 2013). There is evidence in the literature on the relationship between chaotic performance and risk averse (N. Gao et al., 2018). This raises a question about the existence of a risk averse cognitive style of knowledge creation. Further research is needed on the existence, measurement, and impact of such a style in the area of project management (Konnot, 1994) (Stephens, 2016).

2.6.4 Innovative knowledge creation style

Knowledge is related to innovation (Fernando et al., 2019) and managers depend on knowledge sharing networks and on the processing of intellectual properties to achieve innovative performance (Cantarelli, 2020) (De Silva, 1995) (Henry, 2001)

(Linstone, 2011) found that depending on innovations leads to better adaptation to chaotic changes in performance, and newness of knowledge is related to competitiveness. The literature shows an association between knowledge creation and innovation. In fact, innovators are characterized by the absence of depending on the explicit knowledge assets and the dominance of using tacit assets (Brix, 2017).

The literature also indicates an association between instability and innovation (Xuan, 2019) (Yang, 2012) (Forés, 2016). (Mingaleva et al., 2019) found that the most important source of creating new knowledge for innovative purposes is competitors. Innovative human assets and intellectual properties are sources for creating new knowledge (Khamaksorn, 2020) (Engeström, 2010).

2.7 Measurement of Knowledge Creation

This part reviews the constructs of knowledge creation for the purpose of finding consistencies and dissimilarities and possible concordances in its conceptualization.

2.7.1 Measurement of knowledge creation in the literature

Knowledge can be defined as one of the most crucial assets of an organisation with respect to the objectives for competitive advantages in today's business environment (Mingaleva et al., 2019). The value of knowledge in an organisation is improved substantially with the changes in requirements of an organisation and its significance in the present dynamic business environment (Mingaleva et al., 2019). Different organisations are becoming increasingly aware of the necessity for management of knowledge resources in order for them to accomplish

success for the organisation (Andrés, The impact of formal institutions on knowledge economy. , 2015) (Grissom, 2015) (Kamoche, 1997).

This can be accomplished through knowledge sharing and reuse of knowledge albeit with the concerns of knowledge loss arising at various instances in an organisation (Atkočiuniene & Petronyte, 2018). The systematic measurement of knowledge creation has been found to be a reliable intervention in observing the outcomes of knowledge management and the possible areas for knowledge loss such as layoffs or employee resignations (Kess & Haapasalo, 2002). The following review reflects on the various sources of literature pertaining to measurement of knowledge creation and underlines its significance in the overall knowledge management process.

Knowledge creation is a prolific strategic activity for many organisations in the present scenario as it enables them to introduce new products and services based on the understanding of the trends in the concerned market and industry and existing knowledge about the technical and social aspects of their offerings (Amann & Rubinelli, 2017). The need to measure knowledge created by an organisation is observed clearly in the nature of knowledge management as a practice dictated profoundly by anecdotes or previous experience (Calvo-Mora, 2015).

The measurement of knowledge also poses formidable challenges in terms of the unquantifiable nature of tacit information (Richtnér & Åhlström, 2010b). It is imperative that knowledge management involves a wide range of innovative, popular and effective techniques for utilization, reuse and development of knowledge that should be subjected to appropriate management structures in order to obtain new opportunities and increase the chances of making revenue (Cooke, 2017).

The important areas that could be subject to measurement refer to management and utilization of external and internal business-related information through information technology and

services (Teerajetgul & Charoenngam, 2006). Therefore, it is essential for organisations to rely on the creation of techniques that can help in the measurement of knowledge-based assets alongside evaluation and comparison of the performance or outcomes of knowledge-based work initiatives (Migliarese & Verteramo, 2005). Furthermore, it is also inevitable to note that the research on the effectiveness of measures designed to ensure appropriate measurement of knowledge is considerably scant, as it is in its early stage (Kess & Haapasalo, 2002). In the following sections, the different approaches for measurement of activities associated with knowledge management are discussed along with the determining of the appropriate techniques that can support the measurement of knowledge creation (Chirico, 2016). The other significant aspects addressed in the literature refer to possibilities for future research in this area.

Prior to a reflection on the components of measuring knowledge, it is essential to identify the definitions of basic concepts associated with knowledge creation, namely knowledge, & knowledge management (Ramazani, 2015).

Knowledge can be defined as the comprehension or understanding of a particular context along with the experiences associated with it (Reich et al., 2008)of . Intellectual capital can be defined as the knowledge, experiences and information relevant to an organisation that can be leveraged for business objectives (Capaldo, Knowledge maturity and the scientific value of innovations: The roles of knowledge distance and adoption, 2017).

Knowledge management could be defined as a formal and direct process inclined towards identifying the information which could assist others beside determining approaches for making the information available easily to the users (Lin, 2014). It can be used to describe a series of processes that are implemented for acquisition, creation, organisation, sharing and application of knowledge by an organisation with the objective to improve organisational performance (Ahmad & An, 2008) (Ramírez, 2011) (Tan, 2014).

2.7.2 Components of knowledge measurement

The primary notion of measurement is directed towards the labelling of objects and different phenomena with the help of numerical symbols and with respect to certain rules (Olins, 2017), (Ofori-Kuragu, 2016). The theory of measurement implies four specific levels of measurement on the grounds of their strength (Kess & Haapasalo, 2002). The four different levels are identified as nominal, interval, ordinal and ratio measurement. Nominal measurement implies the classification of information into mutually different categories and is particularly associated with numbering of categories and individual items (Cegarra-Navarro, Structured knowledge processes and firm performance: The role of organisational agility. , 2016.)

The internal categorization could be observed in separation of different items into categories based on a scale with different points that are placed equidistantly from each other. The ratiobased measurement is observed in assignment of numerical values that are reflective of the level or the number of characteristics that are being measured (Lancaster, 2004). The ordinal measurement type is observed in the assignment of a relative value to variables as compared to others (Donate, The role of knowledge-oriented leadership in knowledge management practices and innovation, 2015).

The scales of measurement identified commonly such as nominal, ordinal, ratio and interval measurement can be related to knowledge creation through considering different case scenarios (Rusko, 2018). Nominal scale of measurement could be a prolific tool in the measurement of demographic information in market research that accounts for knowledge creation (Songkram & Chootongchai, 2020). Some of the other factors in knowledge creation with respect to project management in business organisations refer to the facility for classifying different sets of tacit information thereby providing quantification opportunities in knowledge creation (Teerajetgul & Charoenngam, 2006). The use of ordinal scale of measurement in knowledge creation could

be identified for the ease of converting tacit information into explicit information (Reich et al., 2008). For example, the data pertaining to customer satisfaction could be quantified according to Likert scale evaluation for different variables such as perceived quality, reasonability of pricing, etc. The interval scale of measurement could be applied effectively for experiential learning aspects of knowledge creation (Songkram & Chootongchai, 2020). Many project managers implement benchmarking for different phases of a project based on their experiences from previous projects (Canonico et al., 2020) (Von Krogh, 2012). The use of ratio scale of measurement in knowledge creation could be observed in examples of comparative evaluation of inferences from different projects in order to develop new knowledge (M. W. Ibrahim et al., 2020) (Paraponaris, Sourcing knowledge for innovation: knowledge reuse and creation in project teams, 2015).

The measurement of knowledge creation with respect to an organisation is particularly reflective of the emphasis on intellectual capital (Marr et al., 2003) (Smith, 2017). The most noticeable highlight for measuring intellectual capital is identified in the requirement for identifying hidden assets and developing strategic approaches for the development of those assets, thereby contributing to the accomplishment of organisational goals (Migliarese & Verteramo, 2005) (Ranjan, 2016).

The specific techniques for financial methods to measure the total amount of intellectual capital are largely classified into direct intellectual capital methods, market capitalization methods, and return on assets (ROA) methods (Davenport, 2015) (Ulrich, 1998).

On the other hand, the non-financial methods are directed primarily towards the evaluation of the benefit of knowledge creation to the performance of an organisation and are largely vested in the perception of knowledge management by recipients (Dubbeld & Blomme, 2020) (Evans, 2013, October.). The different measures that can be considered in the case of non-financial methods including prominent references can be classified into four methods (Kashiwagi, 2020) (Taylor, 2018).

The first method is the knowledge management scan that is directed specifically towards facilitating accurate and precise recommendations to an organisation with respect to its strategies, operations and tactics in knowledge management (Fernando et al., 2019).

The second method is known as an organisational learning scale which has specific dimensions that help in knowledge creation including external and internal knowledge acquisition, distribution of knowledge, knowledge interpretation and organisational memory (Inkinen, 2016), (Inkinen H. K., 2015). The third method for the measurement of knowledge is the assessment tool of the knowledge management capability that determines the effectiveness of knowledge management by an organisation through emphasizing knowledge capability areas such as knowledge documents, data, lessons learned, and expertise (Migliarese & Verteramo, 2005). The most prolific tool in the measurement of knowledge creation is also identified in a questionnaire that focuses completely on the measurement of tacit knowledge, which is a notable challenge for knowledge measurement (Anand et al., 2010) (Sedera, 2010). The specific aspects that are evaluated in the questionnaire include references to the tacit knowledge conversion, tacit knowledge measurement, and tacit knowledge culture (Marsina et al., 2015). The other considerations that have to be taken into account in the case of the measurement of knowledge creation also refer to the group level and individual level measurements, which include social network analysis and observations, interviews, process tracing techniques and conceptual techniques such as cognitive maps (Mudambi, 2015) (O Riordan, 2013). The cognitive behaviour of the project manager is including all four aspects of knowledge measurement and a special focus on the choices of knowledge capabilities as inputs to knowledge creation processes and their measured impacts on the project performance and in light of the interaction between those cognitive behaviours and the level of complexity of the project at hand (Hotho, 2011) (Job, 2015).

The measurement of knowledge creation is also influenced by the different styles sought by project managers such as innovative, specialty, experienced and risk-averse managers (*Task-Technology Fit in Knowledge Creation: The Moderating Role of Cognitive Style*, n.d.).

Innovative managers are most likely to rely on external and internal sources for assessing the credibility of knowledge along with their reliance on substantive evidence as measurement data source in order to develop outcome-based metrics (Samra & Shaalan, 2016) (Ajmal, 2010). The specialty managers would most likely rely on internal sources of assessment and substantive evidence as measurement data source (Samra & Shaalan, 2016). The emphasis of specialty managers on the knowledge creation component of process is clearly observed as their area of expertise which is directed towards a specific process in the business activity (Magnier-Watanabe et al., 2011). The experienced managers would most likely rely on actor judgement as their measurement data source with high emphasis on the process as a knowledge creation component (Samra & Shaalan, 2016). The objective of experienced managers is directed towards refining the process outcomes and obtaining inferences from each outcome in order to improve their knowledge base (De Toni & Pessot, 2021) (Nonaka I. a., 1998). The risk-averse managers are most likely to rely on actor judgement of risks in a project based on internal criteria of assessment (Hartono, Wijaya, et al., 2019). The knowledge creation component emphasised by risk-averse managers is the outcome component (Maqsoom et al., 2020), which determines their decision of considering new knowledge as valid and applicable for the organisation (Samra & Shaalan, 2016) (Voorberg, 2015). For example, if a risk-averse manager has observed that the outcome of a project has resulted in a failure previously, then they would refrain from

participation in a similar project, thereby limiting their knowledge creation according to certain benchmarks (Khattak & Mustafa, 2019).

2.8 Key problems identified from the literature

In this chapter a number of gaps in the literature are highlighted and linked to the research problem of the study at hand. The study at hand is producing a generalized model of measurement of knowledge creation styles and their mediation and moderation impacts on the project success in the MENA region. The need for such a study is clearer after reading this chapter. The chapter is clearly defining a gap in the body of knowledge related to the measurement of all different cognitive behavioural styles of the project manager when creating new knowledge for the purpose of project success. This represents an unanswered question that needs a researched answer and a justifiable one. There is another gap in the scarcity of researches conducted on the interactive nature between the knowledge creation and its contexts including the levels of complexity of projects and whether or not these interactions are controlling or determining the level of conformance between the planned performance f the project and the actual one? In the literature there is no enough evidence on a slid well-researched evidence on the measurement of this interaction. Modelling the knowledge creation process as a mediator or a moderator depending on the cognitive behavioural style of the project manager is a gap in the body of knowledge that if researched, it could change the understanding of the qualitative and the quantitative know how and what of project performance control by using the variance in the knowledge creation and its interaction with the complexity of the project environment. There is a significant need for a study about the innovative cognitive activity, riskaverse cognitive activity, experiential cognitive activity, and specialty cognitive activity that are used by project managers to create new purposeful contextual knowledge. This proposed

classification is built on the limitation of the available classification of cognitive behavioural activities into analytical and intuitive ones only and they do not actually represent all the possible cognitive behavioural activities as the initial library study-based evidences show. As a conclusion a qualitative understanding followed by a quantitative measurement of knowledge creation styles is needed and addressed by the current research.

2.9 Chapter Summary

A systematic review on the meaning of knowledge creation is a starting concern before analysing the knowledge creation process in this chapter. A deep understanding of the knowledge creation components, process, dynamics, and context is importantly introducing a study about a classification of project managers into four types of managers when they create new knowledge. The main purpose of creating a new knowledge for the project manager in this research is to conform the planned performance to the actual one. This conformance is a challenge for project managers in a dynamic rapidly changing market environment. The performance success is an indicator on the project manager's success for the organization and thus, a research about how managers create their knowledge to keep the conformance is important to organizations as well as to project managers. The classification of project managers into different styles of knowledge creation is a contribution to the qualitative answering of a question about what assets do project managers use to stabilize their performance and another question about how these classifications impact the performance stability of the project. The focus on the individual knowledge creation as a start in the spiral loop of the knowledge creation is relatively vital in determining a list of further researches to continue what this study will start to find about the knowledge creation styles. The future of research will may be related to the composition of project teams based on the knowledge creation styles of individuals in a more

successful scientifically based manner. The orientation of this research is opening the door for further investigations from deeper research in the understanding of the hidden cognitive behaviour relying behind the process of knowledge creation and how to understand how does it link to the external inputs and concurrent interactors, hence, how to quantify its positive and negative predicted impacts on project performance. The main three components of this chapter are about understanding the knowledge creation process, then possible classifications of the proposed knowledge creation styles in light of the latest literature results, and finally the understanding of the gaps in the measurement of knowledge creation. This chapter represents a theoretical justification of the need to conduct a qualitative and quantitative studies to answer the research questions and to solve the research problem.

Chapter Three: Literature Review - Project Complexity and Project Performance

This chapter begins with a review of the definitions put forward concerning project management. Next, it discusses the different roles played by the project manager during project life and explores the demographic factors measured for the project manager. The chapter includes a review of the definitions of the project performance and explains the factors affecting the measurement of the project performance in previous research and benchmarking the methods of measuring it. This chapter also evaluates and analyses the extent of stability versus instability of project performance, explains the relationship between complexity and project performance, conceptualizes the project uncertainty and societal complexity, analyses how complexity and uncertainty are related to each other and then discusses the effect of this relationship and its consequences on the project performance. This chapter also provides a detailed review of different methodologies of measuring project performance and discussion of the theories of performance and control and performance management. Finally, the chapter concludes with an explanation of the reflections on the measures of performance and project control.

3.1. Definitions of Project Management and Roles Played by Project Managers

In the following part, the study sheds more light on the literature related to the project manager, and his/her role in the stability of project performance.

3.1.1 Definition of project management

Every organisation has certain tasks that require completion with productive outcomes in order to ensure business performance stability (Choi & Park, 2020). These tasks could be termed as

projects, which require comprehensive scheduling and planning (Jünge et al., 2019). Systematic planning and precise implementation are crucial factors in ensuring the success of a business in its respective industry (Badewi 2016). Therefore, it is essential to focus on the intricacies of project management in detail to understand the various approaches to complete a project with the allocated resources and the desired outcomes in the final stage. The know-how of the cognitive behavioural actions taken by the project managers may represent resources and their understanding may give clearer picture of the quality and quantity of outcomes achieved by those managers.

Project management is primarily related to the application of knowledge, techniques, tools and skills in a particular environment for accomplishing the desired project outcomes (Bjorvatn & Wald, 2018). The discipline has evolved over time and is a prominent requisite for addressing the challenges emerging from fast-paced technological advancements, dynamic changes in economic environment, quality and safety concerns of stakeholders and the large-scale phenomena of globalization (Codeburst 2019) (Raydugin, 2012). In the MENA region such a research is needed to link the cognitive behavioural style of the project manager to the project performance and its success because of the rapidly changing political environments as well as the changes in the structures of the society that is affected by unemployment ratios and that leads to an increase in the desire to run small and medium sized businesses by youth heavily. This is obviously observed by the researcher after working for five years in the incubators and innovation centres in the public educational sector and the work on projects of graduating small and medium sized products and projects. This is the orientation of in the GCC countries to manage the increasing unemployment rates and this increases the importance of this research at this time (Pieterse, 2011).

The sophistication of project management has developed considerably over time and a better understanding of project management could be obtained through reflecting on the definitions of project, project life cycle, dimensions of project performance and the classification of different projects (Badewi, 2016) (Heagney, 2016) (Hornstein, 2015). These factors are crucial for project management as they contribute to the identification of suitable approaches that can be implemented for specific projects to obtain success (Hillson, 2012) (Ramasesh, 2014). This is why the performance success if the focal research point and the dependent variable of the current research.

Project could be defined as a distinct process geared towards a particular objective and is associated with different controlled and coordinated activities with established deadlines (Walker, 2015) (Verzuh, 2015). These activities in a project are intended to accomplish stated objectives alongside following the specific requirements such as the limitations in terms of finances, resources, and time (Ahern 2. M., 2010) (Schwalbe, 2015). Some examples of projects include development of a watershed, construction of a farm building, or developing a new mobile application (Harrison & Lock 2017). In the current research the sample includes construction projects, IT and marketing projects, as well as other types of engineering projects. Each of these projects is associated with different size, scope, resource requirements and time limitations, thereby entailing different approaches for project management in each case exercised by project managers (Hornstein 2015). The focus on different industries of projects is expected to enrich the value of the research application for the current research.

Project management is also prominently dependent on three significant factors such as cost, time, and scope in order to determine the performance of a project (Mirza & Ehsan, 2017). The interplay between these factors for different projects could also be counted as valid indicators of the success of a project. For example, if project scope is changed, then it would require more

time to complete, along with indications towards a surge in the costs required for completing the project (Choi & Park, 2020). It is also imperative to note the increasing focus on stakeholder satisfaction as a reliable metric in establishing the performance of a project (Assaad et al., 2020). The debate on inclusion of stakeholder satisfaction as criteria for project performance can be negated largely based on stakeholder satisfaction with project outcomes depending on compliance with the project scope and requirements which is an existing dimension (Kerzner & Kerzner 2017) and this increases the value of studying the quality of getting a conformance between the planned performance and the actual one. Bearing in mind the different elements required for ensuring project success, project management is found to be associated with different knowledge areas such as integration management, scope, scheduling, cost and quality, risk management, communications and resources management. These knowledge areas identified in project management literature establish the foundation for different roles of project managers (Reich et al., 2008).

3.1.2 Role of project manager during project life

The project manager's role is primarily vested in the management of cross-functional teams in order to provide the desired project outcomes within the constraints of time, resources and costs, along with complying with quality benchmarks in results (Larson & Gray 2015). The project manager is required to perform several roles starting from the conceptualization stages to the implementation and monitoring stages of a project (Aucoin, 2007). These roles include planning, organisation, monitoring and supervision of one or more projects in order to meet business specifications or other desired requirements (Demirkesen, 2017). As a conclusion it is important to apply a research on the stages of planning and implementation to figure out the significance of the project manager's cognitive thinking behaviour impacts on the conformance between those two stages.

The project manager is generally answerable to the program manager or any senior project management role. The primary responsibility of project managers is directed towards definition, planning, tracking and management of an organisational project, along with identifying the key resources and providing the necessary direction in order to accomplish the desired objectives of a project (Lock 2017). Apart from the management of resources, project managers are also required to deal with various implications regarding the involvement of stakeholders in the project life cycle (Samra & Shaalan, 2016). Therefore, the selection of an appropriately competent, capable and driven professional is necessary for the role of a project manager. The decisions of the project managers are built on choices and cognitive behaviours that may differ significantly from one project manager to another causing a scientifically evidenced as well as empirically tested classification of the project managers into styles of knowledge creation and this is another gap that will be addressed by the current study.

Planning

Based on the responsibilities of a project manager outlined above, the essential roles of a project manager can be outlined in different general areas such as planning and scope definition, resource planning, estimation of costs and budget, development of schedule, risk analysis and management and monitoring (Pohl 2010). In the his/her capacity of planning, project managers have to identify the project requirements and develop the project scope in order to prepare the foundation for different activities and approaches to execute the project. The notable cognitive activities that are included in the planning role of a manager involve estimation of work schedule, formation of teams, planning the infrastructure and implementation strategy. Project managers are apprehensive of the iterative nature of planning and can leverage it to their advantage at different instances in the project underway.

Organizing

The next significant role assumed by project managers is organizing. The organizing role of project managers is prominently associated with allocation of responsibilities and tasks to the different teams and team members. Project managers are also required to address organisation objectives such as identifying and communicating the definition of specific roles to the concerned human resources effectively (Ramazani & Jergeas 2015). Project managers are also known to assume roles in organising by defining team hierarchy as well as the various tools and support required for management of project development and delivery (Kerzner, 2017). The significance of organizing role of project managers is specifically observed in the emphasis on human resources that are critical inputs for ensuring improvement in project performance. The utilization and assigning of project team members' experiences is another input to the choices of the project managers that is done implicitly through a cognitive activity that is characterizing the project manager who values the experience as a source of new knowledge creation for the purpose of achieving the stability and success in the project performance. This is a point of research in the current study.

Leadership and control

Project managers are also required to focus effectively on leading as the project team members look up to the manager for instructions and a guiding path towards the objectives set (Assaad et al., 2020). The role of leadership requires project managers have behaviour and emotional intelligence skills in order to address concerns of conflict resolution, identify setbacks and reasons for conflict, recognize the needs of team members and ensuring transparent communication among the team members (Smith & Dodds 2017). The leadership role of project managers is considerably intensive especially during the implementation phase of a project as it is based on physical efforts of the project managers to persuade team members to accomplish different project objectives(Arumugam et al., 2013). The final, yet most comprehensive role of project managers, is observed in controlling, which is associated explicitly with project metrics, project evaluation and modification (Akther, 2019). Project managers have to benchmark the whole project into distinct milestones, which can dictate the measurement of success in completing the project (Akanni, 2015). Project evaluation is the contingency measure for instances when the project outcomes are not suited to the specified targets (Zhao, Hwang & Lee 2016). An in-depth evaluation of the potential causes for discrepancy can help in deriving plausible measures to modify the project in order to accomplish desired outcomes. These roles of a project manager can be identified clearly in the responsibilities such as definition of project baselines, measurement of project progress and reporting the status of the project alongside identifying faults in order to develop corrective measures to resolve issues that reduce or weaken the project performance. As a conclusion the implementation stage of the project life includes choices and decisions depending on the cognitive behaviour of the project manager and needs further research to contribute significantly to the body of knowledge in the area of project management in relation to the knowledge creation.

3.1.3 Demographics of project managers that were studied in the literature

The demographic features of the project managers are one of the most vital factors that have an implication on their approach towards a project(Zare et al., 2019). Previous studies state that the demographic factors of a project manager are considered one of the main success factors which impact the project outcome. The studies and articles that have been referred to in the literature review showcase an interesting association that exists between the demographic variables of the project managers and the success of the project work (Kloppenborg, 2010) (Burke, 2013). Some of the main demographic aspects that have been highlighted here include the geographical region from which the project managers come, the designation or position of the managers in the firm, the duration of the project, and so on and so forth.

Demographic factors

The demographic factors can be defined as the socio-economic aspects relating to a population such as age, gender, education level, income level, kind of occupation, marital status, and religion (Albrecht, 2014). These elements have a major impact on each member of a population. When it comes to a project, the project managers act as the fundamental backbone of the task. They in fact act as the anchor around which the project work is attached. In order to get detailed insights into how the project managers function while working on a specific project, it is necessary to explore the key factors that influence their response to the project (Layton, 2020). As projects involve a number of diverse activities and processes, the demographic aspects of the manager who is responsible for the project work influences how he or she is able to use the available resources, gets involved in risk and uncertainty, and works together with cross-functional teams(Hansen et al., 2021). Some of the main dimensions relating to project performance that have been identified include time, cost and scope. All these parameters are interconnected (Liao, 2017).

For example, the major decisions that are taken while working on a project are influenced by the demographic backdrop of the project manager (Gorsky, Project management and leadership: Practical tips for medical school leaders, 2016). The demographic factors of a manager who is working on a project or in a business setting has a major impact on the success of the work, so much so that it impacts his approach towards a project work (Heyden, 2012). The demographic aspect of an individual shapes him/her in the professional setting as well as in the personal context (Zare et al., 2019) (Wellmilla, January, 2011).

According to research by Rafl Muller and Rodney Turner, the demographic factors relating to a project manager play a vital role in shaping a project manager during a project (Müller, 2007). Some of the main traits relating to a project manager that have been taken into consideration by the research team include gender, nationality, age, level of education, project management certification and job title. The demographic features that have been gathered from the research study are not exclusive in nature. Based on the research findings, the project managers that function in their home countries are considered to be more successful as compared to the project managers who operate overseas (Müller, 2007). The research shows that project managers with different demographic attributes give importance to different success actors. According to the study, the cultural setting in which a project work is being conducted plays a vital role in influencing its success (Müller R. G., 2011). When project managers work in a foreign country, they have to get trained so that they can get a better and simpler understanding of the local cultural setting. Business organisations need to carefully select the project managers by considering their diverse background and competency level. This is because it can have a major implication on the success of the project that has been assigned to him or her (Müller R. a., 2007).

While managing a project, managers have to demonstrate a number of skills and capabilities relating to communication, leadership, motivation, decision making, negotiation, and so on and so forth (Müller R. a., Attitudes and leadership competences for project success, 2010). These elements are governed by many latent aspects that are the project manager proper (Blomquist, 2006). According to a study by Sharma and Gupta, the key demographic variables that come into play while a project manager is working on a project include work experience, the designation that the project manager holds, and age. According to the same study, the identified demographic attributes have a major association with the team composition risk, the dependability risk, and the control process risk of a project (Sharma, 2012).

The various research studies that have been carried out in the past indicate that the

demographic aspects of a project manager have a major impact on the overall success of

the project, and these features include the age of the project manager, his/her designation, relevant work experience, gender, nationality and the geographical location in which the manager operates (Sharma, 2012). These are the elements that influence how the professional approaches the project work and takes decisions in the dynamic setting. Over the years, a lot of research has been carried out to identify the main causes of failure of projects. For example, several projects fail in India due to the outsourcing of the project, the cross-cultural challenges and the macro-economic challenges (Sharma, 2012). All in all, the demographic aspects of a project manager are seen as a major factor that influences the performance of a project manager and the success or failure of the project.

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Figure 3.1 Project manager demographics that are studied in the literature

Ralf Müller &	The Influence of Project	Nationality, the level	When project managers work in the
Rodney Turner	Managers on Project	of competency, age,	home country, the customers seem to
(2007)	Success Criteria and	gender, certification,	be more satisfied.
	Project Success by Type	job title and	Project managers over 55 years old
	of Project	intellectual ability	give high significance to team
			satisfaction while working on a project
			(Müller R. a., Attitudes and leadership
			competences for project success, 2010).
Arpita Sharma and	Impact of organisational	Work experience, the	The demographic factors are negatively
Aayushi Gupta	climate and	designation that the	correlated with the team composition
(2011)	demographics on	project manager holds	risk, control process risk and the
	project-specific risks in	and the age of the	dependability risk that is involved in a
	context to Indian	project manager.	project (Sharma, 2012).
	software industry		

The table shows that there is a mix in the literature between the demographics of the project manager and the demographics of the project itself. The project manager demographics, in turn, has a mix between personal demographics and job-related demographics, as in the case of job tenure or job experience. This kind of demographics may be directly related to the job performance or even the overall project performance (Zhao, 2016).

The demographics of the project are better known as the project characteristics in the sense that some projects are major while others are small, and some are long term ones whereas others are short term. The classification of demographics enables researchers to determine which change is more effective. Is it the change in the project manager demographics or the change in the characteristics of the project that are more effective or have more impact on the project performance? The results of the research mentioned in the literature reveal that there may be a relationship between the project demographics and the project characteristics, and that this interaction may affect the project performance, its team performance, and may constitute the risk averse performance of the project. It is obvious from the previous research results that the shorter scope of projects is more preferable in achieving better performance results and stability and this maybe be due to less cognitive activities exerted by managers during short-term projects. This adds to the level of complexity of the project which increases when the project has longer period of time and larger scope. How does this factor as a demographic of the project itself align with the project manager's demographics to achieve a better performance stability? To have a scientific answer to this question we need a research including both the project demographics as well as the project manager's demographics as parameters of choosing the sample of application.

3.2 Project Performance

Project management and knowledge management are significantly related (Canonico et al., 2013) (Bourouni et al., 2015). Knowing how and knowing what consequently affect performance (Arumugam, 2013). (Mandeep K. Dhami, 2015)found that more diversity in knowledge creation assets, more acceptance of complexity of projects, and more acceptance of uncertainty improve the reliability of forecasting of changes in project performance (Tomomitsu, 2018).

In some other research, it is referred to as the strange attractor that can easily switch instability into stability or stability into instability (Brennan, 2015). Knowing what affects knowing how, and both affect project performance (Arumugam, 2013). The literature shows that the purpose of creating knowledge affects how this knowledge is created. Knowledge that is created for achieving competitive advantage is different from knowledge that is created for control (Layton, 2020). As a conclusion, sufficient evidence is expected in the literature on the existence of

difference processes of creating knowledge by project managers and different knowledge creation styles. There is not enough empirical research on how managers actually use information about performance (Linstone, 2011). The researcher suggests that the style of knowledge creation is not one style for all managers. The know-how and the know-what knowledge creation styles may have significant relationships with the level of stability and instability in project performance.

3.2.1 Definition of project performance

The need to monitor and control project activities cannot be undermined by project managers in any circumstances. This process involves a clear identification of the various setbacks that could be responsible for compromising the progress of a project (Todorović, Project success analysis framework: A knowledge-based approach in project management, 2015).

Project managers need to engage in planning in accordance with the situational context in order to maintain an appropriate balance between the project activities and ensure their positioning in the initial scope established for the project (Estler, 2014). Therefore, project performance is a reliable indicator that can be used by managers to deal with these objectives in their project management approaches to monitoring and controlling. The first instance of the need for measuring project performance emerged as an outcome of the large-scale delays and unprecedented cost overruns in construction projects and development of computer systems in the 1970s. The changing requirements of the commercial landscape imply continuous evolution of the definitions of project performance, especially in terms of the factors responsible for dictating the same. Additional effort is exerted in the current research on the determination of project performance and on measuring it for the MENA region context which is representing a try to fill the gap in the knowledge in this area.

3.2.2 Factors affecting project performance

The basic definition of project performance is observed vis-à-vis the extent of compliance of the final outcomes of the project with the initial scope established by the client (Akanni, 2015). If a construction project is completed according to the specifications of the client at the beginning of the project, then the project performance would be higher(Li & Guo, 2011). The three essential factors which are noted as a prominent influence on project performance refer to time, scope, and resources, which are considered as the basic dimensions that can be used to observe project performance and have also been referred to as Quality Triangle for a project(Khattak & Mustafa, 2019). Any modification in one of the factors can be responsible for changes in the other two (Burke, 2013). For example, changes in the scope of the project such as additional design would imply higher requirement of resources and time. Moreover, if the deadline of a project is limited, then the scope and resources would also have to be adjusted accordingly through reduction. Simply put, it can be stated that a project's performance is favourable if the specified goals (scope) of the project are accomplished within the specified time and resources allocated for the project (Binder, 2009). It has also been noted that stakeholder satisfaction is also being considered as a major determinant of project performance (Li & Guo, 2011). However, stakeholder satisfaction is described by the scope of the project thereby implying only three dimensions for measurement of project performance (Bekr, 2017). Many other techniques can be implemented by managers for the measurement of project performance to establish common traits of projects, category of projects and KPIs for the measurement of project performance (Zamim, 2021). Benchmarking is also a proven technique for comparison between different projects, and it depends on using various metrics for project performance (Gorsky, Project management and leadership: Practical tips for medical school leaders, 2016). The characteristics of a project consist of the type of project, budget and size of
project, technology complexity, environmental influence, and interdependency in the project system (Peñaloza et al., 2020). These factors largely impact project performance, and thus could be associated with distinct benchmarks in order to evaluate project performance (Vrontis, 2017). For example, if a construction project is completed within the specified budget, then it would act as a benchmark for other similar construction projects in the area with the time for completion and budget as metrics for evaluating the performance of new projects. As a conclusion there is an evidence in the literature that the dynamics of the project performance within construction projects needs further research and especially in the MENA region where there is scarcity of researches on construction projects stability. The current research will tackle this area empirically.

3.2.3. Measuring project performance

The most crucial aspect in project performance refers to the measurement techniques and indicators that can be used for evaluating the success of a project or an organisation (Badewi, 2016). Studies on process factors responsible for influencing project performance have indicated that the factors of resources and time could be measured directly(Głodziński, 2019). On the other hand, the scope of the project or stakeholder satisfaction is subjective in nature, and this poses challenges for measurements (Zamim, 2021). Completion of a project on time and within the constraints of resources does not matter for a long time after project completion, but the satisfaction of stakeholders is considered significant for measuring the project performance (Mburia & Bett, 2020). Therefore, the various KPIs or metrics used for measuring project performance are generally based on cost, schedule and quality, and include cost performance, quality performance, safety performance, schedule performance, change management, customer satisfaction, risk management, sustainability, productivity, profitability, material management, functionality, planning effectiveness, innovation and improvement,

effective communication, and public and user satisfaction (Kerzner, 2017). This review directs the current study toward the possible constructs of project performance that are more important to be included in the testing model of the research.

3.2.4 Benchmarking methods

Benchmarking in the measurement of project performance is associated with the development of a unique set of standards dedicated towards the evaluation of performance or quality (Li & Guo, 2011). Most sources in literature deal with approaches to correct estimation of cost and effort in projects by using standards albeit with a lack of references to benchmarking methodologies for projects (L. D. Nguyen et al., 2019). One of such methods is the Analogybased Estimation (ABE) which relies on a comparison process with several projects similar to the one in question as inputs (Leon et al., 2018). The various dimensions of the selected project are evaluated comprehensively in order to determine the performance of the new project (Dixit & Saurabh, 2019). The ABE model was criticized for inaccuracy and bias in the estimates of project performance (Durdyev et al., 2017). Therefore, a weighting system was associated with the ABE model in order to develop a hybrid estimation model that emphasises different underlying characteristics of projects such as development platform, development type, and organisation type (L. D. Nguyen et al., 2019). The independent characteristics of projects and the development outcomes are usually analysed quantitatively for different groups of projects (Onubi et al., 2019), and this clearly implies that the estimations of project performance according to ABE benchmarks could be improved in terms of reliability and accuracy.

Recent research in project performance measurement has been largely directed towards benchmarking the completion of project (Zamim, 2021), and the development of metrics to evaluate project performance at the level of each phase provides opportunities for implementing

metrics per project phase in the future (Bekr, 2017). Some of the essential metrics have been derived from industrial project data, thereby validating accountability and precision in the approaches to measuring project performance (Zhu & Mostafavi, 2017). The main benchmarking metric is the estimated and actual cost for the phase as well as the forecasts of total cost and duration of the project (Leon et al., 2018). Other crucial metrics include estimated and actual start and end dates of a project phase and the number of major equipment required for the phase (Peñaloza et al., 2020). However, the most recent development in the area of project performance is the multidimensional system for measuring project performance in which the first dimension refers to the breakdown of the project tasks into different work packages through a work breakdown structure for the project (Nicholas, 2017). The next dimension refers to the modelling of the activity with specific estimates of input, output, resources, and control (Nyarirangwe & Babatunde, 2019). The performance of the individual project tasks is reviewed for effectiveness, relevance and efficiency, along with the limitations of complicated input requirements (Hartono, Wijaya, et al., 2019). Hence, the project performance could be easily counted as a complex outcome derived from the evaluation of various crucial factors related to a project. This is raising a research question about the extent to which the project managers accept stability in the project performance or instability. This is what is discussed in the following part of this study.

3.3 Extent of Stability and Instability in Project Performance

There is a debate on preference of stability or instability for projects as to which one is needed more in projects performance (Geraldi, 2009). Geraldi (2009) thinks that projects need to have both instability and stability; however, managers tend to avoid their coexistence because they believe that both have drawbacks. According to Geraldi (2009), high level of stability is

accompanied with a low level of flexibility, and a high level of instability is associated with low level of certainty. Geraldi's findings show that bureaucratization of instability (excess of stability) is more harmful than chaotification of stability (excess of instability), and this makes it possible to classify projects into projects with excess instability and projects with excess stability. In any case, both stability and instability exist according to Geraldi, but each with different percentage. (Biscaro & Comacchio, 2018) found that instability is an unconsciousness in the sense that if the project manager is unconscious about the reasons of having chaotic performance, then he or she is in a situation of instability. Instability is unavoidable because the level of ambiguity that is related to instability may include ambiguity of the needed knowledge for adjusting standardization in chaotic performance situations (Biscaro & Comacchio, 2018). Managers' behaviours may consist in mixing agility with control (Razzak et al., 2013). The requirements of dealing with instability are evolving, and one solution is controlling budgets and schedules while using agile approach at the same time for other aspects of performance (T. S. Nguyen & Mohamed, 2020). Project managers strive to keep chaordic performance by achieving the maximum levels of stability through time control, but at the same time, they seek to reach the edge of instability where they have the maximum level of innovation and flexibility (Richtnér & Åhlström, 2010a). Both control and innovation are important at the same time. The question is 'do all managers tend to innovate to bring instability to stability again?' Other experts in the area, by contrast, maintain that project performance must be kept ordinary (You et al., 2016). (Thomas, 2008), for example, highlighted the importance of standardization of project performance (Samra & Shaalan, 2016).

3.3.1 Stability Vs Instability in project performance

Project stability has emerged as a noticeable concept in recent times with references to the perception of a project manager about the progression of a project according to the desired scope and specifications (Khattak & Mustafa, 2019). The research available in literature provides clear indications towards the impact of project results and the schedules of a project on its stability (Khattak & Mustafa, 2019). If a manager perceives that disruptions in the project could be resisted, then the project performance could be counted as stable (Akanni, 2015); in contrast, if the project is deemed vulnerable to disruption, then it can be associated with the instability of project performance(Khattak & Mustafa, 2019). The different factors of scope, stage of completion, project size, experience, and certification level of the managers (Kashiwagi, 2018). The stability of project performance is considered as one of the common measures in the measurement of project performance and, thus, could not be undermined by project managers (Głodziński, 2019). The conventional measures such as cost and schedule-based performance measurement tools accompanied with metrics for earned value have been influential in determining the stability of project performance (Rahman & Adnan, 2020).

3.3.2 Understanding project performance stability

In order to expand the understanding of project performance stability, it would be reasonable to observe the origin of disruption in a project because this could be helpful in determining the stability of a project's performance in terms of limitations on these factors (Kashiwagi, 2018). The references to studies on the impact of disruption and variability on project management provide insights into the significance of different techniques used for measuring disruption in a project. Projects are defined as unique endeavours undertaken for developing a unique service or product, and this clearly implies that projects are unidirectional, non-repetitive and limited in terms of time (Mamédio & Meyer, 2020).

In the case of complex projects, the requirement of adaptive improvements, along with the beginning of new initiatives in the project without precedents, is observed clearly (Gunduz & Mohammad, 2020). Therefore, complex projects are often associated with numerous cost overheads and are often associated with late completion and exceeding the allocated budget while failing to meet the specifications in project scope or the requirements of stakeholders in the project (Floricel et al., 2016). Complex projects are also associated with other factors that continuously present challenges of completion on time and within cost according to the specifications outlined in the scope (C. Wang et al., 2021). These challenges are referred to as disruptions and are often perceived as the indicators of complexity or instability in a project's performance (Chapman, 2016). The notable inference that can be derived from the definitions of stability and instability in project performance suggests variability in the perception of different authors in project management literature (Głodziński, 2019).

For example, some authors have focused on the linguistic and contextual perception of instability with respect to project performance just by applying the term 'project' in various iterations of the meaning of instability such as complexity, risk and uncertainty (Floricel et al., 2016). Hence, it can be clearly observed that the perception of project managers about stability or instability in project performance is a noticeable factor in determining their definition. That said, it would be reasonable to focus on the various factors on which project managers can focus in order to accomplish effective management of project performance stability.

3.3.3 Dealing with instability in project performance

Coping mechanisms for dealing with the issues arising from variability and disruption could be generally observed in two forms. The first type refers to the meticulous scheduling or planning of resources project activities for reducing the sensitivity of the project to instability (Dikmen et al., 2020). The second type of initiative that can be sought to restrict instability in project

performance refers to the implementation of project schedule in a specific way as to manage the compensation for negative outcomes that occur during the project (Y. Wang et al., 2018). The effectiveness of scheduling techniques, project plans, and execution techniques could be leveraged appropriately to reduce the effect of disruptions on project performance stability (Maqsoom et al., 2020). However, project managers have to be aware of an imperative detail that refers clearly to the consequences of obtaining project performance stability and that may result in sacrificing specific desired project outcomes (Głodziński, 2019). Furthermore, it has also been confirmed that stable project performance would lead to requirements of higher costs and more time for completion, albeit without any detailed investigation as observed in the literature (Maqsoom et al., 2020).

The measures for dealing with a specific source of project performance instability could be improvised with an understanding of the basic reason, i.e. loss of synchronization (Larsen et al., 2018). This is the foundation of instability in project performance such as in the example of scheduling instability, which is caused by variability and disruptions that cause delays in duration of various project activities (Dikmen et al., 2020). This source of instability is responsible for instability in further stages of the project (Mba & Agumba, 2018). The deficits in allocation of resources could also be counted as a source of scheduling instability that can support the delay in activities to promote loss of synchronization between the three dimensions of project performance, i.e. time, scope and resources (C. Wang et al., 2021). The loss of synchronization leads to various degrading outcomes on project performance, thereby providing the characteristic traits of instability in project performance (Floricel et al., 2016). The loss of a resource or lack of its availability negatively impacts productivity in the same way as the loss of coordination between project activities and resources (Silva H. E., 2014) (Silva M. K.-C., 2017).

Project performance instability in the context of resources is commonly characterized by outcomes such as late completion of project, additional costs, and reduction in effectiveness of the project. Project managers should be apprehensive of the different sources of project instability since these factors have a ripple effect that may lead to a minor disruption, imposing severely detrimental consequences on the whole project.

The practical significance of project performance stability and its relationship with other measures for project outcomes and the conventional attributes of project performance are detailed effectively in the literature. This reflects on several possibilities for future research to find out the specific measures of project stability according to the conventional metrics for project performance measurement such as time, scope and cost, along with considering the evolving stakeholder requirements (Peñaloza et al., 2020). The study of project performance stability is seen as a promising initiative for project managers to deal with complex projects effectively despite the emerging concerns of variability and disruption.

3.3.4 Degree of instability

The definition of the chaotic situation that was presented by (Samra & Shaalan, 2016) is that circumstances whether they happen before or after the occurrence of an event are unpredictable. (Samra & Shaalan, 2016) defined instability in terms of randomness, but (Burnes, 2004) added that instability is the unpredictable randomness. Sometimes, there is a situation in which the amount of available knowledge assets is not enough to raise the capability to control instability (De Carvalho, 2015). Innovations are not necessarily required to effect a change from instability into stability in all cases; in fact, sometimes more precautions are more needed, and other times experiential or specialized knowledge assets are needed (Kang et al., 2017). The level of instability may affect what is needed to change this instability into stability. The question is 'do

managers change knowledge assets according to degrees of instability or according to their tendency towards having more instability or towards having more stability?' This is a question that needs further research. Instability includes irregular variation which is hard to be forecasted (Khattak & Mustafa, 2019).

3.4 Relationship Between Complexity and Performance Stability

(Kermanshachi et al., 2020) consider complexity as a variable that consists of two main subvariables. The first sub-variable is the risk that is related to the level of uncertainty involved in the project. The other sub-variable is the ability to achieve the project objectives. In fact, the more difficult it is to achieve the project objectives, the higher is its complexity level, and the more uncertainty and risk are involved in the project, the higher is its complexity (You et al., 2016).

There is a relationship between instability and complexity (Abou Samrah, 2017, April.). In fact, major projects experience more complexity (Kang et al., 2017), and complexity leaders who are more experienced in managing complex projects are more disposed towards managing project knowledge (Marr et al., 2003). According to the literature, interaction and connectivity between the known and the unknown form complexity (Baralou & Tsoukas, 2015). Also, according to the literature, knowledge creation and complexity overlap in terms of ambiguity, uncertainty, dynamic changing, and social structures of interaction (Dyball & Wang, 2017). Accordingly, it is expected that there may be significant relationship between the knowledge creation style and the level of project complexity.

There is further evidence in the literature about a significant relationship between the performance stability or instability and the level of project complexity. Instability is related to poor forecasting of weak signals of diversity, and this increases the complexity of the project

(Biscaro & Comacchio, 2018). Complexity in the literature is more related to instability than to stability, so much so that complex projects suffer from instability and chaotic changes in their environment (T. S. Nguyen & Mohamed, 2020); however, two types of complex projects may be distinguished: Complex projects with a higher level of instability and complex projects with lower levels of instability or, in other words, higher levels of stability (Vidal L., 2008) (Vidal, 2011).

This refers to the range between regularity and irregularity in project performance. For instance, regularity leads to higher degree of certainty and ability to forecast and vice versa (Cicmil, 2009). Project managers choose their processes to be standardized or unstandardized since environments and customers are dynamic (Faccin & Balestrin, 2018). Standardization alone is not enough because it has short life cycles (Kerzner, 2017). As a conclusion the short cycles of processes may lead to more changes, and complexity level may consequently be gradually increasing. For this reason, the researcher suggests that projects be divided into two types: high complexity projects and low complexity projects, and that both knowledge creation process and project performance have different characteristics in each type of project.

3.4.1 The relationship between project stability and project complexity in the literature

With the gradual progress in economic and social changes and the advent of technology, there has been a dire need for support of project management, but formidable ambiguities have been posed as to the perception of complexity in a project (Kess & Haapasalo, 2002). The stability of a project, on the other hand, is found to be considerably dependent on the perception of complexity in a project by managers (Ansoff, Implanting strategic management, 2018). Therefore, a clear relationship between project complexity and project stability could be identified and, thus, necessitates the measuring of complexity to identify project stability (Głodziński, 2019).

Another factor that can be pointed out in this context refers to the development of contingency measures by project managers on the grounds of perceived levels of project complexity, thereby leading to higher possibilities for project stability (Bekr, 2017). Hence, it can be observed that the relationship between project complexity and uncertainty could be used for explaining the interplay between project complexity and stability (Albrecht, 2014).

3.4.2 Project uncertainty and societal complexity

The initial step of a project management schedule is primarily associated with the establishment of scope and magnitude of cost (Khattak & Mustafa, 2019). The scope of the project provides clear insights regarding the estimated timelines for completion of distinct stages of the project and the nature of activities to be executed at various instances (Geraldi, 2009). The scope of the project also includes the allocation of responsibilities to different stakeholders in the project. However, this scope can change over the course of the project's proceedings mainly because of the facets of societal complexity tangibly felt in the context of technological, social and economic areas in various markets and industries (Głodziński, 2019). Societal complexity can also be observed as an outcome of the dissolving barriers between national and global economies as well as the reduction of geographic barriers which has been responsible for creating formidable changes in approaches to information exchange and human interaction. Contextual diversity has also been responsible for a number of instances where scope change was required in different projects thereby leading to the disruption of project stability (Samra & Shaalan, 2016).

The primary outcomes of contextual diversity that can be observed in project stability can include references to the changes in demands for time and resource allocation (You et al., 2016). For example, the context of a project at the beginning could have been used for determining the specific deadline for completing the first stage of the project with a specific number of available

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human resources. However, if the number of human resources decreases, then the context changes and, thus, the scope of the project needs to be revised in order to accomplish the desired outcome (Dixit & Saurabh, 2019).

In these cases, the expertise and knowledge of a project manager about uncertainty could be a prolific tool in ensuring appropriate measures to reduce the possibilities of disruption to a project. Furthermore, the awareness of project complexity factors and the expected levels of project uncertainty with respect to the concerned project could also be considered effective in the realization of project stability (Biscaro & Comacchio, 2018).

3.4.3 Association of project complexity and uncertainty

Project management literature indicates credible insights into the association of project complexity and uncertainty on a frequent basis. On the other hand, many authors in the field presented contradictory views related to the interdependency of the two most crucial and prominent facets of project management. This difference in opinions regarding the relationship between project complexity and uncertainty is largely due to the conceptual understanding of the two factors by different authors from distinct perspectives (Wenbo, 2009) (Neely, 1997). The early scholarly articles which explored the interplay between complexity and uncertainty saw the two concepts as different, even though they are dictated by the consideration of project complexity (Nguyen, 2019). With the gradual progress in the body of research related to project complexity, the term has become broader to incorporate terms such as perceived complexity and uncertainty under the umbrella term (Kerzner, 2017). Furthermore, the direction of relationship between project complexity and uncertainty is also often debated in literature with many authors pointing

out towards project uncertainty as an outcome of project complexity (Pfefferkorn, September, 2017).

The arguments presented with respect to these views clearly imply that project complexity is dictated by the higher number and variety of variables, components, and interactions involved in a project, and these impose restrictions on their identification and understanding by project managers, thereby leading to major issues as to the accuracy of forecasts and estimates related to the project. This clearly leads to the development of project uncertainty levels and, therefore, subsequently impacts the manager's perception of project stability (Dixit & Saurabh, 2019). Manager's perceptions are interacting with project complexity to create new knowledge which may impact the project performance and its stability. The interaction between the perceptions of project managers and the contextual complexity is another scope of research in the MENA region which is a focal point in the current study.

3.4.4 Consequences for a project

The understanding of the relationship between project complexity and stability can provide managers with the opportunity to prepare adequately for uncertainties in the project (Cicmil, 2009). Experiential learning is the most promising tool in this context that can help project managers to tailor their responses to specific uncertainties in a project that can pose threats for the project stability. This can be possible by maintaining a sense of novelty associated with the project and perceiving uncertainty as an inherent characteristic of projects (Dixit & Saurabh, 2019).

Managers have to assume that project stability would be subject to disruptions at various stages of the project because of the gap in the information and knowledge residing with the project manager and that required for completion of the project tasks (Akanni, 2015). It may be concluded that the complexity of projects is derived from the inherent uncertainty or sources of instability within a project (Arafa, 2015). Therefore, project stability can be considered as an interdependent entity with respect to project complexity, and both of these elements interact to provide dual connotations for project management, i.e. positive and negative (M. W. Ibrahim et al., 2020). Project stability disruptions by uncertainty factors could be responsible for positive as well as negative outcomes, and since the disruption in project stability promotes the levels of project complexity, it can also be inferred that project complexity can present challenges and opportunities (Olins, 2017).

The practical scenario of project management clearly implies the role of project complexity in creating disturbances in projects stability in the long-term, especially through examples of budget overruns and project delays. It can be concluded that both factors of project complexity and project stability are interrelated and could contribute to positive and negative outcomes for project performance, depending on the perceptions of the manager (Wang Y. a., 2018) (Loch, 2011).

3.5 Approaches of Studying and Measuring Project Performance in the Literature Methodologies

Over the years, a lot of research has been conducted to measure various dimensions of project performance. According to (Thomas, 2008), in order to effectively manage and control the project operations and the project performance, it is necessary to unambiguously define it and accurately measure it. Thomas stated that when it comes to an R&D project, a number of issues and challenges arise that affect its performance. These hurdles include the difficulty to manage and control the project operations and assure that the appropriate project outcome will be achieved in the end (L. D. Nguyen et al., 2019). In order to understand the determinants that

lead to the success or failure of a project, managers have shown keen interest to identify these elements and develop techniques so that they can control and monitor them in an efficient manner (Demirkesen, 2017).

The proper measurement of the success and performance of a project could be a challenging task because success can mean a different thing to different individuals

According to his research, there are seven criteria that can be used to measure the project performance (Frantzeskaki, 2016). These elements include technical performance, the overall efficiency of the project execution, personal growth, project termination, the degree of technical innovativeness, managerial and organizational implications, and manufacturability and organizational performance.

The measurement of the project performance is not similar to the measurement of any team or organizational process (Peñaloza et al., 2020). It is much more complex in nature, and some of the key performance indicators that can be taken into consideration to measure the performance of a project include the direct impact on the business performance, the impact on the bottom-line and the Return on Investment (ROI) of the organization, the perception of the stakeholders, and their participation in the project (Rahman & Adnan, 2020). These are some of the most vital measures that a project manager needs to carefully assess so that the desired performance can be achieved (Głodziński, 2019).

The research study by H. Mauricio Díez Silva highlights that in the past the key measures that were used to ensure whether a project performance was good or not included time, cost and quality factors (Silva H. E., 2014). But in the 21st century, the main determinants of the performance of a project have changed significantly. Some of the key factors that standout today include project organization, measurable efforts and changes in the project setting (Zamim, 2021). It can be stated that these are the controllable aspects of a project work which can have

a major impact on the control capability and the ultimate outcome of the project (Kess & Haapasalo, 2002).

It is necessary to measure the overall performance of a project as it can help to compare the costs with the benefits and determine whether certain improvements can be introduced in the project management technique (Kashiwagi, 2018). In a technology-driven era, business undertakings are trying to employ technical and innovative project management measurement systems so that they can ensure the ultimate value of a project (Mirza & Ehsan, 2017).

Some of the major project management benchmarking measures that have been identified by James S Pennypacker include the level of productivity, the return on investment, the cost of the quality, the cost performance, the satisfaction level of the customers and the project life cycle time (Huckman, 2009). He stated that one of the most vital approaches that can be used to study and measure project performance is the Balanced Scorecard model. Project managers can also implement innovative performance management measurement systems which can help them to ensure the value of the project that has been undertaken by a business undertaking.

Some of the core elements that need to be measured by a project manager include the safety aspects of the project, financial aspects, and use of human resources. The measurement of a project that is being conducted in the construction industry can be highly complex in nature (Hartono, 2019) (Heckmann, 2016). In order to measure the performance, a number of useful techniques that were used in the traditional times include Activity-based ratios and the Variances and the Earned Value Analysis (Fedor, 2003). These measurement tools used to help in understanding various aspects that impact a project performance such as quality, cost, and time (Jamil, 2017) (Menches, 2006) (Van Dooren, 2019) (Van Marrewijk, 2008).

Today, some of the key performance indicators that project managers need to take into account while measuring the performance of a project are the number of defects, the level of satisfaction of the clients, and the predictability in terms of time and cost (Henderson, 2008, July).

For the purpose of making a sound comparison between the performance of a project and another project, a comparison technique which is based on simulation can be introduced. It will not only help to measure the performance of a project but also to predict future costs during the project (Hua, 2016, December).

Thus, with the changing nature of the project that is being conducted by business undertakings, the project performance measurement systems are also undergoing change. In the past, the project managers used to focus only on certain aspects of a project to ensure its effectiveness, but today a wide range of factors are being taken into account so that performance can be evaluated in a comprehensive manner.

Figure 3.2 Project performance in the literature

Description	Research Method	Measures (Quantitative)	Conclusion
		Mode of project	
The Dimensions		1 5	The project determinants
	Interviews	management,	1 0
and Determinants			must be assessed as they
	and Factor	Economies of resources,	
of Project			impact the project
	Analysis	Control over project	
Performance			performance.
		operations	
		Technical performance,	The managerial and
Measuring Project	Literature		
		efficiency of project	organisational
Success	Review		
		execution, personal	implications and the
C T T au O P M S	Description The Dimensions and Determinants f Project erformance Measuring Project uccess	DescriptionResearch MethodDescriptionMethodThe Dimensions and Determinants f Project erformanceInterviews and Factor AnalysisMeasuring Project uccessLiterature Review	DescriptionResearch MethodMeasures (Quantitative)MethodMode of project management, and Factor AnalysisMode of project management, Economies of resources, Control over project operationsMeasures (Quantitative)Mode of project management, Economies of resources, Control over project operationsMeasuring Project uccessLiterature ReviewTechnical performance, efficiency of project execution, personal

Source: Created by the researcher from literature review

			growth, project	manufacturability and
			termination, technical	organisational
			innovativeness,	performance impact
				project performance.
				The core project
(Hartono, Sulistyo, Measurement in	Performance	Qualitative and Quantitative	Time, cost, quality,	elements that need to be
	Measurement in			measured so that the
Chai, et al., 2019)	Chai, et al., 2019) Project			performance can be
Management	technique	process and or product	checked include the cost,	
				time, quality and
				process.
	Measuring Project			Communications, project
Management(Mirza & Ehsan,Performance: Case2017)of ConstructionIndustry	Structured Equation	Project integration, risk	integration, risk and cost	
		and cost factors have an	factors have an impact	
		impact on the project	on the project	
	Industry	modeling	performance	performance and project
				outcome.
(Rahman & Adnan,	Comparisons of			It is difficult to
2020)	Systems for	Simulation	Project performance	determine the best
	Measuring Project	approach	measurement systems	project performance
	Performance			measurement system.

The table above shows that project performance consists of studies using the mixed-method approach and that the qualitative approach was used in conducting interviews and the quantitative approach in conducting structure equation modeling. Time, cost, and quality are among the measurements of project performance, and this study adds the productivity ratios to these measurements as it summarizes the utilization of inputs as a percentage of the quantity of output. Productivity reflects efficient resources allocation and utilization for better project performance. Cost is found to be the most frequent measurement tool of project performance in the literature. This study uses cost as one of the sub-constructs to measure the project performance stability.

3.6 Theories of Performance Control

Performance is crucial to every project because it is a key determinant of the success of a project in particular and the organisation as a whole. Controlling the performance of individual employees can have an overall positive impact on the entire project performance, and this makes performance control a vital aspect for every firm (Taylor, 2018). Be it the success of a project or of the entire organisation, all are dependent on efficient performance management. It starts with the setting of objectives and ends with taking the corrective measure to make sure that performance is in line with the objectives. It may be said that performance control is a continuous process that spans across the lifecycle of the target project (San Cristóbal, 2018).

3.6.1 Performance control in project management

Performance control is a tool for regulating the performance and outcomes of a specific project (Luo, 2017). Without effective performance, achieving the desired results is not possible. Right from the preparation of the initial plan until the completion of the project, having a check on the performance of the team members is important. Upon starting a project, it is important to oversee that all the required resources including the human resources are available according to the set plan. This is the first step to performance control in a project (Marion, 1999). Then while the project is underway, it is necessary to check the performance of the workforce and other resources at every step because this will ensure that the project is working according to the

planned schedule so that taking immediate corrective steps can help in avoiding wasted time, money and efforts (Maylor, 2008).

Through performance control, the project manager eliminates all the tasks and processes that can be a hindrance against the expected outcomes. To complete the project on time, controlling and managing performance becomes very important (Miterev, 2012). This way, awareness of weaknesses and errors are anticipated and corrective measure are taken well in advance to solve the problem; otherwise, the project with all its burden may suffer and, thus, all the investments will have no good returns (Jünge et al., 2019). Moreover, through performance control, employees get to know about the deviations and take corrective measure well in time to make the project successful (Maqsoom et al., 2020) because this tool measures project performance at regular intervals to detect any disruptions (C. Wang et al., 2021). At the end of the project, the set goal and the achieved outcomes of the projects are compared to identify any gap, and any gap or deviation exists, the control measure can help in taking up the corrective actions (Dyball & Wang, 2017). But having a performance control at regular interval throughout the entire life of the project ensures that there are not many gaps between the desired and actual outcome at the end (Antoniadis et al., 2011) (Singh, 2002). This shows the importance of performance control in project management (Klinger, 2018).

3.6.2 Importance of performance control

The Major significance of performance control is to align the action of the employees with the goals of the project (Van Beurden, 2013). In fact, it helps in communicating to the human resources the right way to perform their task so as to contribute effectively towards the set goals (Harbour, 2017). This keeps the workforce focused on the right direction and helps them to provide better outcomes (Dubbeld & Blomme, 2020). It allows the employee to gain knowledge about the important and impactful activities of the project (P. S. Fong, 2003). With such clarity

of work, the employees are successful in contributing their best towards the accomplishment of the project (Sjödin, 2019). This tool also helps employees in receiving useful feedback from project managers and allows them to understand and thus rectify their errors, improve their performance level, make effective contributions, and succeed in the project. This in turn reduces the employee turnover rate and contributes to the enhancement of the overall project (Reich et al., 2012).

Performance control is also important to ensure the effective use of project resources. The control methods check that no resources are wasted (Job, 2015). Be it the human resource or any other physical resource, performance control ensures that all the resources are put to the best use throughout the project. It makes sure that the project is completed in a disciplined and cooperative way (Frederick, 1998) (Lebcir, 2011) (Lundin, 2015).

3.6.3 Theories of performance control and performance management

The different theories of performance control and performance management are becoming important for effective project management (Reeves, 2011, July-August). Control theory, which is one of the important and popular theories of performance control, enables project managers to gain performance control by considering the project context (Biscaro & Comacchio, 2018). Depending on the needs of development among the project team members of the project, managers put in effective control methods in place to ensure complete success of the project (Puddicombe, 2006) (Pfefferkorn, September, 2017). Even when the project goals are challenging, this theory helps managers to enhance the performance level of the employees. Through clear feedback, employees are made to recognize their errors and work according to the standards to ensure better performance (P. S. W. Fong, 2003).

In the project context, the baseline for performance control will be the project management plan and the business case (Khedhaouria & Jamal, 2015). The Association of Project Management (APM) stated that the performance control approaches and techniques must be carefully implemented by project teams so that they are appropriate for the project scale, complexity, and the context of the project work (Akanni, 2015). For a small project, performance can be controlled by making use of a basic slip chart or by making the comparison between the actual progress with the baseline through the use of a Gantt Chart (Albrecht, 2014). But while working on complex and large projects, a robust performance control framework needs to be introduced (Aucoin, 2007). For example, for complex construction projects, there is the need to use the Earned Value Management (EVM) model, a project control process based on the structural approach relating to planning, cost collection, and ultimate performance measurement. This approach can be implemented to obtain a detailed insight into various aspects of the project work (Pfefferkorn, September, 2017). This control model will help to integrate the overall scope of the project, take into account the time and cost objectives, and provide a means to make a comparison of the completed project work against the baseline (Samra, 2016, July).

3.6.4 Control theory of performance management

In order to succeed in a project, be it simple or complex in nature, it is extremely important to focus on performance (Dubbeld & Blomme, 2020). Several control theories have been put forward so that the performance of a project can be efficiently and effectively managed (Yeong, 2010).

The control theory is used not just in the project setting but also in the entire organisational context. It basically relates to business or projects where new ways are learned to streamline and/or optimize the processes. The control theory can be implemented to monitor the behaviour

and outcome of project work and regulate the overall efficiency and effectiveness of the team members involved in the project activity. In their research, Maruping and Venkatesh stated that formal control mechanisms can be introduced while working on projects so that the leader of the project management team can easily layout the expectations and guide the team towards the desired project objective

(Maruping, Venkatesh & Agarwal 2009, p 19). The research team stated that project managers of software development teams need to focus on performance control, but they should at the same time give flexibility to the project members. It will help the project team to make the best use of their judgment to follow controlled protocols and steps to accomplish the project objective by delivering strong performance. Performance control theories have come into existence in the project context as they help to identify the business implications by introducing improvement initiatives and to make a thorough comparison between the costs and the benefits of the project management. The performance control in a project work is effective only when the suitable project performance measures have been taken into consideration (Fang, Chen & Hideaki 2017). This is because these measures enable the project managers to have robust control over the project and its activities (Floricel, 2016).

3.6.5 Project management – monitoring and controlling process

With the increase in project work, high emphasis is being given to performance control approaches because it helps to track the actual performance with the planned performance relating to the project management activities. In order to measure the overall performance of a project, it is vital to have in place several performance control techniques. Monitoring and controlling activities in a project basically enable the project leader to take the necessary steps to make sure that the performance is in sync with the project objective. This monitoring and controlling can be achieved through tracking, reviewing and/or regulating the overall progress of the project work, assessing the status reports relating to the project, keeping a tab on the project and the project document alterations, and formalizing the acceptance of the project deliverables.

The control of the performance of a project is necessary as it helps to get a detailed insight into the progress of the work, plan the appropriate updates, be prepared for risks and uncertainties that might arise in the future and change the requests. A number of techniques have been introduced that can help to control and evaluate the performance management of a project such as earned value analysis, critical ratio model, line of balance approach, conducting review meetings, graphical evaluation, and review technique (GERT) and Project Crashing and Time-Cost Tradeoff (Taylor, Boat & Murphy 2018).

According to the Association of Project Management, performance control is of paramount importance during a project because in case the performance is outside the agreed tolerance level, the issue needs to be escalated to the project leader (Apm.org.uk 2019). The latter, along with the other project members, can take a decision so that suitable steps can be taken to align the performance of the team members with the project goals. A popular approach of illustrating the performance of a project team is the use of the RAG reporting technique (Red, Amber, and Green). The green colour means the project performance is within the tolerable limit; the amber colour means the project performance is within the tolerable limit but expected to exceed the same; and the red means that the project performance has already exceeded the tolerable limit.

3.7 Measurement of Performance Control

Measuring the performance control of a project or activity is conducted to identify whether the performance is adding value to the ultimate goals or not. A project can succeed only if the

performance is kept in check, and comparison of the key performance control metrics is necessary as it provides a sense of direction and control. Several key factors need to be considered while carrying out the process such as the scheduled performance, project cycle time, and the alignment of the individual performance with the strategic goal of the project. According to Bourne (2000) project managers and leaders need to put in place appropriate performance measurement systems so that they can have proper control and check on the performance of the project team (Bourne 2000).

Depending on the specific kind of project that a project team is working on, the performance control needs to be measured. For example, in the case of construction projects, the project managers can measure the performance and control the same by introducing suitable strategies and actions. This measurement is significant because it can have a direct implication on the ultimate project outcome (Demirkesen & Ozorhon 2017).

While working on a project, performance control is extremely necessary because it can give a detailed insight into whether the individual performance of the team members is in sync with the project objective or not. According to Rozenes and Vitner, performance control can primarily help project managers to minimize the gap that exists between project planning and the project implementation process (Rozenes, Vitner & Spraggett 2006). The measurement of performance control can play a critical role as it can enable the project team to track the progress of the process and thus manage the results in an efficient manner.

In order to keep control over performance, the measures need to be tactfully selected so that suitable actions can be taken to improve the performance of team members. However, in many instances, several macro factors might come into play, and this can make it challenging for team members to deliver in an effective manner (Harbour 2017). In order to deal with such kinds of contingency situations, it is extremely vital to have in place a robust performance control which

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will enable the project manager to take requisite actions to bring the performance back on track. To manage the performance control of a project efficiently, it is necessary to measure it (Pennypacker 2005) because it can help in determining how the employees or team members are contributing to the project work. In fact, there is a list of measures that the project manager needs to take into consideration to manage the performance control and overall value of the project (Pennypacker 2005).

3.7.1 Measurement of performance control in projects

According to Diez Silva and Ezcurdia, the thorough evaluation of performance control is possible only if appropriate performance control metrics are analysed, and this can be done through key performance indicators and metrics. In the words of Flapper, indicators play an important role within a project setting as they help in assessing what needs to be measured. They also help in setting the control limits within which the performance can be acceptable (Silva 2014 p 3) (Fang, 2016).

The efficiency of a project is based on the connection that exists between production and input (Silva M. K.-C., 2017). Similarly, the effectiveness of a project is based on the ultimate output that is delivered by the project members towards the project work (Van & Van 2016). Thus, in order to manage the efficiency and effectiveness of a project, key performance mediators must be carefully assessed so that the performance can be controlled, and suitable actions and strategies can be implemented to strengthen individual performance and project performance (Silva 2014, p 3) (Shannak, 2017).

Several standards exist in the project management setting that must be understood in detail to apply the suitable performance control approach. For example, according to the Project Management Body of Knowledge (PMBOK), performance control may be possible through making a comprehensive comparison between the work plan and the execution of the project.

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Some of the key parameters that must be considered to control the performance are deliverables (scope), schedule, and cost.

The popular techniques highlighted in PMI-PMBOK include Key Performance Indicators (KPI) and Earned Value Management. According to Silva et al, performance control is possible by making a detailed and thorough comparison between the actual performances with the planned performances. The parameters that can be employed are the actual work that impacts the financial performance of the project (Silva 2014, p 7).

In order to measure the performance control in projects, it is necessary to focus on various aspects such as the processes that are implemented in the project, the learning and growth measures for the employees, the financial measures, and the customer measures (Pennypacker 2005, p 5). By carrying out a holistic assessment, a project manager can gain a detailed insight into how the performance and contribution of the project members can be improved to a significant extent.

The measurement of performance control is a vital part of the strategy that can help a project manager and his team to succeed in the project. To control and monitor the performance of a project, it is necessary to measure the elements that are quantifiable in nature (Mayne 2017). In a project management scene, performance control plays a crucial role as it not only compares the actual with the hypothetical performance, but it also helps to implement new techniques to achieve the desired results. Various methods can be introduced to measure performance control while working on projects.

3.7.2 Methods of measurement of performance control in projects

As stated above, in order to correct the deviations and make improvements, performance control is necessary; otherwise, the project will have to suffer huge losses at the end. It is not just the financial loss but also loss in time and efforts of the employees involved in the completion of the project. This makes the measurement of performance control even more important (McDavid, Huse & Hawthorn 2018). There are different methods to measure the performance control of a project and the employees of the project. Some of them are listed below.

3.7.3 Project or Process Measurement

Measuring the performance control of a project helps in attaining the objectives successfully and in enhancing the overall performance of the project. In fact, it is an effective instrument in calculating the cost and time of the entire project. While measuring performance control, keeping the objective in mind proves to be helpful. This tool proves effective in problem management way ahead and guarantees the successful completion of the project (McDavid, Huse & Hawthorn 2018) (DeCotiis, 1977) (Bourne, 2000.).

Project completion

Project completion is an effective aspect for the measurement of performance control. The rate of project completion informs a lot about the performance control in the sense that calculating the cost involved in completing a particular project and the time taken for completion helps in getting an effective measurement of performance control (Pennypacker 2005). If the project has been completed within the scheduled time and planned budget, then it means appropriate performance control has been exercised. But if large gaps or deviations are seen, then it means that the performance control adopted has been relatively low.

Performance relating to requirements

This is another technique for the measurement of performance control. The degree to which the project can meet the set requirements has a lot to do with performance control. Before starting a specific project, certain requirements related to quality or quantity are laid down. The work of performance control is to see that the project is carried out in such a way that it can meet all the requirements (Schmeichel & Vohs 2018). If a project is successful in meeting all the

requirements, it means that effective performance control was put in place. On the other hand, any deviation from the actual requirement justifies a lack of proper performance control. By making requirement a tool, measuring the level of performance control becomes easy (Pennypacker 2005).

Process errors

Process errors are a simple way the measure the performance control of a project. Many steps are taken by the project managers to eliminate process errors which can have a huge impact on the entire process. This necessitates appropriate performance control that can minimise errors because reduced errors mean enhanced performance control (Pennypacker 2005), while increase in the number of process errors means a poor performance control. Thus, by finding out the frequency of occurrence of the process errors, the level of performance control can be easily measured. This is helpful in making the required changes in the control level to ensure optimum results of the project.

Utilization of resources

The optimum utilization of all the available resources is important to make the project successful. Resource utilization can also be a good index to measure the performance control level of a specific project. When all the physical resources and the human resources are put to the best use, it means that good performance control has been exercised in the project (Pennypacker 2005). If any unnecessary waste of valuable resources occurs, it means that the performance control has not been properly exercised by the project manager and, thus, a huge loss in the overall project is incurred. Early measurement is, therefore, important to allow for corrective actions to be taken to avoid further losses.

Scheduled performance

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The scheduled performance of a project is yet another efficient criterion to measure performance control; in fact, certain schedules are prepared before the launch of a project and ensure that the project progresses in the right track in order to reach the successful completion according to plan (Pennypacker 2005). When all the performances starting from effective utilization of resources to timely works take place based on the schedule, then a good performance control is put into the project. But any deviation in the schedule performance that has negative impacts on the project means that a poor performance control has been used by the project manager.

Learning and growth measures

Measuring the performance control of the project only is not sufficient to ensure its success. Therefore, evaluating the level of performance control over the employees involved in the project is important because the workforce is not only the most important aspect of every project but also decides the success rate of a project (De Silva 2018). In fact, a large proportion of a project success depends on the employees' performance; hence, having effective performance control over their performance is important and measuring the level of learning and growth among the employees tells about the degree of performance control exercised by the project manager as shown below.

Employee turnover

The rate of employee turnover is an accurate measure of performance control and occurs when the performance of an employee falls below the optimum level. This implies that if performance control is effectively exercised by the project managers, the employee turnover rate can be significantly reduced (Pennypacker 2005). As the employees are made to identify their errors through proper control measures, they can equally rectify them. This helps in enhancing their performance; however, when an employee is oblivious to errors, it leads to increased employee turnover rate. This happens in case of poor performance control in a project. Hence, by knowing the employee turnover rate, performance control can easily be measured (Noe 2017).

Employee satisfaction

The index of employee satisfaction, another important indicator of performance control, is a measure of the morale level among the employees of a particular project. When effective performance control is practiced by the manager, the employees can identify and rectify all the work-related errors (Pennypacker 2005). This gives the employees a satisfaction for being able to complete the work efficiently and builds a cooperative relation between the employee and the project manager. But when the manager is not able to remind the employees of their error, it may lead to their poor performance and may invite a lot of complaints to their work and cause dissatisfaction of the employees due to poor performance control.

Employee motivation

A motivated employee can provide the best results for a given project if he/she receives proper guidance and can perform better. Through performance control, the project managers can show the ways in which the employee can improve and increase their motivation (Pennypacker 2005), but when an employee is given no suggestion, and his/her performance is not controlled effectively, he/she may feel lost. This may also lead to demotivation among the employees for not being able to show positive work results.

Employee productivity

Employee productivity is the measure of the efficiency of the employees. When effective performance control is exercised by the project manager on the employees through constructive feedback, employees' productivity increases (Kouvaritakis & Cannon 2016). But when the

employees do not receive any feedback or suggestion from the manager, their productivity decreases. They may not be able to optimize their performance due to lack of valuable advice. *Training time*

Training time is the duration taken by the employees to learn the specific tasks of a particular project. With proper performance control, employees take less training time. Through effective control, the project manager helps the employees to find out their errors and the various ways to correct them (Noe 2017). Without this control, the employees are unable to identify their errors and keep on making repetitive mistakes, and this can make the training time of the employees longer because they take more time to master a specific task.

3.7.4 Reflection on measuring performance control

Performance control ensures that the project is heading in the right direction. By having a comparison between the actual performance and the planned performance, the deviation can easily be figured out and corrective measures are devised in a timely fashion by the project manager to enhance the quality of the project. Overall, performance control can be exercised in terms of quantity, quality, time and cost, and is useful in ensuring that the project progresses according to the planned schedule and within the set budget. Right from the planning stage of a project till the implementation phase, performance control is important. Also, the measurement of performance control is important for the project to be fruitful. By using the various tools of measurement, the measurement task becomes easier and adds value to the project, increases its benefits, and helps the project manager to save both time and cost, and thus, makes the project a success.

3.8 Research Conceptual Framework

It is obvious that there is a gap in the body of knowledge regarding the classification of manager behaviours of creating new knowledge into styles. There is also a gap in the body of knowledge in linking knowledge creation process to regularizing project performance (stability) and minimizing randomness (instability) and the control of the level of conformance between the planned performance and the implemented performance. The role of knowledge creation style in moderating and/or mediating the impact of complexity of projects on projects performance is considered as a new contribution to the body of knowledge in the field of project management. According to the systematic literature review, this research proposes the following conceptual framework, and to be able to conceptualize the proposed relationships in this study in the light of the systematic literature review, the following graph shows the main variables in this study:



Figure 3.3 Conceptual framework of the study

The conceptual model illustrates the three main factors, and this research is an attempt to explore the relationship between these factors and extends to further level of analysis by finding sub-constructs (see figure above) under the three factors.

3.9 Key problems identified from the literature

In this chapter the literature related to the performance of projects and its relationship with the project complexity is systematically reviewed. Achieving performance stability in projects is a continuously desirable goal for project managers as well as an indicator on their successful management of their projects. This raises the importance of finding justifications of when

stability of project performance is achieved and when the instability of this performance is accepted and why. Th justifications are needed more and more within the context of the MENA region where there is lack of other factors' stability and which means that the contextual level of complexity for the MENA region projects has an interactive impact on the project performance. The qualitative justification and rational behind determination of performance success in the MENA region is still of need for further research to be able to predict it using significantly generalized models. The literature includes evidences on the importance of studying the role of the individual knowledge creation of the project manager on the successful conformance between the planning of the project and its implementation and this is also an area of research where there is a need for qualitative deeper justifications of the cognitive behaviours of managers in reaching this conformance as well as the quantitative measurements of the knowledge creation styles of those managers and how do these styles impact and determine the project performance's success. The creation of the contextually tested measurement of the project performance for the small and the medium sized projects in the MENA region is filling a gap in the body of knowledge and is contributing significantly to a better understanding of how to control and predict this performance.

3.10 Chapter summary

The above account examines different levels of stability and instability and reveals a mix between the instability and the complexity of the project. Complexity is considered as part of instability but in other studies as a determinant of the instability of the project performance. The levels of stability of the project performance is affected by the time, scope, allocated resources, demographics of the project manager, and the characteristics of the project itself such as the specialization and the certificates of the project manager and the duration of the project. All projects are processes that have a deadline, and the role of the manager is to achieve the goal of the project. This role includes planning skills, risk management skills, team management skills, resources management skills, managing customer relationships and delivering the quality and productivity that achieve high levels of safety and satisfaction to the project stakeholders. To accomplish these tasks, the manager needs knowledge that comes from different resources. It may come from certification and study, from experience at work, or from thinking out of the box and innovating new solutions. It may also come a minimum level of thinking which is about how to avoid risks and to find knowledge related to risk averse. The complexity of the project affects the stability of the project performance because there is a relationship between them according to the literature. The literature also reveals that the project manager's demographics and the project characteristics have a significant relationship with the project performance. As to the measurement of the project performance, qualitative measurement, quantitative measurement, and mixed-method measurement are used in the literature. The interviews with project managers are qualitative data collection approaches designed to study the project performance. The surveys are used to conduct quantitative research and are analysed using structure equation modelling. This study adopts a mixed-method approach study to get the benefits of triangulation of research results and to attain generalizable results. In the following chapter the research shows the methodology of measuring the main research variables and the details of research approach, design, structure, sampling, piloting, coding, and other components of research plan.

Chapter Four: Methodology

4.1 Research Design

This study adopts the mixed-method research design and starts with the qualitative research and follows it with the quantitative one. The purpose of the qualitative study is to conduct qualitative investigations of the possible association between knowledge creation, project complexity, and project performance, and to gain insights into the classification of project managers into knowledge creation styles.

In the quantitative research design, the study aims at conducting empirical investigation about knowledge creation process to find what differences exist among project managers when creating new knowledge. If these differences exist, then there is a new classification of knowledge creation styles for project managers. Therefore, using these styles as moderators may or may not lead to changes in the direction and/ or strength of the impact of project complexity on the project performance. The quantitative study provides empirical analysis of the relationships between knowledge creation styles and performance success on one hand, and knowledge creation styles and project complexity on the other.

The study is using the proposed knowledge creation styles as moderators in the conceptual model of the study.

The mixed-method research design is used to apply multimethod examination of the determinants of the project performance, which are analysed first using qualitative design and then quantitative one. This provides triangulation of research results for more reliability and validity. Another justification for using the mixed-method research design is that more insights are gathered through the qualitative study reveals better wording for the items of the survey in the quantitative study.

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The creation of new measurement of knowledge creation styles come from systematic review of the literature by different researchers, the insights gathered from the qualitative study, piloting results, and judges' feedback on the validity of items. Then, the reliability is tested quantitatively using Cronbach Alpha test. These steps enable the researcher to use the gathered data from the research survey in further analysis to be able to answer the research questions and test the research hypotheses (Tolentino, 2015).

4.2 Research Strategy

This study adopts an inductive and deductive approach and includes a case study that involves empirical investigations to examine contemporary phenomenon using multiple sources of evidence (Van Dooren W. A.-1., 2019). This is used to overcome the disadvantages of adopting a case study approach through the triangulation of results by following the qualitative study with a quantitative one (Miterev, 2012). This will allow for deep insights into the research context (Becker, 2012.). The use of the inductive research is in the area of discovering new and emerging constructs in the context of data collection to be able to build the model of the study. A new measurement of knowledge creation styles emerged accordingly after having only two cognitive behavioural styles, the inductive research uncovers more styles in this research like the risk averse one for example. The inductive research is followed by a deductive one to complete the research model's relationships with an existing measure of complexity and project performance and this leads to higher accuracy of prediction after the customization of these researched measurements of project performance and project complexity in the MENA region context.

The purpose of using the case study approach is to address the following general research questions:

- 1- How do project managers interpret their preferences of using different styles of knowledge creation to control their project performance?
- 2- How and why do performance deviations occur in the MENA region?
- 3- How are knowledge creation styles associated with the level of complexity and the project performance?
- 4- Why is complexity associated with project performance?

Interviews with project managers are used to get insights and qualitative investigations to address these questions. Then, a theoretical framework was developed to predict and explain the behaviour of project managers when creating new knowledge and to estimate its impact on the performance control of the project in the light of the level of project complexity. This purpose is achieved using a grounded theory approach including systematic literature review. This theory was then incorporated using a research survey after the conducting of interviews and theoretical framing as a deductive research. The survey was used to answer the following research questions:

- 1- Are there different styles of project managers in creating new knowledge?
- 2- Are there significant impacts of the knowledge creation styles on project performance?
- 3- Are their significant differences in the impact of project complexity on the project performance due to the style of the project manager?

Those three research questions will lead to a new theory in the field of knowledge creation and project performance. They have not yet been answered in the body of knowledge according to the systematic literature review discussed in the next chapters.

4.3 Research Philosophy

This research aims to fill a knowledge gap in the literature related to the knowledge creation styles and their moderating and mediating impacts on the relationship between project

complexity and project performance. Accordingly, the research paradigm is in the first place a positivism one. Then, the research goes to the supporting paradigm, which is interpretivism. Seeking reality by conducting causal research is part of the positivism paradigm for this study. The research relies on distributing questionnaires in this part to find about reality objectively, so it is an objectivist research based on testing hypotheses of relationships. However, there is no single reality, meaning that the concept of reality should be considered from different perspectives, namely understanding people and their contexts. For this purpose, the researcher talked to people inside their organisations and projects. Describing what the researcher found through talking to people is known as descriptive research design. It is not through using questionnaires; rather, it is using interviews, and this is why the researcher conducted qualitative research design to achieve this goal.

The research theme or research paradigm is related to the aim of the present study which is to investigate what knowledge creation styles exist and what is their effect on the relationship between the project complexity and the project performance. This is the based on how and why these styles are formulated and how and why they are associated with the project performance and the project complexity. Finding what relationships exist, in addition to describing how and why research variables are associated, means that the research paradigm includes both descriptive and causal research objectives.

The qualitative research that is part of the descriptive research approach is done because of constructionist philosophy. It explains how more than one reality is constructed in the context and people interviewed in the qualitative study. The ontology is based on viewing more than one reality and then triangulating the results of the qualitative research by testing the single reality found in the present context. Epistemology of the research is related to how we are getting the knowledge or the theory of getting knowledge. Since this study begins with a

qualitative research design, which suggests that there is no single reality, then the reality needs to be interpreted. This is referred to as the interpretest philosophy of research. An ontology research philosophy is the start of this research by conducting the qualitative study and then it is followed by the quantitative study for the purpose of triangulation.

The research moves from designing the research questions to finding the ontology and then epistemology suitable to answer these questions and then followed by choosing the right methodology and methods of data collections to be able to answer these research questions. The thematic qualitative analysis is depending on smaller sample size in this study (101 units), which is enlarged to achieve the ability to generalize results of qualitative study, and the statistical quantitative study is following the qualitative one with larger sample size (402 units). The study is merging realism with relativism by using objective measurements after checking the contextual changes that are studied for the purpose of generalizability to other similar contexts.

The epistemological position of this study is between relativistic view of knowledge as a social construction and the search of objective reality and objective knowledge. The ethnographic contextual experience is needed to understand epistemological issues of the phenomenon and problem under study.

The study uses the Emic approach to get insights about the data collected through in-depth semistructured interviews with project managers. This Emic approach is followed by Etic approach by using surveys to increase the objectivity and to keep the researcher as an outsider viewer of the project manager's behaviour and to increase the objectivity of research results. There is a degree of researcher agency in this study to get the needed in depth experience and this subjectivity of the qualitative study is followed by more objective research approach in the quantitative study to increase the value of the generalizability.

About the axiological issues of the study, the research focuses on what values may result as an outcome of this study. The study is in a position between the total neutral results and the results affected by the researcher's opinion that shapes how the research is conducted. The choices of how to conduct the research are based on understanding what are the studied constructs and variables in one hand, and the changing of them for better values. These research decisions are subjected to the ability to codify knowledge and finding the underlying system shaping thoughts and practices which is the theory existing behind behavioural choices. The language determines the meaning of experience for the researcher about the research constructs and this is another point to consider about the codification of professional knowledge in this study. The extent of originality achieved by this study is planned using the research methodology and choosing from among many decisions, alternatives, and choices interacting with methodological considerations. This methodology is a subject to research pragmatic logistics, time, resources, constraints, and accessibility to articulate the welt Anschauung of the view of context and reality. The lived-in description of the research variables along with the categorical intervals and ratio measurements of the phenomenon shape the epistemological decisions between the theory and the practice in this research. The research starts with the gathering of specific information about the research propositions and then creates tentative hypotheses out of it to eventually develop general conclusions that are linked to the context that is studied.

Interviewees backgrounds, roles, sectors, and current projects under this research are detailed in the quantitative study of this thesis in chapter no. five. Duration and mode of interviews as well as size of targeted projects and educational specialization of the project manager are all detailed in chapter five of the qualitative research

4.4 Research Methodology

Research methodology is designed in the light of the research objectives and aims to answer the research questions. A systematic literature review is followed by multiple exploratory case study design and finally by a survey research method. Systematic literature review is done to create a theoretical conceptual framework. An exploratory case study design consists of using the theoretical framework to create the open-ended interview questions of semi-structured interviews. The study then illustrates the protocol of data collection design and cases selection (Moore, 2011). After conducting case studies and describing the context of each case and the insights of causes and effects that are related to achieving research objectives, the study moves from individual case reports to drawing cross-case conclusions and modifying the theoretical framework accordingly (Lin M. T., 2012). The cross-case report of conclusions and implications is a contribution to the body of knowledge coming from primary data resources, a contribution which increases the value of the research by analysing first-hand insights. At the same time, it is the input to the exploratory survey, and is part of the exploratory multiple case study design (Gray, 2013) (Ahn et al., 2017) (Larsen et al., 2018).

4.5 Research Methods

A large-scale survey follows the analysis of interviews and systematic literature review. The conceptual theoretical model of the qualitative study is followed by hypothetical model of the quantitative study (Thabane, 2010). For the purpose of generalization of both theoretical model and hypothetical model, the study uses multiple case study analysis of 101 participating cases, in addition to analysing a large-scale survey of 402 respondents. Hence, the target of generalizability is achieved and adds to the value of the study as a tool to analyse and predict its main variables (Thornhill, 2009.).

(Sykes, 2018) from University of California conducted a research on the limits of generalizability in mixed-method studies when aligning sampling and case selection in a quantitative-qualitative research design. They found that this increases the internally consistent findings and the externally valid conclusions jointly determined from both methods. The research unit becomes accessible more clearly in terms of narrative saturation, case validity, and overall generalizability (Sin, 2015).

4.6 Pilot studies for testing validity and reliability of the data collection instrument

After this pilot, the questionnaire was sent to five experts in the field of project management and project management and knowledge creation to validate the wording of the statements. The recommendations were as follows:

1- Demographics can be collected before the data collection meeting to save time;

2- Shorter statements with a smaller number of words is better;

3- Changes in the ordering of questions;

4- Randomization of knowledge creation style items is more reliable;

5- Adding titles to the survey and dividing it into sections, with each one in a separate page with separate ideas to measure;

6- Avoid the open-ended questions in the survey meeting and transfer this to interviews part to save time.

7- Out of 30 questionnaires, 23 respondents answered, and this is a response rate of 77% and Cronbach Alpha test indicators for all items of the survey were above .70, and this increases the feasibility of conducting the study and adds to the validity and reliability of the study.

4.7 Sampling Strategy and Data Collection technique

There is difficulty in availing the population frame of projects that have a certain duration and that have a project manager responsible for it from planning, to execution, and until the submission of its final product to the customer. The researcher is after the generalization of the research results, so the sample size of questionnaires was increased to more than 400 units. Simple random sample of projects from project managers licensed and legally represented virtually by websites in the Middle East district is collected using cross-sectional research design (Sykes, 2018). The justification of choosing the simple random sampling technique is to give an equal opportunity for the sampling units to be chosen in the sample and because the population is relatively big. The simple random sample is a type of probability sampling on which all kinds of statistical analysis can be conducted and the results of data analysis can be generalized bearing in mind a statistically approved sample size. This justification also adds to the value of the study by giving generalizability of results to this study as a scientific contribution. The choice of small and medium sized projects and their managers is aiming at the filling of a gap iin the knowledge about the contextual performance control of MENA region small and medium sized projects in relation to knowledge creation and complexity as there is scarcity of research effort on this zone (Daniel & Daniel, 2018).

4.8 The rationale behind choosing the population of project managers in MENA region

The rationale behind choosing the Middle East region is that it is exposed to many environmental changes which may affect its level of project complexity and project performance success. In this respect, the responsibility of project managers to create new knowledge for the purpose of achieving performance success becomes more important and more critical.

4.9 Qualitative data collection technique

Face-to-face semi-structured interviews were conducted with the geographically available project managers. The reason of choosing semi-structured interviews is because of the experience of interviewees and to find new constructs through the process of data collection. Giving structured interviews to experienced interviewees like project managers may lead to losing a relatively big amount of data about the experience they have. The open-ended questions with interviewees enabled them to elaborate more and more about their insights and justifications and this enhances the interpretations of qualitative research results.

Observations were avoided because some face-to-face interviews were conducted electronically using skype. The total number of interviews of 101 project managers came from 101 different projects in different organisations. The protocol of conducting interviews began with arranging

an appointment, introducing the researcher to the respondent, talking in brief about the research purpose, objectives, value, and ethical aspects of the research. Next, permission to record the interview as an audio document for further later analysis was sought, and then the potential respondent was assured of confidentiality and sharing the research summary by the end of the study. The interview points have logic sequence and are understood by the respondents.

4.6.3 Quantitative data collection technique

As for the survey, over 402 questionnaires were collected online from project managers who have projects of specific duration, resources, cost, targeted level of quality and ratios of productivity to measure the projects' performance. Each project manager had an equal chance to be selected with the sample of the research, and there is no available sample frame because of the relatively huge number of projects that have online websites for their organisations. Confidentiality of information is assured and highlighted before the start of the data collection. A consent narrative is written at the beginning of the electronic version of the survey and was sent to the respondents in advance before the electronic face-to-face data collection process.

4.10 Data Analysis Approach

In order to be able to test the research hypotheses and propositions, the research uses the systematic analysis to conclude the relationships found in the literature, followed by the systematic analysis of the data collected from interviews. This happened by reading the transcripts of the interviews and making notes about the first impressions. Next, the researcher re-read the transcripts one by one and line by line, and then starts to put titles for relevant pieces found in transcripts and label similar ideas. This included words, sentences, description of activities and actions, and elaboration of ideas expressed by project managers. Their opinions and points of view were grouped based on relevancy to the research objective. The determination of relevancy to the research objectives were based on a group of criteria, such as the repetitiveness of a certain idea or point of view from many project managers. It is determined also by the contradictions between project managers in their points of view, relevancy to concepts and theories

found in the literature, or relevancy to the propositional framework of the current study. Relevancy is related also to something that was surprisingly found and adds to the expected associations among variables, or even more variables and determinants to the current study, and this leads to the discovery of emerging variables beyond the targeted ones (Dubey, 2014).

Next comes the stage of coding or indexing raw data to valuable groups of relevant titles. After, the researcher implemented the second stage of the systematic analysis of data coming from interviews, which is enhancing the conceptual patterns of relationships in the conceptual model of the research as a contribution over the previous research findings. The researcher started by reporting things as they are and then followed it with an unbiased interpretation procedure to come up with logic conceptual patterns of associations justified by primary data sources. After completing the stage of creating codes, then the stage of grouping codes to create categories started systematically. The researcher stayed close to the raw data to achieve objectivity of analysis and interpretation. This took the data to the abstracting level by conceptualizing it. The categories were then labelled, and a judgmental decision was made on their relevancy and how these categories are connected to each other. The categories and their main connections are then summarized as a conclusion of the qualitative research of the present study. The results represent the knowledge gained from the perspectives of the project managers on the project performance, knowledge creation, and project complexity. The importance of research variables is highlighted based on the qualitative analysis for drawing refined conceptual model for this research. The results are first placed and are followed by a discussion of the interpretation of these results and the reasons behind these results. The discussion includes comparing the results to the literature in relevant scientific journals and other theories and concepts in the field of project performance, knowledge creation, and complexity. To make sense of unstructured data, the researcher needed to add remarks to the discussion of results of qualitative research. (Bryman 2012).

The quantitative part of this study starts with the steps of creating measurements of research variables and illustrates the results of the pilot studies until the measurements reached an acceptable level of reliability and validity to start the data analysis. The quantitative analysis then starts with the descriptive statistics and explanation of the characteristics of the sample and simple statistics of crosstabulation,

frequencies, mean, and standard deviations. Normality tests and Cronbach's Alpha tests are also conducted to measure the reliability of the measurement of research constructs. The EFA follows this part and is confirmed by conducting cluster analysis to validate the measurement of research constructs. Next, the confirmatory factor analysis begins and is followed by the structural equation modelling analysis of moderation and mediation impacts of knowledge creation styles on the relationship between the project complexity and the project performance. After that, the triangulation of analysis is done by using the Hayes process analysis (2013) and the regression analysis and comparing the results of moderation and mediation, using different statistical analysis methods for higher validity of results. After that the research answers some prediction questions about the project performance using the complexity constructs and the significance of change in this prediction power after adding the knowledge creation styles impacts and whether or not there is a sequence of impacts of KCSs on the project performance. This part uses the hierarchal regression analysis.

4.11 Research Structure

The research begins with and introduction and is followed by the research aim and research objectives. The purpose of the literature review is to determine whether or not there are studies that have filled the same gap or solved the same problems. The literature review is followed with the research methodology and then data collection and validation. In addition, the research also includes the epistemology of designing research hypotheses and testing these hypotheses for single reality proposition. This kind of single reality data could be found only by empiricist analysis or by testing hypotheses. Statistical analysis of research hypotheses ensures the objectivity of the research. The method used here is a questionnaire to collect data about the relationships between research concepts. The literature review in this study shows the previous qualitative versus quantitative analysis approaches used to analyse the relationships among research variables. A gap in exploring styles of knowledge creation is found in the literature. Also, the use of these styles as moderators and/or mediators of the relationship between the

project complexity and the project performance is another gap. These gaps are determined based on the systematic critical literature review. Both propositional model and hypothetical model are designed to achieve the aim and objectives of this research. The literature review reveals the gap in the body of knowledge followed by the propositions and then hypotheses to be analysed based on primary data collected from project managers in the MENA region. After the analysis, the discussion indicate the similarities and contradictions between previous research and the findings of the current study with justifications and logical interpretations. Finally, the conclusion of the study explains the different stages in the research, its originality, and the significance of its contribution to the body of knowledge in the area of project management and knowledge management. The concluding chapter includes the implications of the research results on the project managers and on the projects implemented in the MENA region. The conclusion chapter is not only limited to the empirical implications but also to the theoretical ones as well.

4.12 Research Concepts, Operationalization, and Measurement

The qualitative study represents a basic source of creating a new measurement of research concepts such as knowledge creation styles or even customizing the measurement of project performance and project complexity. In deductive research, concepts of the current study are defined and derived from the social theories. Based on the social theory, the researcher designed the research questions and hypotheses, then defined the concepts relevant to the research questions. The concept in the inductive research emerges from the process of interviewing people not from the social theory. This merging between the inductive and deductive research approaches enables the researcher to create a new measurement of research concepts and to test its validity and reliability.

Concepts can have different meanings, and their meanings can change over time. Defining the concepts from the very beginning in the quantitative research structure helped in identifying what indicators can represent this concept and measure it correctly. First, the research started by choosing definitions of concepts of the research variables. The concept definition that best suits what the study aims to examine is relatively better than other less relevant concepts. The indicators coming from the qualitative research on these concepts are criteria for choosing the relatively more relevant concept definition. The present study is somehow multiple-concept.

4.13 Operationalization

Specifying measures to indicate a value of cases on research variables that correspond to research concepts is the operationalisation process of this study. Operationalisation is derived from the literature together with the validated results of interviewing 101 project managers. The purpose is to construct questions to measure the research concepts. Multiple items or questions are used to measure each research concept. The definitions of research variables and concepts are derived from the primary data coming from the interviews with the project managers and its analysis and validated results. This is the reason behind conducting the qualitative research before the quantitative one, as it facilitated the process of the creation of new measurements for the research concepts. The qualitative outputs are compared to the outputs of the systematic review of the literature in the body of knowledge before creating the measurements of the research variables at the beginning of the quantitative study.

This is a mixed-method research that includes both qualitative and quantitative methods. The qualitative research includes collecting data through semi-structured interviews with project managers. The quantitative research includes a questionnaire that is analysed quantitatively about the styles of project managers when creating knowledge. Another quantitative tool will determine the level of project complexity based on the criteria found by Vidal (2011). For

knowledge creation styles, measurements are adapted gradually from the literature and the outputs of the qualitative study, and then are validated by judgement of experts and pilot studies results. The same was applied on the measurement of project performance with less need for modifications as the main part comes from the previous studies measurements of project performance, and the researcher used pilot studies results to find the measurements of project performance that are suitable for different types of projects that are sampled. The challenge in creating the measurement of the project performance is that in the literature, the measurement of project performance has certain criteria that differ based on the type and the field of the projects, it is important to choose the project performance measurement criteria that fits in with all sampled projects.

The qualitative study goes beyond the quantitative one in that it inquiries about the stability and instability of project performance. The reason of adding this part to the qualitative study is that it may be related to the knowledge creation process and its impact on the project performance success, but it is subjective to time and, maybe, to add this dimension to the quantitative study, it has to be conducted using longitudinal approach rather than a cross-sectional one. Due to time constraints, the qualitative part of the study covers this part of stability and instability of the project performance and how project managers interact with it to add value to the current research and then pave the way for studying it quantitatively in future research.

Before starting the qualitative research on stability versus instability of project performance and its relationship with the project managers' knowledge creation, a research was conducted using the literature. The following table summarises the findings of this research from which the interview points in the qualitative study were derived.

Figure 4.1 Discussion points in the literature about instability and stability

Interview points of discussion with interviewees of the study	Source from the literature	Indicator of stability versus instability of performance
Flexibility of introducing changes based on changes in customer's needs and wants	Geraldi 2009	Instability
Importance of rules and regulations when making decisions (bureaucratization)	Geraldi 2009	Stability
Consciousness of reasons of instability in project performance	Cynefin 2009	Stability
Importance of standardization of work	Wang 2010	Stability
Ambiguity of the needed knowledge to adjust standards	Wang 2010	Instability
Flexibility in changing structures, schedules, and budget	Batra 2010	Instability
Degree of control over performance time (*)	Burness 2004	Stability for high degree
Availability of innovative performance	Burness 2004	Instability
Ability to explain what knowledge can lead to change in project performance	Cynefin 2009	Stability
Frequency of randomness and irregularity in control charts (*)	Briggs & Peat 2000	Instability
Frequency of dealing with unpredictable randomness (*)	Burness 2004	Instability
In-availability of knowledge to raise level of control	DeMeyer 2006	Instability
Preference of higher level of stability	Xsun & Cheng 2012	Stability
Preference of higher levels of instability in innovation	Xsun & Cheng 2012	Instability
Hardiness of forecasting future performance indicators	Tolentino & Ruiz 2015	Instability

Source: created by the researcher from the literature review.

(*) the shaded cells in the table show relationship to the performance control and deviation - adopted

from the literature

The contributions of Burness, Briggs and Peat relate the project performance stability to the performance control. Performance control is a comparison process between the actual performance and the planned one to find if there are deviations and if there are needed corrective actions or not. Consequently, less corrective actions may reflect better performance stability. This is the reason why the researcher believes there is a new concept behind this relationship which may be called the contro-stability of project performance. This new concept may be defined as the level of conformance between the planned performance and the actual one that leads to less corrective actions and, thus, an increase in the stability of the project performance. This relationship is important because some non-conformance cases are desirable. As it is indicated in the literature, consuming less time in the project implementation is desirable because it means less cost and consequently more profits, so no corrective actions are needed. In other cases, saving time may save money but may, in turn, affect the conformance in quality level. Therefore, this may lead to delivering less safety product to the customer whose satisfaction decreases. As a result, corrective action is needed.

The researcher uses the previous discussion points in the semi-structured interviews with project managers to support the results found by the analysis of performance contro-stability indicators. As a conclusion, the researcher is planning to conduct a mixed-method research to find the level control that leads to stability in the project performance. Contro-stability needs further research from a quantitative point of view because of the effect on time on stability of performance.

4.14 The items that were used to measure performance control

- 1- The percentage of the out-of-budget cost relative to the planned cost is
- 2- The percentage of the raw material cost relative to the total cost in the current project is
- 3- The percentage of returns on investment of the current project is
- 4- The percentage of resource utilization variance to plan in the current project is
- 5- The percentage of cost savings in the current project is

- 6- The percentage of variance between planned raw material costs and actual raw material costs is
- 7- The average cost/hour for the current project is
- 8- Current Project Cost is
- 9- The percentage of cost variance to plan in the current project is
- 10- The percentage of number of milestones missed relative to number of milestones planned in the current project is
- 11- The percentage of profit per employee's costs in the current project is
- 12- The average percentage of working hours per month in the current project is
- 13- The average percentage of downtime to the total working time per day in the current project is
- 14- The percentage of successful phase exit against milestones planned in the current project is
- 15- The percentage of errors detected during design and process reviews in the current project is
- 16- The percentage of customer satisfaction up to the current stage of the current project is
- 17- The percentage of rework time in the current project is
- 18- The number of training courses provided for the project manager of the current project is
- 19- The defect rate in the current project is
- 20- The planning time needed for the current project is
- 21- The project actual cycle time against the planned cycle time is
- 22- The number of days needed to supply the main resource in the current project is
- 23- The main resource waiting time in the current project is
- 24- The percentage of overtime in the current project is
- 25- The dollar value of time variance in the current project is

- 26- The percentage of cost savings due to early delivery in the current project is
- 27- The average time required to process a request for corrective action in the current project is

The following table shows the scale of measuring each one with the coding of intervals and

justification of this coding:

r			
Item		Coding	Justification
1-	The percentage of the out of budget cost relative to the planned cost is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher =1	The lower the cost is the better as long as the goals are achieved
2-	The percentage of the raw material's cost relative to the total cost in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower is the percentage of the raw material cost relative to the total cost is the better as long as the goal is achieved
3-	The percentage of returns on investment of the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher =5	The higher the ROI is the better
4-	The percentage of resource utilization variance to plan in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower the utilization is the better as long as the goals are achieved
5-	The percentage of cost savings in the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher cost savings in the better as long as the goals are achieved
6-	The percentage of variance between planned raw material costs and actual raw material costs is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower the variance is the better
7-	The average cost / hour for the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower the average cost is the better as long as the goals are achieved
8-	Current Project Cost is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher =1	The lower the project cost is the better as long as the goal is achieved

Figure 4.2 Scale of measurement, coding and justification of coding of project performance items

9- The percentage of cost variance to plan in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower is the variance the better as long as the goal is achieved
10- The percentage of number of milestones missed relative to number of milestones planned in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower number of missed milestones is the better
11- The percentage of profit per employees' costsin the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher the profit per employee is the better
12- The average percentage of working hours per month in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower number of working hours is the better as long as the goal is achieved
13- The average percentage of downtime to the total working time per day in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower downtime is the better because it is affecting the cost of the project and as long as the goal is achieved
14- The Percentage of successful phase exit against milestones planned in the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher percentage of successful phase exit against milestones planned is the better
15- The percentage of errors detected during design and process reviews in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower number of errors detected during design and process reviews is the better because detecting more errors increases the cost.
16- The percentage of customer satisfaction up to the current stage of the current project is	Lower = 1 Slightly lower =2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher the customer satisfaction is the better
17- The percentage of rework time in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower is the percentage of the rework time is the better because it affects the cost of the project negatively
18- The number of training courses provided for the project manager of the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher the number of training courses is the better because it affects the project performance positively
19- The defect rate in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2	The lower the defect rate is the better

	Higher $= 1$	
20- The planning time needed for the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less the planning time is the better as long as the goal is achieved
21- The project actual cycle time against the planned cycle time is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less actual time is the better because it saves project cost
22- The number of days needed to supply the main resource in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less the number of days needed to supply the main resource is the better because it saves time and cost
23- The main resource waiting time in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less resources waiting time is the better because it saves cost
24- The percentage of overtime in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less percentage of overtime is the better because it saves cost
25- The dollar value of time variance in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less the variance in the dollar value is the better for performance and cost stability
26- The percentage of cost savings due to early delivery in the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher cost savings due to early delivery is the better as long as the goal is achieved
27- The average time required to process a request for corrective action in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less the average time required to process a request for corrective action is the better for performance stability

4.15 The items that were used to measure project complexity

The researcher adapted the measurement of project complexity from Vidal's approach (2011, P.723) of finding the scale of complexity for organisational projects. The researcher is not interested in comparable complexity and the use of a constant sum for complexity on the level of each organisation because the current study is measuring only one project from each organisation for the reasons explained earlier in this chapter. The technology complexity

dimension is excluded from the current study measurement of complexity as it does not apply to all sampled projects.

Vidal used the Analytic Hierarchy Process that was introduced by Saaty (1977, 1980, 1990). In this method, Vidal found 4 criteria for measuring complexity.

C1: Project Size

C2: Project Variety

C3: Project Interdependencies

C4: Project - Context - Dependence.

The four criteria are applied to the sampled projects in the quantitative study of the present research. According to Vidal, for each criterion there are sub-criteria.

4.16 Quantitative and qualitative measurement of knowledge creation styles

The researcher uses a questionnaire of a 5-point Likert scale to measure the different proposed styles of knowledge creation that were discussed earlier in the literature review and analysed in the qualitative study. The items of the questionnaire are derived from the previous researchers and validated results of qualitative research. The following table shows the primary sources of creating the knowledge creation styles before conducting the qualitative study. These primary sources are then refined by more resources from the literature, by the results of the qualitative study, and the results of pilot studies, and are illustrated in the quantitative study chapter in details.

#	Items of Experiential KC style	Adapted from the literature
1	Using the performance in the past as a source to create knowledge	Bunderson & Suttcliff, 2003.

Figure 4.3 Primary sources of deriving the KCS questionnaire items from the literature review

2	Depending on experimentation during the occurrence of change to create	Cynefin, 2009
	kilowledge	
3	Using the experience of the other people to create knowledge or to connect pieces of knowledge	Fryer, 2008
4	Using know-what and know-how to control performance	Arumugam, 2013
5	Using social networks to learn and create new knowledge	Berkeley, 2010
6	Using experience as a source of learning	Haleblian, Kim, & Rajagopalan, 2006
7	Using experience as a source of familiarization with change	Grantcharov 2003
#	Items of Specialized KC style	Adapted from the literature
1	Pushing the creation of knowledge to lower levels	DeMacro, 2006
2	Believe in the need to depend on more diversified specializations to pass the chaotic situation successfully	DeMacro, 2006
3	Believe that the project manager's specialization affects his or her goal achieving performance	John, 2003
4	Believe that there is a relationship between the education of the project manager and the project management process	Bonaccorci & Daraio, 2007
5	Believe that reaching innovative solutions for complexity and chaotic performance is related to specialized education	Thomas & Mengel, 2008
6	Believe the it is better to create knowledge by making use of the diversified specializations of the team work members	DeMacro, 2006
#	Risk-Averse KC style	Adapted from the literature
1	Depending more on explicit stored knowledge for creating new knowledge	Milton & Ramsfield, 2011

2	Believe that actionable knowledge zone leads to ordinary performance	DeMeyer & Pich, 2009
3	Tendency to keep contingency reserve for dealing with expected risks	DeMeyer & Pich, 2009
4	Believe that the project manager needs to create knowledge about the existence of risks not only expected risks	Grey, 2014
5	Believe that risk antagonism is important even if we don't know what and how risks are affecting performance	Grey, 2014
6	Believe that risk controllers are seeking higher levels of control over their projects as a goal	Leitch, 2008
7	Believe that psychological safety affects knowing how and performance	Arumugan, 2013
#	Innovative KC style	Adapted from the literature
1	New knowledge is related to innovation	Leonardo, 2011
2	Believe in depending on intellectual properties to achieve innovative performance	Berkeley, 2010
3	Believe in high sensitivity and in finding quick changing plans for unexpected changes that has very low probability to be repeated in the future	Berkeley, 2010
4	Tendency toward innovative coping with instability	DeMacro, 2006
5	Believe that innovation leads to better adaptation with chaotic changes in performance and better competition	Linstone & Turoff, 2010
6	Dominance of using tacit assets more than explicit assets for creating new knowledge	Yi & Baizhou, 2013
7	Competitors are the most important source of creating new knowledge	Yi & Baizhou, 2013
8	Innovative human assets are sources for creating new knowledge	Berkeley, 2010

Source: created by the researcher – Adapted from the literature.

According to the above table, the researcher was able to design a questionnaire that is directed to the project managers to know about their knowledge creation style.

Based on the results of the pilot studies, the respondents prefer the design of the statement to represent them when they speak about themselves such as saying (I believe so and so). Some sentences are designed to be positive, while others are designed to be negative. This will help in discovering the respondents' honesty in answering the questionnaire. The respondents' inability and unwillingness to answer the questions are checked, and the survey was shortened to make it less time-consuming for each respondent (20 to 30 minutes maximum) and the time consumed after modification was checked during the conducting of pilot studies.

This positive and negative formulation of the items in the survey design are considered during the coding of the items of the questionnaire before analysis. The questionnaire is sent to professors in the field of KM and PM for judgment. Any modifications thereof are made accordingly. Then, a pilot study on 10 project managers was implemented to discover the reliability of the items in measuring each KC style. When this questionnaire was ready, the researcher tested the normality of data, and Cronbach Apha test was conducted. The data did not show positive results for normality. However, the normality tests are still possible to be conducted on the sample due to its large size, as indicated in the quantitative chapter of this study.

After preparing the data collection instrument and testing its validity and reliability, data is collected and documented, and then analysed as shown in the quantitative study chapter of the current study.

4.17 Ethical Considerations of the Research

The first ethical consideration for conducting this research is that it does not cause any harm to any party during or after its implementation. The researcher assures the confidentiality of the

information gathered before starting the process of gathering that information. The research also declares the purpose and the problem of this research to the interviewees and respondents.

The researcher identifies the parties involved in this research and discloses the objectives and main purpose of the research to the parties involved. After completion of the research, a summary of results will be communicated to the project managers involved in the data collection process as a token of appreciation for the time and effort they have spared to participate in the survey. In addition to the summary of results, the main recommendations will also be communicated to the project managers to achieve the mission of contributing to the field of application of the present study. The operationalization and implications of these recommendations will then be advised within the contexts of the project manager's organisations, and the researcher may continue to investigate more and more about the knowledge creation in the field of project management during this phase.

The researcher makes sure that ethical aspects of the study are met by avoiding any kind of plagiarism during the thesis writing and that any reference used during the study is mentioned clearly in the list of references to protect the intellectual properties rights of the other authors in the field.

The academic writing style and format is too one of the ethical and professional concerns of submitting this thesis. Following the BUiD style of referencing and formatting is another condition to comply with. Accordingly, the training sessions on this matter and training for preparation for the viva-voce are done on time to conform to the educational standards of the British University in Dubai.

Given time and energy constraints, the researcher acknowledges all research limitations of the current study in the thesis and even suggestions for further research. Limitations are not a weakness in the research; rather, they are ethical considerations as well as borders of the window

from which the results of the research will be seen and assessed accordingly. A consent to share the primary data needed for the study is given to interviewees and respondents before the qualitative and quantitative studies as an ethical consideration. Formal approval from BUiD to start the data collection is also collected as another important ethical consideration.

4.18 Limitations

The following are the limitations of the current study to be considered when assessing the value of the study and its results and contributions.

The study is limited to the data collected during the period of cross-sectional sampling not before or after that period.

All psychological, economic, political, social, and cultural aspects of the project managers' personalities and context changes that have a relationship with the research variables are excluded from this study and considered as constants to facilitate the interpretation of the moderation and mediation impacts of the KCSs on the relationship between the project complexity and the project performance.

The research is also limited to the projects managed by one person and excludes the impacts of project teams or other less responsible members in the team of project management.

A final limitation of the research is that it is confined to the small- and medium-sized projects in the MENA region.

4.19 Accessibility Issues

The researcher applied the research on project managers in different projects and in different organisations, whatever the country or the field in which the project is operating. No specific industry is excluded and no specific sector in which the project is functioning or for which the final product of the project is delivered is excluded. This means that there no frame is available for the population of the study. Access to the data is based on the simple random sampling from

all project managers in the MENA region. Project managers are found through organisational web-sites on the Internet. Any project based-company has an online website and was contacted to find only one project manager and to ask him or her about only one project under his leadership.

4.20 Chapter summary

This chapter presents the outline of the whole study and links the objectives of the research to their interview points and hypotheses as well as the suitable methodology and data collection methods needed to achieve the research objectives. The following table illustrates the research questions, approach to answer each research question, analysis methods, interview points, and hypotheses analysed.

Figure 4.4 Linking the research questions to the numbers of interview points and hypotheses in qualitative and quantitative studies

Research main questions	Approach to answer research	# Interview	# Hypotheses
	questions	points	tested
		analysed	
What is the comparative importance and preferences of	Qualitative approach Critical	1-5	
using knowledge creation assets for achieving	case study analysis		
performance success?			
What are the reasons behind deviations in project	Qualitative approach Critical	6-11	
performance?	case study analysis		
What are the characteristics of the stability or instability	Qualitative approach Critical	12-14	
of project performance?	case study analysis		
		15.00	
How does knowledge creation associate with project	Qualitative approach Critical	15-20	
performance?	case study analysis		

How does project complexity associate with project		21-22	
performance?			
Which knowledge creation styles mediate the	Quantitative approach: EFA,		Н1-Н2-Н3
project performance?	CFA, SEM, Regression, Hayes		
	(2013)		
Which knowledge creation styles moderate the relationship between the project complexity and the	Regression analysis, Hayes		H4-H5
project performance?	Process (2013) analysis, SEM		
Which knowledge creation styles moderate the	Regression analysis, Hayes		H6-H7-H8-H9-
relationships between the complexity sub-constructs and	Process (2013) analysis, SEM		H10-H11-H12-
the performance sub-constructs?			H13-H14-H15-
			H16-H17-H18-
			H19-H20
Which knowledge creation styles mediate the	Regression analysis, Hayes		H21-H22-H23
relationships between the complexity sub-constructs and	Process (2013) analysis, SEM		
the performance sub-constructs?			
What independent factors predict what dependent	Regression analysis		H24-H25-H26
factors of the study?			
Does the prediction power significantly change after adding the knowledge creation style variables to the prediction model?	Hierarchical analysis		H27-H28-H29
What knowledge creation styles predict the project	SEM and regression analysis		H30-H31
performance?			
What hierarchical relationships between KCSs	Hierarchical regression analysis		Н32-Н33
significantly exist to determine the change in the project			
performance?			
How do KCSs impact the relationship between	Hierarchical regression		Н34-Н35-Н36-Н37
complexity and performance?			

Source: created by the research in light of relevance of current research analysis to the previous research analysis in the field of project management.

The following chapter discusses the results of data analysis of qualitative and quantitative data collected during the research sampling period.

Chapter Five: Results - Qualitative

5.1 Introduction

To be able to conceptualize the proposed relationships in this study in light of the systematic literature review, the following graph shows the main proposed associations among research variables and sub-variables:



Figure 5.1 Summarized conceptual framework of the study

The study suggests that the dimensions of the project complexity have a qualitative association with the project performance dimensions.



Figure 5.2 The possible associations on the level of sub-constructs of research variables

The study also suggests that the four proposed knowledge creation styles have a qualitative association with the project performance dimensions.



Figure 5.3 The possible associations between KCSs and project performance

The qualitative study then analyses the relative importance of the proposed knowledge creation styles to the achievement of the performance stability under control.

The research proposes variations among project managers in prioritizing the usage of innovative knowledge creation style over the usage of risk averse knowledge creation styles in contributing to conformance to the planned performance (Sultan, 2013) (Wagner, 2016)



Figure 5.4 Project managers prefer one style more than another (IKCS & RAKCS)

The research proposes variations among project managers in prioritizing the usage of experiential knowledge creation style over the usage of specialization and educational knowledge creation styles in contributing to conformance to the planned performance.



Figure 5.5 Project managers prefer one style more than another (IKCS & RAKCS)

The study again proposes that there are two contradicting points of view about the association between the project complexity and the conformance to the planned performance.



Figure 5.6 Direct relationship between project complexity and project performance

The project complexity in some cases has an association with the conformance to the planned performance and in other cases does not have this association. The quantitative research follows

the qualitative one to determine the role of the proposed knowledge creation styles in identifying this association between the project complexity and the project performance and explaining it.

5.2 Propositions of the Qualitative Study and background about the sample characteristics

The study suggests that the dimensions of the project complexity may or may not have a qualitative association with the project performance dimensions, namely cost, productivity, time, and quality. The study also proposes that project managers can be classified into four proposed knowledge creation styles qualitatively. These styles are proposed to have qualitative association with the project performance dimensions. The study also proposes that the proposed knowledge creation styles are qualitatively associated with the dimensions of the project complexity.

As a conclusion, the purpose of the qualitative study is to find qualitative associations between all variables of the research model.

The purpose of the research is to analyse these associations among research variables and also to analyse the relationships among the same variables in the same directions quantitatively. This is the reason why this research adopts a mixed-method approach, especially that the number of mixed-method research in the field of the relationship between project complexity and project performance is relatively small. This has been noted after revising the literature in the *International Journal of Project Management* and the *Project Management Journal* across a five-year span (from 2014 to 2018). The following graph illustrates the derived relationships in the propositional framework of this research based on the previous conceptual framework:



Figure 5.7 Propositional framework of proposed associations among research variables

In this propositional framework, there are four proposed styles of project managers when describing how project managers create new knowledge. The propositional framework is related to the qualitative part of this study. The propositional framework proposes that there are qualitative differences between knowledge creation styles. From the respondents of the research sample, the possible traits that distinguish between styles of knowledge creation and the behaviours related to each style are illustrated. Then the propositional framework relates the level of project complexity to the project performance using the knowledge creation styles as a moderator for this relationship. The purpose of this propositional framework is to answer the research main questions qualitatively.

Table 5.8 shows the propositions of the qualitative study and the questions used to test these propositions:

Project managers tend to prefer	Project managers deal with	Projects in the MENA region	There is association	There is association
certain KCS over another one.	deviations between planned	vary in their level	between PP and KC	between PP and PC

Figure 5.8 Linking propositions of the qualitative study to the interview questions

	performance and actual one	of stability and instability		
What is the comparative importance of each style of knowledge creation from the point of view of project managers?	How did you deal with unexpected problems in your project?	Do you consider the performance of the current project a stable one and why?	When do you prefer to create new knowledge; during stability or during instability of your project performance?	Do you believe that the level of complexity of the project affects its performance? Why?
Why do you think that experience is more important than the education for the success of the project?	What are the reasons behind deviations between actual and planned performance indicators	What are the main reasons behind the instability of the project performance?	How does the new knowledge creation affect your project performance?	Do you believe that the level of complexity does not affect its performance? Why?
Why do you think that education is more important than the experience for the success of the project?	Why does the actual cost exceed the expected one?	In which aspects of the project performance do you as a project manager accept instability?	How does your personal experience affect your project performance?	
Is it more important to have low risk project performance than to have innovative project performance?	Why does the actual profit become less than the planned one?		How does risk management and taking possible precautions affect your project performance?	
Is it more important to have innovative project performance than having low risk project performance?	What are the reasons behind deviation between the planned time of the project and the actual one?		How does specialization and certification in project management affect your project performance?	
	Do you expect the real time needed to implement the current project will be longer or shorter than planned? And why?		How does innovating ideas affect your project performance?	

Source: Created by the researcher.

To be able to achieve the qualitative research objectives the following description in table no. 5.9 illustrates the sample characteristics before going through the findings of the qualitative study:

Current education Level "Minor"	Which part\s of the project are you managing?	What is the category of number of workers in this project?	The customer of this project is	What is the final product of this project?
			Public sector	
			business	Delivering Cyber
Management	All	10 to 50 workers	customer	security systems
			Public sector	
Business		less than 10	business	Banking software
Administration	All	workers	customer	programming
			Mixed sector	
	Consulting and	100 1 500 1	business	Customer satisfaction
Accounting	training R&D	100 to 500 workers	customer	and financial results
			Private	
Computor			sector	
Sciences	A11	10 to 50 workers	business	Papking SM/ Product
Sciences	All	10 to 50 workers	Driveto	Ballking SVV Product
			rivale	
			business	
Bachelor	all nartied	10 to 50 workers	customer	Banking products
Courses for		10 10 50 WORKERS	customer	Tower (1 basements
managements				+Ground + 40 Typical
and			Public sector	flats+ dunlix +
Engineering		more than 500	husiness	Roof+TopRoof) at
purpose	Executiing	workers	customer	Dubai Marian
Park Para			Private	
			sector	
			business	
Civil	Construction	51 to 100 workers	customer	Mall

Figure 5.9 demographic description of the qualitative sample
	Planning,			
	Implementing,	less than 10	Individual	Online Insurance
N/A	Controling	workers	customer	Portal
			Private	
			sector	
		less than 10	business	Network upgrade,
Electrical	PMO	workers	customer	SDLC, ERP Oracle BS
			Public sector	
	design, planning and		business	
bachelor	monitoring	10 to 50 workers	customer	system
			Other	
			departments	
	General		in my	
	management	10 to 50 workers	company	Software
Masters of				
Business	Managerial	100 10 500 100	Individual	Manufacturing food
Administration	tunctions	100 to 500 workers	customer	раскадеѕ
			Wixed sector	Customer convice
	Delivery	10 to 50 workers	business	customer service
	Delivery	10 to 50 workers	Drivete	аррисации
			Private	
	DM and recourse	loss than 10	business	
	Pivi allu resource	workers	business	Application
	manager	WUIKEIS	Drivato	Аррисации
			sector	Core Banking /
Bsc Computer			husiness	Islamic hanking
engineering	All	10 to 50 workers	customer	solutions
chancering	All the project	10 10 50 Workers	Mixed sector	
	(arch.elec.mech.fir		business	Excellent security
Engineering	e Fighting)	51 to 100 workers	customer	systems
			Mixed sector	
			business	
Engineering	project deliverable	10 to 50 workers	customer	automation
			Public sector	
Computer			business	
Engineering	Project Coordinators	10 to 50 workers	customer	Computer Software
			Public sector	
			business	national plan and
Business	All	100 to 500 workers	customer	implementation
			Mixed sector	
		less than 10	business	Network traffic
Bachelor	Implementation	workers	customer	optimization
	Requirement			
	analysis, Planning,			ATM integration with
Bachelor	Implementation and			a Bank Switch (Back
Degree	Testing	10 to 50 workers	Bank	office System)

			Mixed sector	
Bachelor of		less than 10	business	
Commerce	Project coordinator	workers	customer	Electric wires
			Mixed sector	
			husiness	
Msc inmedicine	excution	10 to 50 workers	customer	medical equinment
ivise infredience		10 10 50 Workers	customer	Material
			Mixed sector	management
	Full project: Leading	less than 10	husiness	nrogram and
Business admin	the team	workers	customer	implementation
Dusiness durini		Workers	Internal	implementation
CIS	All	10 to 50 workers	customer	Web application
	Time cost quality	10 10 50 Workers	Public sector	
	stallholders and	less than 10	husiness	
Commerce	communication	workers	customer	Web application
commerce	communication	WORKETS	customer	
			Public sector	
Computer		less than 10	business	
science	All	workers	customer	Consulting works
			Mixed sector	
			business	
CIS	All	51 to 100 workers	customer	SW
			Mixed sector	
Bachelor	Monitoring &		business	
Degree	Controlling	10 to 50 workers	customer	Banking Solution
			Public sector	
			business	
CIS	All	10 to 50 workers	customer	Software Product
			Public sector	
			business	System for
CIS	All PM activities	10 to 50 workers	customer	government entity
			Private	
			sector	
Business	Development and	less than 10	business	
Administration	Implementation	workers	customer	Legal/HR/Pharma
Bachelor				
Degree in			Private	
Electronics and			sector	Telecommunications
Communicatio			business	towers full turnkey
n engineering	The whole Project	10 to 50 workers	customer	solution
			Private	
			sector	
Project		less than 10	business	Implemented
management	UAT	workers	customer	software solution
Fuculty of			Mixed sector	
commerce	Development scope		business	deliver scope of
,PMP	/ UAT / Production	10 to 50 workers	customer	software,

				implementation of
				software
			Mixed sector	
			business	
University	whole project	10 to 50 workers	customer	Application
			Mixed sector	
			business	
University	whole project	10 to 50 workers	customer	Application
			Public sector	
Computer			business	
Science	Full implementation	10 to 50 workers	customer	Service
			Private	
			sector	
		less than 10	business	Budgeting and
Math	Budget	workers	customer	Planning
			Private	
			sector	
		less than 10	business	Construction
	Engineering	workers	customer	drawings
			Public sector	
		less than 10	business	
		workers	customer	
	I am the senior		Public sector	Training the public
Project	manager of the		business	sector on using latest
management	project	100 to 500 workers	customer	technology
			Mixed sector	
		less than 10	business	
	Sales & Marketing	workers	customer	Exhibition
	Selling exhibition			
	space -stands /			
	Communication /		Mixed sector	Universities and
	coordinating	less than 10	business	Colleges admission
University	sponsorship	workers	customer	services
			Mixed sector	
		less than 10	business	
College	Academic	workers	customer	Educational
			Private	
	I am the only		sector	Information system
System	manager of the		business	for a private sector
dynamics	project	10 to 50 workers	customer	company
	I am the manager of			
	the project	51 to 100 workers	Banks	Information system
			Public sector	
			business	
Management	lt	100 to 500 workers	customer	ERP system
	All parts of the			
	project (Design-		Mixed sector	
	Planning-		business	
Master	Implementation)	51 to 100 workers	customer	Multi-story Building

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engineering Execution sector profitable buildings	Architecture		100 to 500 workers	Private	constructions and
	engineering	Execution		sector	profitable buildings

Civil				
engineering	Cost control	100 to 500 workers	Public sector	Building
				a basement, three
Civil			Private	floors, and 10 car
engineering	The whole project	100 to 500 workers	sector	parking areas
Management				
of engineering	Managing the whole			Safeer tower, 5
projects	project	100 to 500 workers	Public sector	parking, and 15 floors
Management				one villa consisting of
of engineering	Managing the whole		Private	a basement and one
projects	project	100 to 500 workers	sector	floor
				Installation of
Business				external boards for
administration	Executive manager	10 to 50 workers	Public sector	the ministry of labor
		less than 10		
Commerce	Human Resources	workers	Public sector	Highly trained leaders
	Decoration and			a big caravan 80
	paravanes	less than 10		meters Hight and 24
Engineering	constructions	workers	Public sector	meters width
		100 to 500 workers		building steel and
			Private	aluminum wall 180
Engineering	Cul-set alumenium		sector	meters Hight
		100 to 500 workers		installation of stands
Decoration				for the directorate of
engineering	Decoration		Public sector	cultures in Sharjah
Business	Transportation	100 to 500 workers	Private	manufacturing ready
administration	management		sector	concretes
	building data bases			achieving profits in
Marketing	and marketing			the field of
management	websites	10 to 50 workers	Public sector	transportation
0				buildings and
		less than 10	Private	profitable
Architecture	execution	workers	sector	constructions
		100 to 500 workers		buildings and
			Private	profitable
Bachelor	execution		sector	constructions
		100 to 500 workers		Buildings and
			Private	profitable
bachelor	execution		sector	constructions
bachelor	execution	100 to 500 workers	Public sector	producing a medicine
bachelor in		less than 10	Private	p
Science	execution	workers	sector	commerce
Bachelor in				
Business			Private	
Administrative	execution	10 to 50 workers	sector	achieving profits
Bachelor in	manager of the	less than 10	Private	
Business	whole project	workers	sector	achieving profits
Bachelor in		less than 10	Private	
Civil engineer	All	workers	sector	achieving profits
	· ···	Workers	50000	

Bachelor in	the owner of the	less than 10	Private	to bring in new ideas
Business	company	workers	sector	to the environment
		less than 10	Private	
bachelor	df	workers	sector	40000 dollars profit
Bachelor in		less than 10	Private	Updating the bank
MBM	All	workers	sector	system
		less than 10	Private	
engineer	system control	workers	sector	system integrations
		less than 10	Private	
bachelor	execution	workers	sector	achieving profits
Bachelor in		less than 10	Private	
Civil engineer	All	workers	sector	Building
Bachelor in		100 to 500 workers	Private	
Engineering	All Around		sector	residential building
		100 to 500 workers		a building consisting
Bachelor in			Private	of a basement and
Civil engineer	All		sector	two floors
Bachelor in		100 to 500 workers	Private	
Engineering	All over		sector	residential building
Bachelor in		100 to 500 workers	Private	
Civil engineer	All		sector	Centre
financing	All Around	100 to 500 workers	Public sector	football field
Bachelor in		100 to 500 workers	Public sector	
Civil engineer	All			Tower
Bachelor in		100 to 500 workers	Public sector	
Business	all over			continental towers
Bachelor in		100 to 500 workers	Public sector	
Civil engineer	All Around			residential building

Table 5.9 illustrates the diversification of sectors, sizes of projects, final products and deliverables, and educational backgrounds as well as roles of selected project managers in the picked sample. This diversification increases the representation of all variations and hence increases the reliability on this sample.

For validity of qualitative data, the appendix 7 includes the quotes of respondents and how these quotes are linked to the theme of the current study. The designing of the qualitative questions of interviews are derived from the conceptual model concluded from the literature review and gives a room for finding emerging constructs in the field of data collection.

Data collection technique was based on appointments for 30 minutes on average. The starting of the interview was by explaining the objectives of the interview and asking for a consent from

interviewees. Video meetings on Skype were used to collect interview data and a permission to audio record the interviews was given by more than half of the sample. For the rest of interviewees notes taking was the possible method of collecting interviews' qualitative answers. Semi- structures interviews were used to reflect the deep experience of project managers and to give them a chance to elaborate more within the theme of the research.

Regarding the process of data analysis, the researcher used systematic analysis of interview quotes and linked the found indicators to the literature findings and refined the research model accordingly.

To increase the validity and reliability of qualitative data, grouping similar answers to qualitative questions and using empathy to reflect on the project managers feelings and thoughts as well as actions uncovered the research constructs as well as the justifications of the choices of project managers in the sample and the frequency of responses increases the validity and reliability of qualitative results findings. Same questions were asked to all interviewees without any differences in giving further elaboration to some of them more than others. Also, a trial of showing interview questions to 5 professors in the field of science and modifying questions based on their feedback increases the validity of the qualitative data collected.

5.3 Findings of the Qualitative Study

There is an evidence that the four proposed knowledge creation style exist in the sample of this study. The project manager may have more than one style or may use different styles and may change the style of knowledge creation due to interaction with the upper management policies. All project managers described an effect of knowledge creation on the project performance. Planning, accuracy of estimation, quality of technical work, reduction of effort, cost, and time,

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goal setting and productivity are possible areas where the effect of knowledge creation appears in the project performance. Sources and targets of knowledge creation are not the same. The main source of knowledge for innovative style is the marketplace. The main source for knowledge creation for the risk averse style is mistakes and previous estimation records. The main resource of knowledge for experiential style is the work experience itself. The main source of knowledge for the specialist knowledge creation style is the latest techniques in the body of knowledge collected by training and educational certificates. Targets of knowledge creation are not the same among the different styles of knowledge creation. The target in case of innovation is to find new mechanisms of performance in a way that affects the final product of the project. The target for risk averse is to reach better estimation for future variables. The target for expert style is organisational learning and the target for the specialist style is to apply the best practice. *Styles of knowledge creation*

In the following part of the study, the purpose is to elaborate more on each style of knowledge creation based on the qualitative data gathered from the qualitative study sample, which is equal to 101 project managers who come from different countries within the MENA region, as explained in the sampling section of the research strategy chapter.

Experiential Knowledge Creation Style,

Experiential project managers do not see themselves having common points with the innovative and the specialized styles of knowledge creation. Rather, they are more related to the risk averse knowledge creation style. They think that they are experienced and have better skills of risk management because they have learnt from previously committed mistakes. The main skills that link the experiential style to the risk averse style are communication skills. Experiential project managers see themselves as more inclined towards dealing with unexpected issues and more successful when working on projects similar to the project that the manager has encountered in previous implementations. As to the complexity of the project, experiential managers are more disposed towards dealing with larger size of stakeholders because of their relatively stronger communication skills. They are more experienced in working with minimum resources and with the best allocation of such resources. They are concerned with the preparation of the environment before starting the project execution. They can control conflicts of interdependency because of their experience. All these aspects enable the experiential manager to deal with the complexity of the project. With respect to the quality of performance, experiential managers see themselves as more capable of planning, putting managerial and technical checkpoints, discovering performance deviations early and solving it, and expecting the sudden requirements of the stakeholders. As for the time dimension of performance success, they can meet deadlines, implement the project as scheduled, eliminate time waste, work relatively faster and find alternative solutions and higher percentage of utilization of resources without impacting time. Concerning cost, they can preventively fix the deviations in cost by providing wise solutions. Finally, as to productivity, experiential project managers can check the progress of operational processing and minimize the inputs to the production process by having the optimal use and allocation of resources.

Risk Averse Knowledge Creation Style,

Risk averse knowledge creation style takes all the possible precautions when there is decrease in demand, increase in supply, and lack of development. This style affects the safety of the performance during implementation and the safety of the final product of the project to be delivered to the customer. These managers spend nearly 50% of their time in risk management activities and even random irresistible crisis. They try to control the likely occurrence an event occurring and the magnitude of its impact. Quick decisions are the highest risks in project management from their point of view. Risk averse managers are concerned with managing risks to save time and money; however, they may need extra time to manage risks. They believe that spending extra time on risk management activities will lessen the number and the impact of problems during project implementation. They are focused on gap analysis phase of the project life cycle, especially when the scope of the project is not clear enough for them. Risk averse style interacts with the complexity of the project and is concerned with preparing regular progress reports and having a full view about any deviations, especially when managing major projects or long-term ones. The forecasted risks are identified at the beginning of the project so that the mitigation process is started earlier. Managers think that risky projects are relatively more important than less risky ones. To illustrate this point, project managers in the private sector are more concerned about risk management than those in the public sector, and this may be due to limited resources. On the other hand, research shows that the public sector does not accept failure, and so the risk averse behaviour, especially in financial terms, is relatively highly important. Among all the four dimensions of complexity in this research, risk averse style interacts with the environmental and cultural complexity dimension only. The findings reveal the high importance of the virtual environment as a mechanism for dealing with forecasted risks with the least amount of cost. Risk averse style affects the level of success of the project performance. For example, the quality of the working environment and the quality of the final product are the main concerns for the risk averse manager when talking about the level of quality in the project. They believe that the good risk management is the key to the high level of success of the project performance. Risk averse style managers believe that delays caused by lack of technical training are risky and represent an area that affects the quality of the project performance. In order to raise up the level of the project performance, risk averse managers think that the unclear or incomplete scope requires more focus on the gap analysis phase to avert the risks of unclear scope. Regarding the relationship between the risk averse style and the

success in controlling time performance of the project, risk averse style assures the avoidance of rework, delays, and waste of time. However, the risk averse manager takes extra time to manage risks. The success in controlling cost is related to avoidance of wasting money, especially during lack of demand periods, increase in supply, and lack of development and innovation to attract new customers. The avoidance of rework is related to savings in costs. Again, the risk averse managers believe that the clarity of the project scope will lead to savings in costs.

Specialized Knowledge Creation Style,

In specialized knowledge creation style, a manager is believed to have the basic knowledge needed to start a project for the first time. Specialization gives enough knowledge to have the full view of the whole project to balance between the time and cost of the project. Specialized managers believe that they can have better control and monitoring during implementation, care about KPIs in their project performance, and motivate their team members to get certification in their areas. There is a relationship between specialization and risk management. Specialization enables the project manager to react to both known and unknown risks and helps in reorganizing the project again to fulfil customer requirements. Specialization gives better planning skills, and even specialized managers believe that experience is much more important than certificate. This shows the reason why they prefer to have practical professional education. The research reveals that there is a qualitative association between the specialized knowledge creation style and the complexity of the project. Specialized project managers are more experienced to talk with the stakeholders in the same language they use, can create collaborative working environment and, hence, improve the project performance success. However, they increase the level of project interdependency in their projects. As to the relationship between the experiential knowledge creation style and the level of performance success in terms of quality, the research investigates that specialized managers are more geared towards the success of the project. They can improve the level of performance quality, have more control over the plan of performance and its implementation, have easier monitoring processes, react faster to known and unknown risks, and reorganise the project again to fulfil the customer requirements. Experiential project managers can create positive reputation for the project in the eyes of their customers because they have the ability to assess the project's performance and its lasting impact on the customer. Overall, the specialization of the project manager contributes to the better execution of the project plan. There is a qualitative link between the specialization and the time stability of the project performance. Specialization gives suitable amount of knowledge about the project. It enables the manager to have a thorough view of the whole project and allows him/her to balance between time and cost of the project. Specialized managers can also improve the speed of project performance. In fact, specialization leads to better control and easiness of monitoring performance, which minimizes the time taken to seek corrective actions, and this leads to higher level of project success. There is evidence in the feedback of project managers that the specialization of the project managers is related to the cost of the project in the sense that they can balance between the time of implementation and the cost. With specialized knowledge, the manager can have a thorough view of the whole project and spot possible delays immediately. By creating collaborative work environment, the project manager positively supports project success and performance improvement. Specialty has to do with the productivity of the project, and the respondents talked about supporting project success and creation of collaborative environment, thus contributing to the performance productivity. This productivity becomes more controllable and easier to monitor when the project manager creates specialized knowledge.

Innovative Knowledge Creation Style

Innovative project managers consider the deviations in the project performance as something positive that leads to better opportunities in the market. Their view of deviations in project performance is not the same as other styles of knowledge creation. Deviations for them is an opportunity to solve problems and create new solutions, believing that many problems are not solved unless one thinks out of the box. The qualitative study includes evidence that there is a relationship between the innovative knowledge creation style and the risk averse knowledge creation style. Innovation is important in the vertical experience of the project manager rather than in the horizontal one; in fact, it is the vertical experience that enables the project manager to grow vertically throughout the upper levels in the career path. Innovative knowledge creation is related to the quality of performance, and project managers believe that they can achieve unexpected results by adding new engineering ideas and modern innovative standards to the project. Some of them propose new structure for the technical guide that positively impacts the easiness and speed of performance. This innovative knowledge creation also decreases the number of technical mistakes in the project performance. For instance, innovative project managers can deal with the deployment duration and other types of problems that may affect their customer satisfaction. Therefore, innovation enables these managers to solve problems and meet customers' expectations. For example, one of these managers created a new knowledge about working by batches of sites. After making each site, this manager worked on air and faced many problems. When he used innovation, he solved problems faster and met his customers' expectations effectively. In general, innovation affects the functioning, time, and cost of the project, and also the stability of project cost through finding better ways of functioning. For example, one innovative manager said that innovation enabled his team to propose a new

structure for the technical guide, and this made it easier and faster to understood and, thus, caused a decrease in the number of technical mistakes in project performance.

Comparative importance of each style of knowledge creation,

In this part, the research compares different styles on the basis that managers have more than one style and tend to prefer one over the other.

Experiential more than specialization

Some project managers prefer experiential style of knowledge creation to specialization knowledge creation style. Some of them could not enter the market as manufacturers until they have had experience because they believe that experience is related to creative solutions and at the same time to coping with the latest changes in the market. They strongly believe that experience is important because the more management the more experience in managing projects. In fact, experience supports their ability to deal with unexpected problems, especially when the kind of projects is the same for a long period of time. These managers see that practical experience in the field is much more important than theoretical education because it is related to reality. They care about gaining others' experience and learn from the mistakes of other people in the field. They are convinced that experience plays a great role in project management because it provides successful management, the ability to avail the needed resources of the project, experience of workers not just the manager, and speeding up achievement. For them experience is a source of strength of management and better organisation. Moreover, to them, experience gives higher level of credibility and reliability in implementation and better determination of deadlines. Experience is also for them a source of enthusiasm, motivating others, delegation of authority, building successful teamwork, and ability to solve problems. They believe that experience is more reliable than specialized knowledge, as it plays a major

role in speeding up implementation, in learning how to avoid risks, and in finishing projects faster and successfully.

Specialization more than experiential

Another group of managers in the research sample believe that specialization is more important than experience when creating new knowledge. This is an opposing point of view to the last one, and to minimize the subjectivity of the qualitative research, the research introduces both opposing views objectively. Project managers who think that specialization is more important than experience have their rational justifications. They take certain types of educational courses because they think they [courses] are related to the application in the real life of the project management. They maintain that education is important because well-educated project managers implement their projects better; in fact, education enables them to recognize the possible risks and devise ways of avoiding them better than non-educated or less-educated managers. Some of their comments reflect their perception of education as more important than experiential knowledge and management of the implementation processes. They think that education helps in investing all that they have learned in the project.

Risk averse more than innovation

Another group of project managers perceive risk averse style of knowledge creation as more important than the innovative one on the basis that knowing about the risks before starting the project will increase the percentage of its success. Risk averse style takes care of any factor that may lead to any kind of delay in the due date of project submission. Risk averse managers know that lowering down the level of risk enables them to create clear vision in light of what abilities and skills they have, but this takes more time and may exceed the lead-time of providing the final product to their customers. They prefer to be on time with customers and other stakeholders. They think most of the time about assuring that the project will not face any kind of obstacles that may affect the project success negatively. Many aspects in the project are risky such as the changes in the price of the dollar, changes in the number of workers, and scarcity or unavailability of resources. Risk averse knowledge creators believe that taking care of these factors must be top priority because they [factors] increase the ability to minimize the risks that a project may encounter. In fact, minimizing risks helps in achieving planned results without running into any serious problems, in maximizing profits, and increasing efficiency of work. Risk averse is important for them because it keeps the process of building the project smooth and hence boosts the trust of the client. Also, risk averse is more important when there is high level of complexity. They believe some factors such as the delay in submission because of the geographic location, the cultural norms, and traditions of the host country of the project may indicate a high level of complexity and may lead to more risk taking.

Innovation more than risk averse

Another group of project manager believes that innovation and novelty of knowledge creation are more important than the risk averse knowledge creation because much minimisation and avoidance of risks limit the achieved results and limit the growth of the project. They give priority to innovative knowledge creation because they are sure that this kind of knowledge creation will enhance reaching better solutions to minimize risks in the future. The researcher interprets this by investigating a desire to have a unique monopolistic condition where these innovative knowledge creators want to position their product as a distinguished one, so they can easily limit the effect of competitors on their profits. This kind of risk that comes from the competitors' side is, they believe, a major one and can be dealt with through innovative knowledge creation. By providing unique product to the market, they can get out of the standardization competition, gain the pioneers market shares, and perhaps have better control over market prices. They can also charge their customers premium prices for their differentiated value simply because of their innovative knowledge creation. They believe that they can always find better solutions in the future to minimize their risks. Innovative knowledge creation style values the importance of innovation but at the same time needs to take care of the basics and plans for the whole project from start to finish. Innovation for project managers who belong to this style is important because it affects the customer satisfaction; however, this depends on the infrastructure of the project day after day. Innovation is the priority, but innovative project managers believe that they must submit their projects on time and conform to the standards followed in such projects. They do not think that innovation takes longer time to implement. On the contrary, they think that the more innovation they apply in their projects, the faster they can finish it before its due date. For them, innovation is necessary because they do not fear and surrender to the rules of managing their capital. It is a natural type of fear, but they are brave enough to keep it in the acceptable limits while innovating new knowledge. Innovation is an impetus to achieving the right performance. The latter, along with perfect management, plays a great role in the project success and in avoiding many risks. Overall, innovation is necessary for survival in a fiercely competitive market.

5.4 When to Create New Knowledge?

In this research, the respondents answered an interview question about their preferences to create new knowledge and about whether this process is more preferred during the stability of project performance, or both. The responses can be classified into three groups:

5.4.1 During stability view

Project managers who believe in this point of view think that creation of new knowledge needs to be done without stress, better organisation of ideas, better knowledge transfer planning, plenty of time for knowledge sharing and deep thinking. Creation of new knowledge during stability may lead to lower risks, clearer thinking without risks, avoidance of impacts on performance, and plenty of time for members of the team to learn from one another. Moreover, less workload during stability periods gives better chance to create new knowledge than instability periods.

5.4.2 During instability view

Project managers who believe in this point of view think that knowledge creation during instability brings back stability to fix errors in the plan, to manage failure in implementation, to react to the challenges of competitiveness during instability periods, to assure successful plan execution, and to have clearer reflection and quicker corrective action. All in all, knowledge obtained during instability is more valuable.

5.4.3 During both views

New knowledge creation must be continuous in all periods because it will lead to innovation and thus to better results; however, it is more important during instability periods to help in future projects. Project managers think that knowledge is cumulative, and that even repeated activities need to be logged and retrieved to create new knowledge.

5.5 Dealing with Unexpected Problems

Project managers in the sample of this research gave many examples on unexpected problems they dealt with when managing their projects. They spoke about the solutions they gave to those problems, and the researcher linked these solutions to the proposed styles of project managers. Finding qualitative justification to link solutions to unexpected problems depends on the behavioural characteristics of project managers.

When there is lack of knowledge creation, the project managers speak about indicators such as delays in the time frame of implementation, cancelling or terminating the project, failure of the project, or failure to satisfy the customer. These indicators result from the inability to innovate new solutions for the unexpected problem, inability to avoid risks, inability to find something related to the specialty of the project manager that could help in solving the unexpected problem, and/or inability to create knowledge related to the previous experience about similar or semi-similar problems that occurred in the past. The following colour-coded table shows the different problems and their solutions:

#	Problems	Solutions	Style behind solution
1	Unexpected increase in the price of raw	Depending on more than one supplier	Risk- averse and
	material	Keeping aside an amount of money	experiential knowledge
2	Changes in dollar price	Keeping a side an amount of money	Risk averse knowledge
3	Workers quit during implementation	Depending on more than one supplier	Risk averse knowledge
4	Unexpected changes in the weather	Take this period off and work for extra shifts	Experiential knowledge
	condition	during pleasant weather days	
	Condition	during preasant weather days	

Figure 5.10 Color-coded table of styles related to problem solving

5	Delays of machines and tools	Delete the deal with the customer and find	Undecided knowledge (-)
		another one.	
6	Actual losses percentage exceeds the	Project is a failure	Undecided knowledge (-)
	expected one		
7	Delay of finance	Delay in project time frame accordingly	Undecided knowledge (-)
0			D'1
0	Lack of communent of suppliers	Start contacting alternative supplier quickly	KISK averse knowledge
9	Changing the project manager during	Use the team skills until the new project	Experiential knowledge
	implementation	manager starts working	
10	Unexpected changes related to	Coping with customer related changes	Innovative knowledge,
	customers		experiential knowledge
		Changing parts of the project	
11	Inability to find enough subcontractors	Delays or failure to satisfy the customer	Undecided knowledge (-)
12	No unexpected issues	Repeated solutions	Experiential knowledge
13	Interference of a third party based on the	Discipling contract conditions at the	Experiential knowledge
15	interference of a time party based on the	Discipline contract conditions at the	Experiential knowledge
	customer demand	beginning of the project	
14	Customer disagreement on updates	Refer to the contract	Risk averse knowledge
			and innovative
		Changing updates to get customer agreement	
			knowledge
15	Regulatory changes by government	Just change what the government want no	Risk averse knowledge
		other choice	
16	Changes in the time frame of the project	Minimization of dependency and hence	Risk averse knowledge
	due to conflicts with other projects	minimization of complexity and unexpected	and innovative
		instability	knowledge
17	Resignation of an important human	Resignation forced the project manager to	Specialized knowledge
	resource	split his tasks among self and some other	

		members until they were able to hire and	
		train him	
18	Installing the system on French	The solution for this problem was to mock	Innovative knowledge
	windows.	the system on English windows and then	
		change the language after installation to	
		display the application on French windows	
		and it worked well.	
19	Increasing quantities compared to the	The project manager must make re-survey	Specialized knowledge
	official contract	with a consultant to decide on what to do.	
20			
20	One challenge that may not be expected	May lead to changes in the time frame	Undecided knowledge (-)
	is the change of the management of the	May lead to termination of the project	
	client company. This may cause that the		
	approval cycle is debatable or changes in		
	the seriousness of work.		
21	Decourses are not evailable on time due	When these recourses return healt to the	Experiential Imoviled as
21	Resources are not available on time due	when these resources return back to the	Experiential knowledge
	to urgent cases.	same project, the project manager may need	
		to force these resources to work for extra	
		time when they come back to the project.	
22	The unavailability of transit space for	The project managers was forced to use	Innovative knowledge
	materials since no store is dedicated for	containers to keep project materials in it	
	such a task.		
23	During the implementation process the	He solved this problem by depending heavily	Specialized knowledge
	project manager found that the	on the safety and the measurement of safety	
	measurements in one of the	was conforming to the standard so he	
	implementation processes are not	accepted deviation of the process as long as it	
	conforming to the standards	is not harming safety.	

24	Some changes were needed in the IT	The manager went back to the contract and	Experiential knowledge
	part of the project by the customer	made some agreements with the customer	
		and accordingly the customer retention rate	
		was increased	
25			
26	W. L. C.		
26	Working against the decisions of the	The project manager had to replace him with	Experiential knowledge
	holding company. The holding company	a better one quickly.	
	in a project assigned a supplier. By time		
	the project manager discovered that the		
	supplier has a technical incompetency		
	problem in his resources.		
27	Having major changes in the scope of	Project managers first finalize the main scope	Risk averse knowledge
	the project	of the project then they go to additional	
		scope after having agreement with the	
		scope after having agreement with the	
		customer about it. The customer must agree	
		on the needed changes to change the scope of	
		the project and any related activities.	
28	Level of knowledge of the project	Reporting the added value of the project	Experiential knowledge
	manager is higher than the level of	manager	
	knowledge of the stakeholders		

Source: created by the researcher's analysis and judgement on interviewees' responses.

Colour codes:
Innovative specialized Risk averse experiential mixed styles

The feedback from the project managers about the way they solve unexpected problems enabled the researcher to classify their solutions into four groups. The following matrix summarises the four groups of solutions and relates these solutions to the four proposed styles of project managers:

Experiential solutions are characterized by
Considering changes in weather when scheduling shifts.
Attention to previous problems when planning.
Using available resources until solving the problem.
Using repeated solutions.
Discipline when writing the contract.
Better usage of resources for many projects at a time.
Quicker rescheduling.
Knowing how to change the contract to get higher customer satisfaction.
Quicker replacement of lower performance members.
Quicker spotting of added value of project management.
Finding alternatives easily and quickly.
Higher ability to control cost and save money.

Figure 5.11 Four groups of solutions and relating these solutions to the proposed KCSs

	· · · · · · · · · ·
Risk averse solutions are characterized by	Innovative solutions are characterized by
Keeping aside part of the budget	Changing based on customer's feedback.
Depending on alternative resources and more	Working with minimum level of dependency
Depending on alternative resources and more	working with minimum level of dependency
than one supplier.	
	Aiming lower level of complexity.
Getting customer's agreement on changes	
5 6 6	Targeting minimization of unexpected instability.
Following legislations	
I ono wing registations	Initiating and trying new solutions for the first time.
Focusing on main goons of the project first	
rocusing on main scope of the project first	
then starting additional ones.	

Colour codes: \Box Innovative specialized \Box Risk averse \Box experiential

Analysis of the problems faced by project managers and the frequency of using different solutions show that most of the time the experiential knowledge creation is the most used type of creating knowledge to solve problems, followed by risk averse, innovation and then specialization as shown in the following graph:



Figure 5.12 Solutions classified by proposed KCS

It is obvious that using experiential solutions and risk averse solutions are more common in the sample of the research and that the innovative solutions and specialized ones are less common. This shows closeness between experience and risk avoidance on one hand, and between innovation and specialization on the other. It may be noticed that there are still indicators of deleting and delaying projects or having customer dissatisfaction or project failure cases. This may be due to lack of finding solutions using any of the four bases of knowledge creation.

There are three main areas where project managers may use more than one style when creating new knowledge for solving problems. The first one is the area of sudden changes in prices where the manager uses a mix of risk averse knowledge and experiential knowledge. The second one is the changes in customer's needs. If the changes are caused by dissatisfaction, then the project managers tend to mix innovative knowledge with risk averse one to devise solutions. If the change is caused by new customer needs, then the project managers tend to mix innovative knowledge with experiential knowledge to find new solutions. The third type of problems is the one that is related to changes in the time frame due to dependability on and complexity with other projects. In this type of problems, project managers try to lower dependability and complexity by generating a mix of risk averse knowledge and innovative one. This means that a manager may need to use more than one style of knowledge creation to solve certain types of problems to minimize deviations.

5.6 Reasons of Performance Deviations

Project managers compare all the time between the planned indicators of the project performance and the actual ones, so it was possible for the researcher to collect data about different dimensions of measuring project performance such as cost, profit, time, and productivity. Deviations between the planned and the actual indicators represent the meaning of short-term instability in this research. The next section discusses the findings of the reasons behind short-term instability or deviation in each performance indicator.

5.7 Reasons Behind Deviations of Project Cost

The researcher attributes the instability in project cost to the following three reasons:

5.7.1 First reason in the plan

This happens when the plan is inaccurate. When the scope of the project is not clear at the beginning of the project life and during implementation, the actual cost becomes higher than planned because of many challenges that need extra time to handle, especially if these challenges have not been considered during the planning stage. Also, scope issues and interdependency with other variables are strong reasons for having extra costs than planned.

5.7.2 Second reason is the implementation

Knowledge is an input and costs money. If knowledge is available, then the implementation time and cost could become less by reducing re-work and time of implementation. Replacing some of the team members during the implementation of the project is another reason for having higher costs than the projected ones. Cost is related to time, and when the project manager completes the implementation of the project within a short time, the actual cost may become less than the planned one and vice versa.

5.7.3 Third reason is external factors

External factors such as currency rates are uncontrollable, and changes in the market prices are most of the time toward increasing rather than decreasing, and this may affect the deviation between the planned and the actual cost when this happens unexpectedly. Another reason for deviations is the change in the prices of raw materials, especially when there is a smaller number of available sub-contractors.

5.8 Reasons Behind Deviations of Project Profit

First reason is the plan: Project managers do not expect exact figures of profits, but they always expect a range and put an upper limit and a lower limit to the expected profits. Projects that are famous for a history of trust in the market and a sound reputation can achieve actual profits higher than the planned ones.

Second reason is the implementation: Sometimes, there is positive deviation in the profits of the project because during implementation, the project manager can decide on expecting better results by the end of the project.

Third reason is external factors: External factors are represented in changes in shipping prices and changes in currencies. This means that the difference between the gross profit and the net profit is deviated from the planned one. In this case, the calculation of the marginal profit for each unit may differ, too. Most, if not, all the time, the change is towards increases in the prices of currencies and shipping not toward the decrease. Accordingly, some project managers prefer to leave a margin in their estimation and plan for less than the estimated profit because of these changes, and this implies why managers find increases in their profits by the end of the project. On one hand this is a precaution, but on the other, this shows that the project manager has achieved more than expected.

5.9 Reasons Behind Deviations of Project Time

This part discusses the findings related to the reasons behind deviation between the planned time of the project and the actual one.

First reason is the plan: Deviations during the planning process may happen because of waiting longer for the delivery raw materials needed for the project, or sometimes the plan does not allow for the delays that may occur in the process of acquiring raw materials. This delay applies to the tools and equipment as well, especially when there is a relatively high level of dependency among projects taking place in the same company. Delays are not always expected, but they sometimes reflect lack of experience of the planner or the implementer.

Second reason is implementation: Instability may occur due to implementation reasons, according to some managers, who explained that this happened during the different stages, but they were able to finish before the time because of taking immediate corrective actions. They revealed that completing the project and submitting it to the customer before its due date means higher net profit due to savings in project costs. Other respondents believed that submission on time means conformance to the standard time of implementation, and this is better for keeping the expected level of safety. A third group of project managers considered conformance as a conditional matter. They think that if the time and cost of the project are lower than estimated, then this will consequently lead to higher profits than estimated ones. Their opinion correlates with that of the first group but only in so far as saving time is related to saving costs without compromising the level of safety. They believe that in many cases changes in the scope of the

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project may lead to changes in the cost and, thus, change in the budget of the project. The scope of the project is one of the relatively important components of stability and minimizing deviations during the implementation process. One of the relatively important controlling points for better stability and conformance levels during the implementation of the project is the contingency reserve. If the project is not consuming the contingency reserve in full, then the final profits will be higher than the estimated ones. This is a positive indicator toward better performance success. The estimated profits are in comparison with the achieved ones for project managers, and some of them measure his or her personal success by creating positive deviation between estimated profits and actual ones.

Third reason is the external factors: Many projects are dependable on shared resources with other projects in the same organisation. This leads to difficulties in calculating the estimated profits of the project for some project managers. They tend to estimate the ROI instead of calculating the estimated profit. The nature of the weather in which workers implement some projects that involve outdoor working conditions such as construction projects may affect the performance stability and cause deviations in time. In cases when the weather poses an obstacle such as a hot temperature that conflicts with the human tolerance levels, delays in implementation processes occur, and the project takes longer to complete. Delays that are out of control are translated to higher costs on the project managers and paying wages for workers for producing nothing. In these cases, the actual profits may become less than the estimated ones, especially if there are fluctuations in the prices of raw materials and currencies during the periods of delay. In general, the changes in currency prices and raw material prices representing another separate external reason for instability and deviations in project performance. On the other hand, changes in the prices of raw materials and currencies in a positive way like having lower prices, especially for imported raw materials and machines may cause positive deviation

between the estimated profits and the actual ones. This type of external factors has more influence on projects that have global nature or dependency on resources from other countries. Projects of local nature or projects that are implemented using local inputs of production are relatively less likely to face severe fluctuations. Project managers who are working on service products think that their customer satisfaction of the public users is the main factor to be considered when calculating the actual profit. If they plan a certain amount of profit to be achieved, then the level of customer satisfaction is higher than expected. This may become a good reason for achieving higher profits than the estimated ones. Having many risks may also cause a decrease in the actual profits compared to the estimated ones. Some managers think that if the interdependence scope of the project is added, achieved profits will be lower than the estimated ones. In one of the cases, the project manager reported that the achieved profit was lower than the planned by 20% because they experienced many risks during project implementation, and this had negative effects on the poor quality of the product that was supplied to the customer. Also, the project life cycle experienced several delays. This represents another good reason for the lower actual profits when risks affect the project life cycle, product quality, and maybe customer satisfaction. Sometimes the client has unexpected decisions which represent a good reason for having lower profits than the planned ones.

5.10 Expectations of Needed Time to Implement the Current Project and Reasons Behind These Expectations

After analysing the qualitative data of interviews with project managers, their perspectives about the required time for implementation can be classified into the two following groups:

5.10.1 Project managers who expect required time to implement the current project to be longer than the estimated one

Managers who perceive that the expected time for the implementation of the current project is longer than the planned one justify their position by giving several reasons. The research found 10 justifications from analysing the data of the interviews which may be classified into three subgroups:

5.10.2 Negative deviation in time of implementation due to reasons related to the plan

Managers expect to have longer time for implementation due to unplanned vacations that have not been considered during the planning stage. This happens when managers have less experience or do not consider sudden circumstances that may cause absenteeism or vacations, especially in less stable environments. Another justification related to the planning stage again is linked to the experience of the project manager and how he or she uses this experience during the planning stage. Project managers who have relatively better experience than others in other projects attribute the conformance in the time of implementation to their previous experiences, whereas managers who have experienced previous delays and nonconformance cases in the project implementation time said that they were able to conform to the planned time because they had better planning skills based on their experience. For example, they avoided reasons of delays or they had better precautions in their plans.

5.10.3 Negative deviation in the time of implementation due to reasons related to the project inputs

Project managers face other reasons that are related to the implementation processes. They justify the probability of negative nonconformance to the planned time to sourcing problems related to raw materials, such as problems of nonconformance between the organisation and its suppliers, or under-processing sourcing of raw materials which sometimes happens due to changes in implementation schedules. This mainly happens when the scope of the project is not clear enough, so changes occur during implementation because the specification of the required inputs of production and scope are not clear, or they are clear but have been changed. Sometimes project managers are assigned new projects in which they do not have previous experience related to its implementation. This means that either implementation techniques are new or there is a contradiction between planned processes and implemented ones because such processes are implemented for the first time by the project manager. Lack of experience in general is a critical reason behind negative deviations in time. It may be concluded that the more experienced project managers can implement tasks faster and with less ratio of errors and that less experienced managers take longer to implement tasks and have higher probability of deviations and mistakes. There is evidence in the qualitative analysis that experience of the project manager is associated with the level of negative conformance of implementation time. Missing the scope of the project is another reason for taking longer time. If the nature of the project is characterized by complexity, then it leads to longer time of implementation from the project managers' perspective.

5.10.4 Negative deviation in the time of implementation due to reasons related to external uncontrollable factors

Some project managers reported that sometimes they need new requirements for the project; as a result, it takes them more time to benefit from it. This is considered to be beyond their control. The new requirements may be related to new customer requirements or to special customized nature of a certain project. Some project managers reported the main reason for the extra time is due to external factors and changes in those factors such as dependability on vendors who have lower levels of quality in delivery time, delivery conditions and specifications.

5.11 Project managers who expect time to implement the current project to be shorter than estimated one

There are two groups of reasoning the positive time deviations from the analysis of the research interviews. One group of project managers attributes the positive deviation to the conformance in implementation time to reasons related to the planning stage. The other group attributes this positive nonconformance to reasons related to project inputs. Most of the reasons found belong to the second group of project managers. The two perspectives are further explained below.

5.11.1 Positive deviation in the time of implementation due to reasons related to the project plan

Some project managers reported that there is a relationship between the project manager's experience and the time needed for planning. This is the only reason found during the planning process from the qualitative analysis of interviews.

5.11.2 Positive deviation in the time of implementation due to reasons related to the project inputs

Those who have reported that the actual project time would be shorter than the planned one attributed this to knowledge. One of the managers said that he used the library to find ready-made small solutions that would take longer time to develop. This refers to educational type of knowledge. Others reported that based on the dependency of this project on common resources with other projects, if there is delay in other projects, then this means that the project can be finished in shorter time because it will receive top priority over the other interrelated projects during the same period of time. Some project managers reported that there is a relationship between the project manager's experience and the time needed for implementation even if this is related to production inputs. As a conclusion if the level of experience is high, then the time needed for the project becomes less.

5.12 Project Performance – Stability and Instability

The answers given by the project managers as to whether they consider their project performance as stable or unstable and why may be classified based on the proposed styles of project managers.

5.12.1 The experiential knowledge creation style

Project managers who belong to the experiential knowledge creation style believe that they are running the project as planned and are conforming to the plan; therefore, there are no deviations between the planned performance and the actual one. They describe their performance as a stable one. Whenever they have conformance, they describe their project performance as a stable one and attribute the stability of the project performance to the collaboration among team members and the positivity and support coming from the supplier of production inputs. Project managers place great emphasis on the relationship between the project management and the suppliers of the project. Stability is defined by some of the project managers in terms of the ability to pass the milestones as planned. Another reason is the ability to pass the intermediate acceptances. The official time schedule plays a great role in achieving the stability of the project performance. If there is a high level of commitment to the official time schedules, then the level of project stability is expected to be high. Experiential knowledge creation styles of project managers consider the performance to be stable even if there are deviations in the implementation, because the deviations are considered as slight not sever ones, and they occur within the control limits. There is a point of view provided by experiential project managers about the stability that says that if the delays are justified, then the project performance can still be considered as a stable one. A group of experiential project managers depends on the regular progress reports and on the periodic meetings with their customers. This means that they consider stability as a periodic measurement that has to be tracked carefully, and project managers must not wait until the final stage to measure it. Taking immediate corrective actions eliminates the end of project instability of performance. This shows how performance stability or instability is associated with project control.

5.12.2 The specialized knowledge creation style

Specialized knowledge creation styles depend highly on progress indicators to check if the project is stable or not and have a common understanding with experiential knowledge creation styles about the role of controlling process in achieving performance stability. They care about the extent to which the performance indicators show that it is stable and within the control limits

and normal ranges of inspection. Specialized project managers tend to believe that if the project managers and his team have higher base of knowledge, then the project performance is expected to be more stable than those without knowledge improvement. Again, the specialization knowledge creation managers agree with the experiential knowledge creation managers that the team collaboration in the project and the support of the supplier of the project are the main factors to achieve the stability in the project performance.

5.12.3 The risk averse knowledge creation style

Risk averse knowledge creation managers believe that the main reason behind the stability of the project performance is their continuous care about avoiding risks and keeping risk level under control. They consider the project performance as a stable performance as long as they do not have any implementation obstacles. They also place a high value on the collaboration of the teamwork as a reason behind the minimization of the project risks and the better readiness for the performance stability. Risk averse project managers collect information about their suppliers and attach high importance to the supplier support and discipline for achieving the performance control and stability. The financial aspects of the project are related to paying the project credits on time until the project manager is able to get the return on investment by providing the customer with the final product. In case the risk averse project manager finds that the project cannot cover its costs, he/she starts to consider it as part of unstable performance projects.
5.12.4 The innovative knowledge creation style

The innovative knowledge creation style of project managers exerts relatively more effort during the planning stage of the project life. When innovative project managers spend longer in the planning process, they expect relatively higher levels of stability during the implementation process. They have common interest with the other styles in terms of focus on the team collaboration as well as the supplier support. Change happens, and project managers perform change management accordingly. The change management process focuses on keeping changes under control, and the ability of project managers to keep changes under control limits is a sign of the performance non-conformance of the project. Stability of conformance does not mean that there are no changes; it means that changes are still under control and exist within the control limits. Keeping the changes within control limits reflects the project manager's readiness for changes and his/her innovative capabilities to estimate and deal with these changes. If project manager's capabilities to keep changes within the control limits are high, then the project performance is relatively stable. Other project managers reported that during the project life cycle, there is a stage of instability that usually happens early at the beginning of the project. At this period, there are some changes in the plan until the project manager feels that the customer will be satisfied by the end of the project. This change in the plan increases the planning period and cost, and this is where the instability in the performance of the project usually lies. In this case, it can be concluded that the innovative project managers tend to consider the instability in the project performance as necessary as in some cases. Instability is needed for a short period temporarily to reach higher level of performance stability afterwards. Other project managers may be able to avoid this instability by depending on regular progress reports and on periodical meetings with their customers. Meetings with customers is a kind of depending on external sources of information, and this is a source of new knowledge and could be an innovative one that is directly related to higher levels of customer satisfaction and, consequently, better performance stability and success. It is expected that when the innovative knowledge creation styles depend on their customers as a source of new knowledge, they can affect the performance stability of their project than other styles of knowledge creation.

5.13 The Main Reasons Behind the Instability of the Project Performance

Based on the data collected from the interviews conducted with project managers, the reasons behind the instability of the project performance may be grouped into four perspectives

5.13.1 Experiential reasons

These are a set of reasons that are related to the level of experience of the project manager or the people working with him/her. These reasons include, for example, the lack of workers' experience. When the manager deals with new workers, he or she focuses more on tracking their mistakes and their training, and the time consumed in adding to their experience is taken from the performance stability level of the project. The experiential project managers reported that the lack of experience in collecting data, for example, is a main reason behind performance instability due to the collection of improper data. Missing planning is another reason where project managers lack the skills of planning and considering all scenarios and possible changes in the performance stability. Experiential project stability. One of the main reasons of the instability in the project performance from their perspective is missing planning, which is directly related to the project manager's experience. Experience increases the storage knowledge for managers and according to the manager knowledge creation style he or she determines how and when to use this knowledge. Generally, there might be an association between the style of the knowledge creation and the level of stability of the project. One of the main tools of creating knowledge is the communication process. Project managers claimed that the effectiveness of communication processes directly and strongly affects the level of the project stability and success. Experiential knowledge creation managers believe that if some factors are not taken correctly taken into consideration from the beginning of the project, then this may lead to instability afterwards. They believe that the tight schedules of implementation give higher probabilities to deviations in project performance and getting out of the control limits. Even the scope of the project and the size of inputs needed for implementation are important inputs to the stability of the project performance. Any changes in the scope of the project or lack of clear determination may lead to the instability in the project performance. Another aspect from the experiential project management perspective is the human resources. Human resources are important in project success and stability because their experience and hiring human assets who have suitable experience support the stability of the project performance to a great extent. It is not only the experience of the project manager that matters but also the experience of the working team involved in the project.

5.13.2 Specialization reasons

Project managers who believe that the specialization and educational backgrounds are the basic requirements of performance stability said that lack of specialization on one hand, and the overlapped specializations on the other are significant reasons behind the instability of the project performance. The interference of other departments in the work of the project manager is a kind of overlapped specializations and may lead to the performance instability. Specialization knowledge creation managers see themselves as more apt to collect proper data

for achieving the performance stability and that the improper data collection processes lead to the missing of planning and, consequently, to the missing of implementation. Knowledge about the project management specialization is a determinant of the level of stability. Specialization knowledge managers also believe that the level of stability of the performance is related to the level of knowledge creation in the project. They perceive that communication determines the level of stability of the project. They see that if some factors are not taken into consideration from the beginning of the project, this may lead to performance instability. They have the same perspective of the experiential knowledge creation managers about the tight schedules of implementation. They also believe that the human assets are important factors that affect the stability of the project performance. In general, It may be inferred that there is a high level of similarity between the specialization knowledge creation style and the experiential knowledge creation style.

5.13.3 Innovation reasons

The reasons behind the instability for innovative project managers are the improper data collection, the unclear determination of project requirements, the missing of planning, the lack of knowledge, and the type of management styles. Moreover, communication effectiveness, lack of clarity of the scope of the project, misunderstanding the client expectations, and absence of knowledge about the internal cycle of the client work are all possible reasons for the instability according to the innovative project manager. There is a common understanding among knowledge creation styles about the importance of the human resources in achieving the performance stability of the project. Moreover, the innovative knowledge creation style adds the inaccurate surveys during the preparation phase of the project, believing that this will lead to the instability of the project performance later on.

5.13.4 Risk averse reasons

The risk averse project managers also believe that the improper data collection and the missing planning lead to the instability in the project performance. They also believe that the knowledge and the management style are important determinants for the level of performance stability, and like other knowledge creation styles, they have common understanding about the role of communication processes and their effectiveness in achieving the performance stability of the project. They said that if some factors are not taken properly into consideration from the beginning of the project, then this may lead to instability afterwards. They also think that the tight schedules of the project implementation may lead to performance instability, and it is the duty of the project performance as he/she perceives. Moreover, like any other styles, risk averse managers have a common understanding of the importance of the human resources in achieving the stability of the project performance.

5.13.5 Reasons related to contextual changes

There are other reasons behind the instability of the project performance that are not related to the knowledge creation style of the manager. This set of reasons is related to the context of the project and consists in the fluctuations of currencies, especially in the case of the projects that depend on importing some inputs from other countries. The increase in the prices of the raw materials is another contextual reason for performance instability. In their interviews, mangers mentioned the changing of the project manager during the implementation process as a reason behind the instability and deviations of the project performance. Sometimes the instability in the project performance comes from human aspects like human conflicts and disputes and the lack of collaboration among team members. Human assets are critical in achieving the performance stability, but they may at the same time lead to performance instability. Another contextual reason is the delay in receiving the equipment or any other input from suppliers, that is why the relationship and accuracy of the supplier is a critical contributor to the performance stability. The lack of performance stability may happen for financial reasons such as the lack of capital during the implementation process or even before the start of implementation. Interdependency between the project and other projects in the same organisation increases the overlapped specialization and the interference of other departments in the work of the project manager. The relationship between the project manager and the senior manager of the organisation to which the project belongs is relatively uncontrollable, especially if the style of the senior manager is hesitant regarding decision making. Another contextual condition causing instability in the project performance is the unclear requirements of implementation. This happens sometimes when the customer is not clear about what is the final product, he/she is targeting or when the type of the project is still new to the project manager, and he/she is implementing it for the first time. During interviews with the project managers of more than one hundred organisations, managers perceive top management style as a determinant of the level of stability of their projects' performance. The researcher concludes that when the requirements of the project are not clear for any reason, the scope of the project and the required inputs become unclear. Sometimes the context circumstances force the project manager to put tight schedule of implementation under pressure from senior management or from customers, and this may lead to performance instability such as lack of quality or lack of organisation, or may be delays in submitting the final project on time to the customer. The changes in the dollar value causes instability in the project performance from the perspective of many project managers. Moreover, the misunderstanding of the client expectations and not knowing about the internal cycle of the client work will respectively lead to instability in the project performance from the point of view of project managers. One more reason found in the contextual environment of the project for performance instability is the existence of unexpected milestones during the implementation process. This may happen when customers introduce changes during implementation or when deviations are found, and new milestones are put as a corrective action or a plan B implementation for the project.

5.14 When Does the Project Manager Accept the Performance Instability?

After analysing the data collected from semi-structured interviews conducted with project managers, the acceptance of instability in project performance by managers may be classified into two groups of reasons.

5.14.1 Accepting instability in project performance due to external reasons

Accepting instability in the project performance due to external reasons can be summarised in the increase in the price of the main resources of the project, conflicts with customers about finalizing the project, lack of suppliers' commitment, and facing instability in the availability of clients in the market (end user of the project). This never exceeds 10% of project manager's estimations; low number of customers or no customers affects the performance of projects in general. Instability is mainly found in the availability of resources for the project, and this instability may represent a maximum of 20% deviation in the plan. Project managers have instability of a minimum of 5% in the availability of resources but accept instability that is represented by changes in the project resources and project scope. Instability happens most of the time when project managers have a third party for their projects, and dependability on a third party increases the risk of uncontrollable contextual variables that result in the chances of instability increase.

Accepting instability in project performance due to internal reasons: The reasons of accepting instability in the project performance due to internal reasons can be summarised in the lack of experience for some employees, delay in the required financial resources, having problems with the human resources management, delays in project implementation, and inability to meet the submission deadline agreed upon with the customer. The escape of some team members may represent a source of instability, and project managers can afford the escape of a maximum of 30% of team members and can manage it. At the beginning of the project, particularly during the initiation stage, project managers accept 20% of instability in the performance indicators, and this percentage is reduced with time. Project managers are forced to deal with instability in the project performance and do not have the choice to accept it or reject it. All they do as project managers is to plan to avoid it, but it does happen, though. Project managers may face instability in the quality of performance within the planned time and budget. According to one of the project managers, the accepted instability must not exceed 5%. From the interviewees' perspective, project managers face the highest percentage of instability in the project performance during the initiation phase, and it does not exceed 10% of the planned performance. Some project managers said that instability happens because measurement and inspection are constantly happening, and this takes more time and may cause delays. They try to balance between duration and inspection processes. Instability can occur during planning or implementation phases by 10% deviation. If the changes percentage is in excess range of 20% to 30%, it would be worthy to revisit the business objectives and the scope of the entire project.

5.15 The Effect of Complexity on Project Performance

The level of complexity of the project affects its stability. After analysing the results of the interviews with more than 100 project managers, project managers can be classified into two groups of perspectives. The first group perceives complexity as a determinant of the project performance stability and is associated with it. The second group of project managers believes that complexity has no impact on the project performance. Both groups defend their different views by giving the following justifications.

5.15.1 Group of managers who believe that complexity is a determinant of project performance

The effect of complexity on the stability of the project performance to four groups based on the reason of the effect of complexity on stability.

The effect of complexity on project performance due to project system size: Managers who believe that the system size of the project affects its stability support their position by referring to planning for large-sized projects. Another reason is that customer needs may require increasing the size of the project. Project managers think that more complexity is a motive to increase the principles, standards, and the relationships that lead to the successful implementation of the project even if this increases the size of the project system. They also think that over-planning and over-structuring cause radical changes in time schedules and costs when there is a need to change the plan.

The effect of complexity on project performance due to project system variety: The group of project managers who perceives the system variety of the project as a determinant of the project stability support their stance by referring to planning because the plan becomes complex if it includes dealing with many stakeholders. Other reasons include customer needs; for example, customers may require dealing with many suppliers and/or investors. They see that more

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complexity is a motive to increase the principles, standards, and the relationships that lead to the successful implementation of the project even if this increases the variety of the project system. They think that it is more difficult to find workers to implement certain specialized tasks in complex projects. One of the reasons found when analysing interviews is delays in receiving the resources needed for implementing the project.

The effect of complexity on project performance due to project system interdependencies: Project managers who believe that the system interdependency of the project is a determinant of the performance stability maintain that interdependency of the plan on the plans of other projects in the organisation and on the overall plan of the organisation represents one of the reasons. They believe that interdependency is reflected when more than one project is implemented at the same time. Sometimes they have higher interdependency on customers to be able to fulfil their needs. This leads to higher interdependency among projects. More complexity is a motive to increase the principles and the relationships that lead to the successful implementation of the project even if this increases the interdependency of the project system. Over-planning and over-structuring cause radical changes in time schedules and costs when there is a need to change the plan. Delay in receiving the resources needed for implementing the project shows the risk of dependency on suppliers or any external entity.

The effect of complexity on project performance due to system context: The project managers who perceive system context as a determinant of the performance stability of the project have their reasons and perspectives. Contextual reasons include cultural aspects of the plan. Customer needs are components of the project environment, which may change it rapidly. More complexity is a motive to increase the principles and the relationships that lead to the successful implementation of the project even if this increases the complexity of the context of the project system. For instance, Arab countries have their own mechanisms of implementation and certain

policies and legislations to make decisions about the projects, and this too is considered as one of the contextual cultural complexity components. Different culture backgrounds of people might have an effect on complicating communication and delaying project progress.

5.15.2 Group of managers who believe that complexity is not a determinant of project performance

This group of project managers believes that the effect of complexity on the project performance is manageable and controllable. They put forward some methods to avoid this complication. They maintain that even if there is an effect in general, they do not have it in their projects because of using these methods of avoidance.

5.15.3 Complexity leads to delays in submission

This problem is manageable by project managers if they exert extra effort to coordinate among projects to avoid losses or cases of overlapped schedules of using resources, for example. This happens generally when an organisation has more than one project to run at the same time. It is a matter of implementation, and this creates repetitive experience for project managers on how to coordinate with other projects' managers.

5.15.4 Complexity leads to unexpected problems

In case the project manager faces any unexpected problems in the project, this will affect the stability of its performance and its success. Therefore, they can increase the potential to avoid unexpected problems relatively and gradually by experience or depending on experienced teams.

5.15.5 Complexity affects the success or failure of the project

Complexity greatly affects the success or the failure of the project, but project managers can avoid the failure in the project performance by changing their plans or sometimes their management styles of the project which, as a result, works for them.

5.15.6 Complexity affects delays in implementation

Complexity may affect the time of implementation and cause delays. Managers believe that if all workers and team members are working toward one unified and clear vision, this eliminates the delays in the implementations and keeps efforts focused on the vision and the goal.

5.15.7 Complexity affects the ability to recognize risks

Complexity may affect the project performance by causing lack of ability to recognize the risks related to the project. Project managers can avoid this effect of complexity by taking into account both flexibility of changes and possibility of introducing changes to the plan and to the implementation processes as needed.

5.15.8 Complexity decreases profits because it increases time needed for implementation

Complexity leads to increase in the time needed for implementing the project and, consequently, leads to decrease in profits. Project managers can avoid this by creating favourable project environment and creating one common culture among workers in the whole organisation. This facilitates communication and, consequently, decreases the required time for planning and for implementation through achieving effective cultural communication.

5.15.9 Cultural complexity affects project success

Project managers deal with different cultural backgrounds inside and outside their projects, especially within global and multinational organisations. This may initiate cultural problems

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because of different cultural backgrounds in the workplace. As a result, communication becomes more complicated, and this may relatively delay the project progress. Managers who can avoid this effect of cultural complexity claimed that more cultural complexity needs more planning.

5.15.10 The outdoor working conditions may affect the project stability

Working conditions such as the weather, for example, and the inability to continue to work under high temperatures is an example of uncontrollable delays that may be related to the working conditions in the Middle East. Legislations force organisations to avoid outdoor working during high temperature conditions to protect workers' safety. This leads to delays of implementation and may consequently affect the project stability. Managers who can avoid this effect of environmental complexity extend the duration of their projects to absorb environmental conditions so they can stay stable and work within standards and control limits. Before they start looking at the project itself, they start by looking at the project environment and dealing with its variables. They also believe that they can overcome the environmental effect by focusing on the project attraction. They choose to accept projects that have high level of environmental complexity when they believe that they are of high levels of attraction to their customers and to the whole market. They create high level of awareness about the project dimensions and its importance among team members. They also believe that ease of communication and having common aspects to focus on, and using the right language of communication are major factors in avoiding the environmental and even cultural complexity effects on the stability of the project performance.

5.16 The actual interview quotes connected to the key themes that emerge from the data

According to the model of the study we have the following table of variables that are proposed by the researcher based on the literature review:

Figure 5.13 synchronizing the qualitative research to the proposed model of the study

Knowledge creation	Level of project complexity:	Level of stability of project
styles:		performance:
Innovative style	Size of the project "big – small"	Stability of the level of quality as
		planned
Risk averse style	Project system variety "High-	Stability of time as planned
	Low"	
Expert style	Project interdependency "high-	Stability of cost as planned
	low"	
Specialist style	Complexity of environmental and	Stability of productivity as planned
	cultural contexts "high – low"	

For better understanding of the real quotes of the interviewees and linking them to the purpose and objectives of the current study, a full detailed report of speech words and real quotes of interviewees after classifications and linkage are added to the appendixes of the current study.

5.17 Chapter summary

The chapter is a summary of primary research on the possible classifications of project managers into styles based on their behaviour when they create new knowledge for the purpose of achieving better control over their projects' performance. This section also attempts to find possible associations and justifications of these associations between the project performance and the knowledge creation, the project performance, and the project complexity. The following table summarises the main results of the qualitative study:

Questions	Summary of results
Questions covering tendency to prefer every KCS	
1- What is the comparative importance of	Some points of view preferred IKCS over RAKCS some are the
each style of knowledge creation from the	opposite
point of view of project managers?	Some points of view preferred SKCS over EKCS some are the
	opposite
	In general, two styles are most of the time closely used
2- Why do you think that experience is more	Practicality justifications
important than the education for the	
success of the project?	
1 5	
3- Why do you think that education is more	Upper view justifications
important than the experience for the	
success of the project?	
1 5	

Figure 5.14 Summary of qualitative study results

4-	Is it more important to have low risk project performance than to have innovative project performance?	Some said yes and justification is to achieve higher stability on the short run
5-	Is it more important to have innovative project performance than having low risk project performance?	Some said yes and justification is to achieve higher stability on the long run
Question	ns of Performance deviations and its reasons	
6-	How did you deal with unexpected problems in your project?	Examples of problems with reactions are explained
7-	What are the reasons behind deviations between actual and planned performance indicators?	Planning reasons, implementation reasons, and uncontrollable external ones.
8-	Why does the actual cost exceed the expected one?	Delays in time, rework, unclarity of scope, and changes in prices and currencies are the main ones
9-	Why does the actual profit become less than the planned one?	Inability to calculate it because of dependency and change in the prices
10-	What are the reasons behind deviation between the planned time of the project and the actual one?	Tight schedules and weather changes are good examples
11-	Do you expect the real time needed to implement the current project will be longer or shorter than planned? And why?	Most f the time the focus is on the completion before or at most at the planned time to save costs
Question	ns of performance stability and instability	
12-	Do you consider the performance of the current project a stable one and why?	Some said yes. Clarity of scope and support from vendors and top management are main reasons.
13-	What are the main reasons behind the instability of the project performance?	Customers changed requirements, contextual factors like market demand and supply
14-	In which aspects of the project performance do you as a project manager accept instability?	At the starting of each phase and before the completion of the project or when testing new solutions for the first time.
Associat	tion between PP and KC	
15-	When do you prefer to create new knowledge; during stability or during instability of your project performance?	Both points of view are found with justifications
16-	How does the new knowledge creation affect your project performance?	Competitive advantage, higher customer loyalty and satisfaction levels, more profits
17-	How does your personal experience affect your project performance?	Having tested ready-made solutions speeds up the implementation at lower costs and with less errors
18-	How does risk management and taking possible precautions affect your project performance?	More conformance to the plan, less uncertainty, better control over costs and completion time, less implementation obstacles.

19- How does specialization and certification in project management affect your project performance?	Having thorough view and better understanding of scientific basics of coordination and organisation during planning and implementation
20- How does innovating ideas affect your project performance?	Thinking out of the box generates higher profits on the long run- more opportunity and survival
Association between PP and PC	
21- Do you believe that the level of complexity of the project affects its performance? Why?	Some said yes and justifications were focused on non-conformance issues caused by this effect.
22- Do you believe that the level of complexity does not affect its performance? Why?	Some said yes and justifications are focused on the ability to avoid this effect for better control.

Source: Created by the researcher.

This chapter aims to examine all possible associations among research constructs, namely the association between the project complexity and the project performance on one hand, and the association between the project performance and the styles of managers when they create new knowledge on the other. The association between the level of complexity and the styles of knowledge creation is also discussed in detail. The section also includes an interpretation of why a project manager would accept or reject the fact of having instability in the project performance and whether this is considered healthy or not. After discussing the feedback from interviews with over one hundred project managers, it is concluded that there is ample evidence that there are associations in the sample of the study between the level of project complexity, the knowledge creation styles, and the level of project performance and its success. Further detailed analysis is included in this chapter about the sub-components of the proposed conceptual model. In order for this study to further contribute to the relevant body of knowledge, it is not enough to answer the qualitative questions and to find evidence about qualitative propositions only but also to use the triangulation of results by continuing toward a quantitative hypothetical research model and testing it statistically. This is the main focus of the next chapter.

Chapter Six: Results - Quantitative

6.1 Introduction

At the beginning of this chapter it is relatively important to highlight the value of the quantitative study in this research. The study of the phenomenon of the knowledge creation and its association with the contextual cognitive behavioral styles of project managers are qualitative in nature. The validation of the qualitative results is reinforced by a triangulation of results using the quantitative study as a deductive approach following an inductive one for more accuracy of prediction of project performance. This adds to the value of the generalizable results of the qualitative study by following it with a quantitative one. As a conclusion, a quantified measurable model of prediction and control is determining the changes in the project performance in the MENA region is resulted from the quantitative research.

Due to indications in the data and the literature, the study examines the moderation and mediation impacts of KCSs on the relationship between project complexity and project performance

At the beginning of the chapter, exploratory techniques such as correlation, crosstabulation, factor analysis, and cluster analysis are used, then inferential techniques such as regression analysis are used to facilitate the production of justifiable results by applying them appropriately and judiciously. The quantitative study is not just about finding significant relationships, or finding high coefficient betas, t-values, p-values, or good confidence intervals or even significant model fit and paths. Rather, it's about the prompting of reconsideration of what constitutes the key relationships. The researcher did not rely too heavily on positive signals as indicating problem solutions (Głodziński, 2019).

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The question is "what factors and effects of complexity in the project environment might be influenced in some significant ways by project managers' styles of knowledge creation?" Then, a further question, consistent with the line of argument of the thesis, "under what circumstances might project managers' knowledge creation styles influence positively project performance, and which of the measures adopted in the survey are relevant and seem to have a relationship?" In the discussion chapter that follows the present one, is a discussion about the risk-averse and the innovation knowledge creation styles and how they empirically and theoretically examine the desired impacts (Ahn et al., 2017). This chapter is about the descriptive statistics of the research and the hypotheses testing and attempts to show the description of the sampled projects and project managers. The study includes hypotheses testing the relationship between the level of complexity, the four proposed styles of knowledge creation, and the level of performance stability as the dependent variable of this study. At the beginning, the research prepares the data for hypotheses testing, and this preparation includes building constructs from the qualitative analysis results and testing the exploratory and the confirmatory factor analysis. The Cronbach Alpha test is used to test the reliability of the measurement of the research variables. After making sure that the exploratory factor analysis, confirmatory factor analysis, construct validity and discriminant validity tests are showing a good model fit, the hypotheses are tested using the structural equation modelling technique, and the results are detailed with appropriate objective interpretation of statistical analysis results. This chapter represents an introduction to research conclusions and recommendations.

6.2 Data Collection Protocol

The researcher used the LinkedIn, project management groups, approaching project managers in companies directly (walk ins), and snowball network of connections to reach project managers in fields of engineering projects, business projects, and IT projects. Booking for interviews was done via emails and phone calls. The respondents were read an introduction about getting the consent of the respondents and the objectives of the research and the estimated duration this questionnaire will take, along with a mention of the purpose of the study and the confidentiality rights. This introduction takes one minute maximum. Then the researcher goes to the reading of the items group by group starting with the coding relevant meanings (1 is high importance, 5 is low importance for the complexity items, 1 is strongly agree and 5 is strongly disagree for the knowledge creation styles, then 3 is as estimated, 4 and 2 are slightly higher or lower than estimated, and 5 and 1 higher and lower than estimated, respectively). The first group of items in the questionnaire is measuring the project complexity and is made of five items measuring the size complexity, four items measuring the system variety of the project, five items measuring interdependency, and three items measuring the environmental complexity of the project. The duration of collecting the data by getting all questions answered is between an average of 20 minutes, taking into account the time the respondent takes to think about each statement.

6.3 Research Population Definition and Sampling Unit Definition

The population of the study has no specific source of a list of all units or a sampling frame of all projects during the data collection period in the MENA region. The population of this study consists of all project managers managing small- and medium-sized projects that have a starting date and a completion date, have a final product to submit to contracted business customers, do not have a continuity nature of implementation, and are managed by one manager not a team of two or more managers in the MENA region. After revising the published research in the *Journal of Project Management* and the *International Journal of Project Management* across a five-

year span (2015-2020), there is a lack of enough applied research on MENA region project management; however, there are field indicators on the importance of research on performance control. According to the ME construct news web page, the project management is undervalued in the Middle East. A survey in 2014 done by PwC (The Annual Global CEO survey) 130 projects in the GCC countries were surveyed and many indicators on out-of-control facts were reported. Time control measurement shows 90% negative non-conformance in the form of delays, 71% shows negative non-conformance in the form of exceeding the planned costs. In 2020, the same survey concludes that over 53% of CEOs believe that the rate of global economic growth will decline. This makes this study more significant for this region.

6.4 Sample Characteristics

The following table shows the classification of the sample 402 units based on the crosstabulation between the age group of the project managers and the number of projects they are managing simultaneously during the period of the data collection:

6.5 Sample Size

The total number of units collected in the sample is 402, which exceeds the 384 units, making it possible to run the statistical analysis on it and reach a generalization of results. Statistically, the sample size is sufficient.

6.6 Link of Measurements to the Previous Research Measurement

6.6.1 Measurement of project complexity

The measurement of the project complexity is derived from the measurement of Vidal of project complexity (2011) (Vidal, 2011). The measurement of the project complexity in Vidal's research depends on determining a weight for complexity main criteria, and then another weight for sub-criteria under each criterion and then multiply the weight of the criteria by the weight of each sub-criterion to find what he calls the relative value for each project. Then, rank projects in one organisation based on the project relative value and how high or low is this value compared to other projects, so the manager can decide the prioritization of managing project complexities based on this comparison. In the current research, the focus is on the measurement of the project complexity for each project and is not on the comparison between projects Accordingly, a modified measurement will be used by excluding the complexities. multiplication of scores and finding the relative value for projects complexities against each other. This is because each project in the sample of the study belongs to a different organisation and is managed by a different project manager. The aim is to be able to achieve the research objective which is not the classification of projects based on their complexity but to find the independent effect of complexity on the project performance moderated and mediated by the knowledge creation styles. Table 6.1 illustrates the criteria and sub-criteria used to measure the project complexity by Vidal (2011):

Criteria	Sub-criteria
Project Size	• Number of stakeholders
Project Variety	 Variety of information systems to be combined Geographic location of the stakeholders
	Velate of the latenet of the state of the state
	• Variety of the interests of the stakeholders
Project Interdependencies	• Dependencies with the environment
	• Availability of people, material due to sharing.
	• Interdependence between sites, department and
	 Interconnectivity/feedback loops in the project networks
	Team cooperation and communication

Figure 6.1 Vidal's measurement of Complexity (2011)

	 Dependencies between schedules Interdependencies of information systems Interdependence of objectives Level of interrelations between phases Specification interdependence
Project context-dependence	 Cultural configuration and variety Environment organisation complexity Environment technological complexity

Source: Vidal (2011)

Table 6.2 illustrates the modifications in the measurement of Vidal's measurement based on the pilot studies and the judgement of experts in the field of project management:

Criteria	Sub-criteria	Sub-criteria added (a) or modified (m)
Project Size	Number of stakeholders	 In general, the importance of the effect of the project operational size on complexity (a) Number of investors in the current project (a) Number of suppliers of the current project (a) Number of workers of the current project. (a) Duration of the current project (a)
Project Variety	 Variety of information systems to be combined Geographic location of the stakeholders Variety of the interests of the stakeholders 	 In general, the importance of the effect of variety in the project operational system on complexity (a) Variety of information systems used in the current project (m) Variety of geographical locations of the current project (m) Variety and conflicts among project's goals (m)
Project Interdependencies	 Dependencies with the environment Availability of people, material and due to sharing. Interdependence between sites, department and Interconnectivity/feedback loops in the project networks 	 Inter-dependencies between sites, departments, and companies for Implementing the current project Inter-dependencies between information systems of the current project Inter-connectivity & feedback loops in the tasks & networks of the current project In general, the importance of the effect of the level of interdependency with other projects and systems on complexity

Figure 6.2 Thesis measurement of complexity - Adapted from Vidal (2011)

	 Team cooperation and communication Dependencies between schedules Interdependencies of information systems Interdependence of objectives Level of interrelations between phases Specification interdependence 	 Availability of people, materials, & any resources due to sharing with other projects Dependencies between schedules of implementation of the current project with other projects Inter-dependencies between objectives of the current project Processes inter-dependencies of the current project Team communication and cooperation problems Level of interrelation between project phases
Project context- dependence	 Cultural configuration and variety Environment organisation complexity Environment technological complexity 	 In general, the importance of the effect of the complexity of environmental and cultural contexts of the project on complexity (a) Networked environment (environmental complexity) (m) Cultural configuration and variety in this project Dependencies between the current project and external environment (then this was deleted after piloting)

Source: researcher adapting the measurement of complexity from Vidal (2011)

Two qualitative interview questions were added to the measurement for further in-depth

clarification:

Do you think that the level of project complexity affects your project's planned performance?

If yes, how?

Do you think that the level of project complexity may lead to performance deviations? If yes, give an example.

6.6.2 Measurement of SKCS

To derive the measurement of knowledge creation styles, the researcher referred to the literature in the area of knowledge creation. In 2003, Bunderson and Suttcliff explained how they considered the use of the past performance as a source of creating knowledge upon which managers base their decisions (Bunderson, 2003). This is considered as a type of experience because it occurred in the past, and the manager is the one who went through it personally and then stored this experience as a piece of knowledge and referred to this piece of knowledge when needed as an input to new knowledge creation. Bunderson and Sutcliff dealt with this kind of learning from a psychological point of view. They linked the team learning in which people learn from the experiences of other people to the improvement in performance (Bunderson, 2003). They explained how they found that the improvement in performance can be compromised by giving higher priority to the team learning to increase the team effectiveness and, hence, the performance will improve for longer periods of time. They did not apply their research on projects. They applied it on business units; however, their psychological analogy added the dimension of building new knowledge based on the learning from behaviours of another member in the team. Another analogy was introduced by Cynefin in 2009 (Chandran, 2009.). Cynefin argued that the knowledge creation in Nonaka's Spiral model that starts with the individual and develops to the organisational level lacks clarity and organisation. He took the knowledge creation from the point of view of dealing with information systems and depended on using experimentations and documenting these experimentations during the introduction of a new change as a source of creating new knowledge for individuals. This scientific approach is another contribution to the creation of the measurement of knowledge creation styles of project managers in this study. A year before the contribution of Cynefin appeared in the body of the science of knowledge management, Fryer used the experience of other people to connect pieces of knowledge as a stage of creating new knowledge. This

contribution emphasised and validated the work of Bunderson & Suttcliff and Grantcharov in 2003 (Grantcharov, 2003) (Demirkesen, 2017). They all emphasised the use of experience as a source of creating new knowledge. Bearing in mind that Nonaka's model did not give adequate clarity for the sources of knowledge creation as claimed by Cynefin (2009), this is scientifically considered as a gap in the knowledge that needs further effort of measurement and investigation. DeMacro (2006) (Akhavan, 2006)classified knowledge creation into different groups based on the type of knowledge that managers wish to create. He claimed that there is cognitive knowledge, emotional knowledge, spiritual knowledge, and organisational one (Du Plessis, 2007). He highlighted the pushing of knowledge creation process to lower levels in the organisational knowledge creation process in case the specializations required are available in lower levels in the organisational teams (Akhavan, 2006).

Oluikpe (2015) (Oluikpe, 2015), who conducted a research on the Knowledge creation and utilization in project teams, claimed that organisations tend to use explicit easy-to-measure knowledge rather than tacit knowledge. He measured the effect of organisational knowledge creation on innovation, project completion time, project success, operational efficiency, and generation of new knowledge/project learning. He had a different classification of knowledge creation compared to DeMacro's contribution. Oluikpe measured the knowledge creation and categorized it into categories that are aligned with project cycle. The interpretation category of knowledge creation is aligned in his model with the identification stage of the project where project teams create one common interpretation of project objectives as a platform for the project. Table 6.3 illustrates the items used to measure knowledge creation and its relationship to the project outcomes provided by Oluikpe aligned with the evaluation relative to the measurement of knowledge creation and its relationship to project performance in the current research:

Constructs	and question	nnaire items of	measuring knowledge creation	Constructs and questionnaire items of measuring project outcomes			Evaluation	
Category	Alignme nt with project	Definition	Questionnaire items	Category	Alignme nt with project	Definition	Questionnaire items	
	cycle				cycle			
Interpret ation	Identific ation	Common interpretati on of project objectives	We consider a knowledge management process at the initial stage of the project. Change management is a factor in our project planning. We conduct a risk analysis of our project at the planning stage. We estimate the time necessary for completing various aspects of the project. Our project defines what constitutes success for this particular project. We reviewed similar project reports/lesson learnt in the past before planning the project. We also conduct feasibility studies at the commencement of the project. We consider the experience and qualifications of staff seriously before assigning them to any project. Best practices are a very important aspect of our project considerations We had information management	Innovati on	All stages of the cycle	This variable explores new things (ideas, products, processes, and outcomes) that happen in the project as a result of collaboration.	We usually generate new ideas on a project We often stumble on new things as a result of relating with our team members. New ideas are welcome & implemented in the team by team leaders.	The author mixed risk- averse with experiential sources of knowledge creation in the interpretation category. The author considered innovation as an outcome of knowledge creation not a source of it.
Assimila tion	Preparati on/ Develop ment	Project team members collaborate and work with commonly accepted (interprete d) symbols, mental models, framework s, and principles. These are internalize d (assimilate d) even if temporaril y to implement the project.	plans put into place at the beginning of the project. There was/is a lot of teamwork during the project. Team members helped each other learn on the project and newcomers especially were able to learn from others on the job. We held/hold regular progress meetings to review work done, brainstorm, and to correct mistakes and also plan ahead for the project. There was the presence of informal groups/communities within the project. Team members are also allowed and encouraged to communicate with other similar external projects to gain knowledge. Project team members are encouraged to share what they know and there are technologies that encourage them to document and share (please, also complete the knowledge management technologies section).	Project success	All stages of the cycle	This variable explores the linkage between social (team) collaboration & the successful outcome of the project.	Our project succeeded because of collaboration among team members. We attribute the project's success to knowledge sharing & collaboration among team members. In my opinion, I can say that our project succeeded.	Learning from the experience of other is obviously one of the main sources of knowledge creation in the assimilation category, however; it is not clear which specialization is needed for better results. The author refers success to team collaboration, however; the source of knowledge may create a behavioural pattern for creating new knowledge
Reprodu ction	Impleme ntation	This is the stage at which the project is implement ed using knowledge resident in the project and team members. The unique feature at this stage is the	Knowledge gained from group collaboration, discussion, and sharing were critical to executing the project. There were attempts to translate innovative ideas into practical equivalents during the execution. In my estimation, our project created new knowledge during its lifecycle. The project leadership was very critical to its success. The team work on this particular project was adequate in helping project delivery.	Operatio nal efficienc y	All stages of the cycle	The variable explores project's perception of how better their processes are running due to increased collaboration and knowledge utilization.	Our projects complete on time because of team cooperation. Our project met the specific timelines given by the stakeholders.	Implementation of project is accompanied with utilization of knowledge. The clarity of the contribution of utilizing the knowledge is illustrated by role of project leader, identification of out of control issues and

Figure 6.3 Evaluation of measuring KC and measuring PP of Oluikpe (2015)

		replication of knowledge (utilization)	There was an issue management process which enables project staff to identify concerns and raise them appropriately to leadership for necessary action. We had a quality management procedure in place to ensure the project adhered to accepted standards. There was also a breakdown structure in place to ensure that various aspects of the project were successfully assigned to competent staff. I would consider our project success from the point of the stated objectives at the commencement of the project. The project also met the cost, schedule, and time requirements of the stakeholders.					conformance to standards and planned objectives highlighting cost, time, quality, and schedule controls by running better processes
Codificat ion	Evaluati on	Here, the knowledge used during the project and lessons learned are documente d (codified). Project reports, lessons learned reports, lessons learned reports, repositorie s, FAQs, blogs, success stories, & many other outputs from projects constituted useful project knowledge in codified form.	The project was analysed at the end against stated objectives & stakeholders views. We have a system/process put into place to review our projects. We maintain a repository/documentation/reports detailing the activities that went on from the identification to the evaluation stage of the project. This report is available for project members & other interested parties. Staff who have been reassigned to other projects could also be reached when questions regarding the project come up.	Generati on of new knowled ge	All stages of the cycle	This variable explores project's perception about the generation of new knowledge from collaboration	Team relationships impact on the quality of work we deliver on the project. Our processes run efficiently & is understood by majority team members.	Reviewing and documenting the new knowledge is a source of storing history of success (experience) to be used in the future by project managers and teams.
				Timely completi on	All stages of the cycle	This variable explores the impact of collaboration & knowledge sharing on timely completion of projects.	We have learnt new things in this project which we can transfer to future projects. We document lessons learned in order to adjust future work. The lessons learned are made accessible to all stakeholders.	Experience is a source of new knowledge and learning.

Source: Created by the researcher and adapted from Oluikpe research (2015)

Table 6.3 illustrates how the classification of sources of creating new knowledge may add to the clarity of knowledge creation styles and behavioural patterns of creating new knowledge by project managers rather than by mixing the inputs with the expected outputs of the knowledge creation process, as in the case of considering risk averse as an input and innovation as an output of knowledge creation.

There is a common understanding by DeMacro (2006) and Oluikpe (2015) in the area of the use of competencies of team members in the process of creating new knowledge (Aucoin, 2007) (Oluikpe, 2015). Both highlighted the importance of collaboration due to the availability of specialized knowledge in lower levels or in diversified collaborated project teams for the purpose of passing changes and creating new practices successfully during chaotic situations. This is backed by the findings of John Austin (2003) who studied the transactive memory in organisational groups and specifically the effect of specialization of each member in the group on the accuracy of the group performance and the attainment of the planned goals of the group (Austin, 2003). In his research, he measured and valued the contribution of the specialization as a determinant of performance and the goal achievement. Austin used the direct questioning for group members about the use of their specializations in knowledge creation processes of the group (Austin, 2003).

In this research, the focus is not on the aggregation of individual scores to calculate the group score; rather, it is on individual project manager's behavioural style, and this is the reason why the concern is about measuring the use of specialization in creating new knowledge at the level of individuals not groups. Bonaccorci and Daraio (2007) wrote a book about knowledge creation for universities which shows how specialization is a core component of creating new knowledge and how this specialized new knowledge affects the strategic performance of the universities in Europe (Bonaccorsi, 2007).

For the specialized knowledge creation style, there are several research contributions that lead to the creation of a measurement of this style. Thomas and Mengel (2008) talked about the behaviour of project managers and how to prepare them to deal with the project complexity

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(Thomas, 2008). Their work was extended in the study of Moura, Carneiro, and Diniz (2018) about the personal traits, skills, and knowledge that affect the project performance (Moura, 2018). They asked about the knowledge component directly and used previous evidence on the use of this knowledge component from the literature, as shown in table 6.4:

Knowledge I have knowledge in; of		References		
Q1b	Project management tools and techniques	(Haggerty, 2000, April); (Diniz, Oct-Dec 2018); (F.TEdum- FotweRMcCaffer, April 2000) (Brill, 2006)		
Q1c	Project success measurements	$(D_{-1}, 11, 2006)$		
Q1d	Writing proposals	-(BIII, 2000)		
Q1e	Technology assets	-(Diniz Oct Dec 2018)		
Q1f	Multidisciplinary topics	-(DIIIIZ, OCI-Dec 2018)		
Q1g	Politics or culture external to the organisation	(Brill, 2006)		
Q1h	Partners	(Brill, 2006) (Diniz, Oct-Dec 2018)		
Refe	rence: (Moura, 2018)			

Figure 6.4 Adapted measurement for plenty of measurements in different studies

In table 6.4 the measurement is about the available knowledge without showing how it was created and how it was used, and this does not show the dynamics of knowledge creation. The use of the knowledge assets as an input or as an output of implementation may show better results of affecting the attainment of goals or the achievement of better performance. However, the current study has a similar approach of using evidence from the previous studies in the literature to create the measure of the knowledge creation behavioural style. The study of Moura and his colleagues revealed the use of certification as an evidence on specialization and that it moderates the relationship between the available knowledge for project managers illustrated in the previous table and the project performance, and this is used to create the measurement of specialized knowledge creation style in the current study. DeMacro (2006) mentioned that it is better to create knowledge by making use of diversified specializations of the project team

members and believed in the importance of project leader's specialized knowledge (Akhavan, 2006). The diversification of specializations is also used to create the measure of specialized knowledge creation by direct statement formulation. Risk averse appears in the literature of project management and is the concern of the project manager at the stage of planning and goal setting of the project, then throughout the implementation and until the delivery of the final product to the customer. The estimation of risks uses explicit sources and documented assets to create estimations and trends. Milton and Ramsfield (2011) reported that project managers create risk averse knowledge by depending relatively more on explicit stored knowledge to create new knowledge about how to avoid project risks and prepare for them (De Moura, 2018). Risk-averse knowledge creation focuses on the actionability of knowledge and avoids the implicit non-documented sources of knowledge to increase the accuracy and minimize uncertainty (Binder, 2009). As found by DeMeyer and Pitch, the creation of risk-averse knowledge using these resources maintains the ordinary level of performance and minimizes outliers. DeMeyer and Pitch also contributed to the risk-averse knowledge creation measurement of this study by stating that the project manager tends to keep contingency reserve for dealing with the expected risks; accordingly, risk-averse is a knowledge input to the control over the project performance, and asking about keeping the contingency reserve is asking about a risk-averse knowledge creation asset and about how frequent the project manager relies on it (Hasan, 2009). This is backed by the findings of Grey (2014) who believed that the project manager needs to create knowledge about the existence of risks not just the expected risks and that creating precautional knowledge and risk antagonism is important even if the project manager does not know what risks they are and how they will affect the project performance (Gray, 2013). One of the behavioural pattern items related to risk-averse knowledge creation is the belief that the risk controllers seek higher levels of control over their projects and consider this as a goal to achieve (Leitch 2008) (Leitch, 2008). Arumugum (2013) believed that the psychological safety affects the know-how and the performance of the manager and the learning process (Arumugam, 2013).

This can be considered as an indicator of the manager's behaviour. The behaviour of the manager who has safety has indicators according to Arumugam, and these are like continuity of monitoring reactions (Arumugam, 2013). As for the creation of the measurement of the innovative knowledge creation pattern of behaviour, the literature review indicates the existence of positive significant relationship between creating new knowledge and innovation (Luo, He, Xie, Yang, & Wu, 2017) and that the innovative assets and resources upon which the project manager depends to create new knowledge include his or her belief in depending on intellectual properties to achieve innovative performance (Berkeley S, 2010). Berkeley claimed that there is a DNA measurement of innovation and that it affects the organisational performance, but he also asserted in his measurement that there is a measurement of the use or resources of innovation, and this is what is known as knowledge assets. This measurement, too, affects the organisational performance. One of the behavioural patterns that Berkeley speaks about in his measurement is the belief in high sensitivity and in finding quick changing plans for unexpected changes that has a very low probability to be repeated in the future. The project manager who depends on innovative knowledge creation assets tends to behave in a way that represents innovative coping with instability (Akhavan, 2006). These findings were reinforced by the findings of (Linstone, 2011) who claimed that the innovative knowledge creator believes that innovation leads to better adaptation with chaotic changes in performance and to better competition as well. With respect to the risk-averse knowledge creation, there is more dependency on explicit knowledge assets than on implicit ones; however, as for the innovative knowledge creation, the dominance is for the use of tacit knowledge creation assets (Girdauskiene, 2013). Berkeley's measurement of the human assets' DNA is evidenced on considering the innovative human asset as a source of innovative knowledge creation. The manager, when depending on innovative human assets to create new knowledge, is considered as innovative knowledge creator based on the used sources of knowledge (Berkeley S, 2010). To measure the experiential knowledge creation, Bunderson and Suttcliff (2003) found that people learn from the experience of each other and can create adaptive behaviours that lead to improved performance (Bunderson, 2003), but this relationship is found to be complex and non-linear. Their work was improved by the work of Bunderson and Sutcliffe (2005) to add more evidence on the existence of this relationship; however, according to (You et al., 2016), diversity of experiences learnt by the individual leads to decreased performance. (Reich et al., 2008) found that motivation to get this experience is a moderator to improve the performance. This is happening when studying the group learning not the individual one, which is the focal point of the current study. Cynefin (2009) came up with a classification of leaders and how they make sense and adapt in complex landscapes, as illustrated in the following graph (Hasan, 2009):



Source: Adapted from: (Beurden, 2011)



The above graph illustrates similarity between the proposed four styles of knowledge creation and the Cynefin's model of how leaders adapt to complex landscapes. There is no evidence that the proposed KCSs are correlated to the four categories of Cynefin; however, there is evidence that leaders differ when they adapt to changes. They estimate based on documents in the sense that when there is risk-averse response, they try high risk solutions for the first time when they innovate; they depend on each other's experience to implement good practice; and they use specialization to categorize things to be able to adapt to change. The change is represented by the gap between the planned performance and the actual one, and the action is to minimize it while the context is dynamic. Cynefin recommended the experimentation during the occurrence of the change to create knowledge (Hasan, 2009). (Fischer, 2006) found that the use of the experience of other people is moderated by the interest in the topic. The more interest the more use of other's experience as he claimed, and this is connecting pieces of knowledge to one another to solve problems. Haleblian and Rajagopalan (2006) (Haleblian, 2006) found that the acquisition of prior experience and the performance feedback are positive predictors of further success in future acquisition, and this is related to learning and creation of knowledge from past performance and from previous experience. Experience is related to the know-how and the know-what about controlling performance (Arumugum 2013), as previously mentioned in the discussion of Berkeley's study about the impact of social networks on learning and creating new knowledge from another people's experience. A study about the surgical skills was published by The American Journal of Surgery about the improvement in time performance and number of errors and minimization of unnecessary effort by increasing the impact of operative experience on performance on a virtual reality simulator. This study was conducted by Grantcharov (2003) and contributes to the area of using self-history of success and experience in improving performance and increasing its success (Grantcharov, 2003).

After this discussion of measurements of knowledge creation, here is the formulated measurement of knowledge creation styles using the following items:

Figure 6.6 Adapted measurement of KCSs from the literature

	Styles of Knowledge Creation			Related to
1	Safety precautions enables me to stabilize my project performance. (RA)	RAKCS1		(De Moura, 2018) (Fischer, 2006)
2	Risk avoidance is my first priority in managing chaotic changes in my project performance. (RA)	RAKCS2	_	(Bell & Pether,
3	Controlling risks is not the first priority goal of this project. (RA-)	RAKCS3	-	1998/01/01)
4	I practically ignore keeping contingency reserve for dealing with expected risks to increase my profits (RA-)	RAKCS4	- RAKCS	(Leitch, 2008)
5	I keep contingency reserve only for dealing with expected risks that I am sure it will affect my project performance. (RA)	RAKCS5	_	(Hasan, 2009) (Grey 2014)
6	Changing the plan is not my favourite coping solution for unexpected changes. (RA)	RAKCS6	-	(Bell & Pether, 1998/01/01)
7	I don't feel comfortable with changing the way I manage the project (INN-)	IKCS1		(Fischer, 2006) (Surget, 2011)
8	I try to innovate something new to cope with chaotic changes in my project performance. (INN)	IKCS2		(Linstone, 2011)
9	Innovations is my best course of action to solve chaotic problems during project implementation. (INN)	IKCS3	IKCS	(Linstone, 2011)
10	I depend on collecting information about competitors to create new knowledge, (INN)	IKCS4	-	(Baizhou, 2013)
11	When I take critical decisions, I depend on the available databases more than my feelings and personal skills (-INN)	IKCS5	-	(Arumugam, 2013) ; (Berkeley S,
12	Feelings and skills are more important to me than databases and documents when creating new knowledge. (INN)	IKCS6	-	2010) (Berkeley S, 2010)
13	I depend on others' experience to learn new things. (EXP)	EKCS1		(Mark, D., &
14	My Social networks help me in creating new knowledge. (EXP)	EKCS2	-	Adam., 2008) ((Berkeley S,
15	Others' experience enables me to connect pieces of knowledge. (EXP)	EKCS3	EKCS	2010) (Arumugam, 2013)
16	I use my experience for dealing with chaotic situations in project management. (EXP)	EKCS4	_	(Grantcharov,
17	My experience enables me to familiarize with a new change in the environment. (EXP)	EKCS5	-	(Hasan, 2009) (Grantcharov,
18	My performance in the past is an input for creating new knowledge. (EXP)	EKCS6	-	2003) (Bunderson, 2003) (Haleblian, 2006)
19	I push the decision-making process to lower levels if I don't have enough information (SPEC)	SKCS1		(Fischer, 2006)
20	I used my educational background when managing this project. (SPEC)	SKCS2	-	(Moura, 2018)
21	Depending on diversified specializations is ineffective in managing chaotic situations. (SPEC)	SKCS3	SKCS	(Fischer, 2006)
22	I disregard thinking of what I have studied when dealing with chaotic changes in my project. (SPEC-)	SKCS4	-	(Thomas, 2008)
23	My study helped me to achieve my project goals (SPEC)	SKCS5	-	(Austin 2002)
24	I focus on one specialty to deal with new changes. (SPEC)	SKCS6	-	(Ausuii, 2003)

Source: Created by the researcher upon the use of the literature in formulating the KCSs items of measurement The following table indicates the taxonomy pertaining to measurement of knowledge creation

styles in the literature in comparison with the current study

Knowledge	Measurement	Criteria for	Definition	Researchers, year, References
creation aspect	Data Source	Assessment		
Process Metrics	Actor perception	Internal	Metrics are based on the subjective classification of immediate output obtained from knowledge creation by participants	Inkinen referred in 2015 to participant interviews in evaluation of knowledge creation processes in joint ventures such as personnel movements, parent interactions and technology transfer. (Inkinen H. K., 2015)
Output Metrics	Actor perception	External	Metrics are based on subjective classification of immediate output from knowledge creation by non- participants	Nonaka stated in 2014 about observational assessment of the performance of an actor in a knowledge creation process. (Nonaka, 2014)
Output Metrics	Actor perception	Internal	Metrics are based on the subjective classification of immediate output from knowledge creation processes.	In 2006, Paul stated about the example of tele-medicines consultations coded as knowledge creation.
Output Metrics	Non- participants	External	Metrics are based on the classification of immediate output of knowledge creation processes by non-participants	Parent and Gallupe provide the example about enriched ideas coded by experienced and hypothesis-blind researchers in 2000.
Outcome Metrics	Substantive evidence	Internal	Metrics are based on an internal assessment by the organisation for new operational resources such as new products, documents, services or routines.	Schulze and Hoegl provided the example of developing new product prototypes in 2006.

Figure 6.7	Taxonomy p	pertaining to	o measurement	of knowledge	creation
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Outcome	External	External	Metrics are based on external	McFayden and Cannella stated
Metrics	evidence		criteria established for observing	about journal impact data in 2004.
			knowledge creation that are often	
			reflective of the value added by the	
			knowledge creation process.	
Output metrics	Internal	Internal	Metrics are based in internal criteria	Abousamra, R. stated about the
	evidence		focusing on knowledge creation	project implementation performance
			perception of behaviour that is often	compared to the planned one in
			reflective of the action taken to	different complexity levels.
			create knowledge for the purpose of	
			controlling performance in a	
			changing dynamic context.	

Source: Created by the researcher from literature compared to the current study.

6.6.3 Measurement of project performance

There are several attempts to measure the project performance and to create its

constructs.

Table 6.7 illustrates the seven-dimension model of project performance for

practitioners found by (You et al., 2016)

Dimension of measuring project performance	Sub-dimensions	Evaluation and relevance to the current study's measurement of project performance
Respect for time	a. Respecting the initial planning	The stage of measurement is before delivering the project
	b. Presenting an efficient product development	to the customer. And time is considered as one of the dimensions
	c. Exceeding the planning at the end	Exceeding the planned
	d. Being on time in the market	performance indicator is considered in coding and justified

Figure 6.8 Relevance of the measurement of project performance in the current study to the measurements in the
literature
Respect for budget and technical specifications

and transfer
Contribution to prestige
Respect for innovativeness
Contribution to business success
Financial and commercial success

Source: (adapted from Anneke, 24/7/2020.)

Another more focused model on project performance scope is found by Oluikpe (2015) and

consists in measuring the project outcomes as illustrated in table 6.8 (Oluikpe, 2015):

Cotogory	Alignmont	Definition	Questionnaira items	Evaluation and relevance to the current study's
Category	to project cycle	Demntion	Questionnaire items	measurement of project performance
Innovation	All stages of the cycle	This variable explores new things (ideas, products, processes, and outcomes) that happen in the project as a result of collaboration.	We usually generate new ideas on a project We often stumble on new things as a result of relating with our team members. New ideas are welcome & implemented in the team by team leaders.	Items are mixing the innovation with the team experience and the encouragement to generate new ideas. Innovative knowledge creation is considered as a moderator between project complexity and project performance in the current study not a performance outcome however it could be measured as an outcome for other purposes in future studies.
Project success	All stages of the cycle	This variable explores the linkage between social (team) collaboration & the successful outcome of the project.	Our project succeeded because of collaboration among team members. We attribute the project's success to knowledge sharing & collaboration among team members. In my opinion, I can say that our project succeeded.	The project success is dependable on cooperation among team members, however the learning from team members' experience is the source of creating new knowledge for closing the gap between the planned performance and the actual one in the current study.
Operational efficiency	All stages of the cycle	The variable explores project's perception of how better their processes are running due to increased collaboration and knowledge utilization.	Our projects complete on time because of team cooperation. Our project met the specific timelines given by the stakeholders.	Conformance between planned time and actual time performance is measured in the current study but not related to the team cooperation as the focus is on the individual project manager.
Generation of new knowledge	All stages of the cycle	This variable explores project's perception about the generation of new knowledge from collaboration	Team relationships impact on the quality of work we deliver on the project. Our processes run efficiently & is understood by majority team members.	The conformance between the planned quality and the actual quality performance is measured in the current study. Understanding of the processes by the team is excluded as it is not within the aim of the current study.
Timely completion	All stages of the cycle	This variable explores the impact of collaboration & knowledge sharing on timely completion of projects.	We have learnt new things in this project which we can transfer to future projects. We document lessons learned in order to adjust future work. The lessons learned are made accessible to all stakeholders.	Documentation of learning is out of the scope of the current study.

Figure 6.9 Relevance of Oluikpe's measurement of project performance (2015) to the current study's measurement

Source: Created by the researcher to compare between previous research and the current study's measurement of project performance

In the Project Management Journal, Shenhar, Levy, and Dvir (1997) (Shenhar, 1997) tried to

create a new measure for the project performance. They call it the project succession

dimensions, and it includes three main dimensions as illustrated in table 6.9 with the

evaluation of its relevance to the current study:

Figure 6.10 Shinhar, Levy, and Dvir (1997). Measurement of project performance in comparison to the current study

Meeting design goals	Meeting operational specifications	This is the main dimension of
	Meeting technical specifications	measuring performance
	Meeting time goals	success in the current study
	Meeting budget goals	

Impact on customers	Fulfilling customer needs Out of scope of the curr	
	Solving major operational problems	quantitative study
	Actual used by customers	
	Level of customer satisfaction	
Benefits to the	Level of commercial success	Out of scope of the current
organisation	Generated a large market share	quantitative study
	Opened a new market	
	Opened a new line of products	
	Developed a new technology	

In this study, an updated factor analysis reveals that the first and the second items in the first group may be added to the second group items under one factor called 'customer satisfaction' which means that meeting operational specifications and meeting technical specifications will directly or indirectly contribute to the level of customer satisfaction. The meeting of time goals and budget goals were grouped together under another different factor called budget and schedule. The researcher measured the difference in these dimensions before the completion of the project, and after the completion of the project and then delivery to the customer, the researcher found that there is no significant difference between these factors before and after completion, as illustrated in table 6.11:

Figure 6.11 Evidence on the insignificant difference between the success measurement before project completion and after it

	Success dimensions							
	Customer sa	atisfaction	Budget and	d schedule	Business S	luccess	Future Potent	tial
Project phase	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Before completion	5.96	1.00	5.15	1.28	5.24	1.59	3.96	1.86
After completion	6.25	.64	5.46	1.34	5.60	1.40	5.07	1.36
ANOVA F	2.23(n.s.)		1.65 (n.s.)		1.23 (n.s.)		10.19 (p less	than .005)

Source: (Shenhar, 1997)

This adds to the ability of the current study to limit the research to pre-completion phase and direct interaction with customers and, at the same time, to exclude the updated dimensions related to the business success and future potential. This has been done to achieve the current

study's objectives of closing the gap between the planned performance and the implemented one. This has been achieved through studying the interaction between project complexity and knowledge creation by project managers. It is important to notice that this research indicates that the relative importance of the succession dimensions is time-dependent as illustrated in graph 6.12:



Relative Importance of Success Dimensions is Time-Dependent

Source: (Shenhar, 1997)

Figure 6.12 Project performance is a time dependent variable

This means that the current study focuses on the primary and early stages of achieving the project success and leaving the later ones to further research in the future.

Atkinson (1999) provided another model for measuring the project success in the field of constructions which is within the scope of the sample of the current study. Graph 6.13 illustrates Atkinson's model for measuring project performance success:



Source: (R., 1999)

Figure 6.13 Atkinsons model of measuring project performance

In his quantitative measurement model, Atkinson revealed that the scope of measurement that is related to the delivery stage of the project life in which the project managers focuses more on the process, and the doing-it-right approach is the first stage of achieving the project success. The second one is called, according to Atkinson, post-delivery stage in which the focus is on the measurement of system point of view and the impact on the customer and other stakeholders in the project. Again, it is obvious that in comparison to Atkinson's contribution, the focus in the current study is on the measurement of the delivery stage success and on studying the impacts of knowledge creation at this stage not at the post-delivery stage. This is compatible with the studying of the micro level of project success found by another measurement study done in the same year by Lim and Mohamed who talked about the points of view of evaluating the project success. Graph 6.4 illustrates their contribution to the measurement of project success on the micro levels:



Source: (Lim, 1999)

Figure 6.14 Lim and Mohamed's model (1999) of project success

The current study focuses on the micro level viewpoint of the measurement of the project success and measures the conformance to the planned time, cost, quality, and productivity.

Dr Albert Chan from Queensland University of Technology in Australia wrote a report in 2001 on a framework of measuring succession in construction projects in which he mentioned over 31 pieces of research between 1990 and 2000 used time, cost, and quality as measurements of performance success.

Freeman and Beale (1992) claimed that the measurement of the project success depends on the measurement of the technical performance during execution, in addition to other factors such as early termination, personal growth, and technical innovativeness of the project. They considered manufacturability as an impact factor on the project performance, and this is related to the measurement of productivity and the relationship between inputs and outputs of the project during its implementation.

TECHNIQUE/TOOL O	IN MONITORING AND CONTROL				
Variables	PMI	APM	ICB	ISO	PRINCE2
Scope	Inspection, Variance analysis			Measurement and control progress	
Time	Performance reviews, Variance analysis, Project management software, Resource leveling, What-if scenario analysis, Adjusting leads and lags. Schedule compression, Scheduling tool	WBS (Work Breakdown Structure), OBS (Organizational Breakdown Structure), Gantt Charts, Milestone Charts, PERT, CPM, Precedence diagram,	Responsibility matrix, Critical path planning, Time contingency 'buffers' or 'float', Time planning methods and time control methods	The timings of reviews, Work breakdown structure	Activity-on-node technique, The critical chain technique, Gantt charts, Spreadsheets, Critical path diagram, Milestone chart, Estimating techniques, Product checklist
Costs	Earned value management, Forecasting, To-complete performance index, Performance reviews, Variance analysis, trend analysis, Project management software	Earned value management, CBS (Cost Breakdown Structure), Cash flow, Trend analysis – predictions, Key performance indicators	Cost control methods, Earned value, Budget planning and budget control, Key performance index, Project reporting system	Earned value analysis, Flowcharting, Measuring project performance (KPI), Plan for remaining work	
Quality	Cause and effect diagrams, Control charts, Flowcharting, Histogram, Pareto chart, Run chart, Scatter diagram, Statistical sampling, Inspection, Approved change requests review	Quality management		Pareto chart, Control charts, Trend analysis, Statistical methods, Inspection and auditings, Quality auditing	Pareto analysis
Risk	Risk reassessment, Risk audits, Variance and trend analysis, Technical performance measurement, Reserve analysis, Status meetings			Regular reviews of the project schedule, Progress review meetings	Risk checklists, Risk prompt lists, Risk models, Risk breakdown structure
Communications and procurements	Forecasting methods, Communication methods, Reporting systems, Contract change control system, Precurement performance reviews, Inspections and audits, Payments systems, Claims administration, Records management system			Control of documents and records	

Figure 6.15 Techniques of monitoring and controlling performance for Guerra and others (2014)

Source: (Guerra, 2014)

Table 6.15 shows that there are different tools of measurement of the project performance success for certain critical variables such as time, cost, quality, risk, communication and procurement. However, this concerns a measurement over time of implementation, and the current study is cross-sectional which, at a certain period of time in sampling, made a comparison among several projects and project managers regardless of the amount of deviation and focused on the interval of positive and negative deviation in performance during data collection period. Al-Jibouri (2003) (Al-Jibouri, 2003) conducted another study specifically about cost control in the construction sector and came up with the following measurement of project performance as illustrated in graph 6.16:



Source: (Al-Jibouri, 2003)

Figure 6.16 Al-Jibouri equation of calculating the deviation in the project performance (efficiency)

In the above formulas, there is a ratio of comparison between the actual performance and the planned performance, and this is the first attempt of the current study, but after piloting this method, it was found that it does not allow the researcher to collect exact figures due to the confidentiality of data. A possible solution is to transfer the data from ratio data to ordinal one by using a scale that asks the project manager if the actual figures are as estimated or slightly higher or slightly lower or greatly higher or greatly lower. Through this, the research achieves its objective of comparison between projects avoids confidentiality. This was obvious by comparing the response rate to performance measurement statements before adding this change (which was below 30%) and after adding this change (increased to above 90%). Al-Jibouri confirmed that it is difficult to determine the best project performance measurement system, and the practicality of measurement critically affects the data collection (Al-Jibouri, 2003).



Source: (Todorovic, 2015)

Figure 6.17 The role of knowledge creation in relation to the project success

Figure 6.17 indicates that the documentation of the project success measurement feeds the knowledge acquisition, which is a direct input to the knowledge creation process which occurs prior to the application and transfer. Finally, the created knowledge is documented. In this research, another view of the continuous loop of the process is measured where the knowledge creation may affect the measurement of the new project performance success and so on and so forth. In the same study, it was concluded that the knowledge creation is positively correlated with the following improvements in project performance: more efficient planning of time

schedule, improved control of work processes, more efficient communication, faster task execution, enhanced problem solving, and decreased resource consumption. The contribution of the current study is to find how managers depend on different knowledge assets when they create the new knowledge and how these styles of knowledge creation interact with the project complexity to affect the performance success of the project.

Table 6.18 illustrates the link between the current study measurement of project performance and its measurement in the literature:

Category	Items of measurement	Adapted from
Time	The project actual cycle time against the planned cycle time is	(Daniel & Daniel, 2018)
	The planning time needed for the current project is	
	The number of days needed to supply the main resource in the	(Menches, 2006)
	current project is	
	The main resource waiting time in the current project is	(Ofori-Kuragu, 2016)
	The percentage of overtime in the current project is	(Kloppenborg, Demographic
	The dollar value of time variance in the current project is	determinants of project success
	The percentage of cost savings due to early delivery in the	Research Conference: Defining the
	current project is	Future of Project Management,
	The average time required to process a request for corrective	2010)
<u>a</u>	action in the current project is	-
Cost	The percentage of the out of budget cost relative to the planned cost is	(Luo L. H., 2017)
	The percentage of the raw material's cost relative to the total	Inputs from the results of researcher
	cost in the current project is	judgement after qualitative study on
	The percentage of returns on investment of the current project is	the performance measures that fit
	The percentage of resource utilization variance to plan in the	with different surveyed projects
	current project is	belonging to different industries.
	The percentage of cost savings in the current project is	
	The percentage of variance between planned raw material costs	
	and actual raw material costs is	
	The average cost / hour for the current project is	
	Current Project Cost is	
	The percentage of cost variance to plan in the current project is	
Quality	The percentage of errors detected during design and process	
	reviews in the current project is	
	The percentage of customer satisfaction up to the current stage	
	of the current project is	
	The percentage of rework time in the current project is	
	The number of training courses provided for the project]
	manager of the current project is	
	The defect rate in the current project is	

Figure 6.18 Adapting the measurement of the project performance from the literature

Productivity	The percentage of number of milestones missed relative to
	number of milestones planned in the current project is
	The percentage of profit per employees' costs in the current
	project is
	The average percentage of working hours per month in the
	current project is
	The average percentage of downtime to the total working time
	per day in the current project is
	The Percentage of successful phase exit against milestones
	planned in the current project is

Source: Created by the researcher depending on the literature

6.6.4 Measuring the demographics of the projects and the project managers

Kloppenborg, Tesch and Chinta (2010) (Kloppenborg, Demographic determinants of project success behaviors. Paper presented at PMI® Research Conference: Defining the Future of Project Management, 2010)found that there is a relationship between the project performance and the demographics of project managers. The determination of project success behaviours by demographics factors in this study included the details and its relevance to the current study are illustrated in table 6.19:

Project outcomes	Project dimensions	Demographics	Relevance to the
			current study
Agreements	Meeting schedule	This study included	The current study
	expectations	demographics of project	divided demographics
	Meeting budget	managers that divides the	into the same main
	Finishing a project on time	project managers to	categories of project
	Meeting technical	executives and non-	manager's
	expectations	executives.	demographics and
		And to certified, pursuing	project demographics.
Customer *	Creating a project that leads	certification, and not	The current study
	to enhanced satisfaction on	certified.	asked project
	the part of the customer	This study included the	managers about
	Creating a project that is	demographics of projects as	certification and
	used by the client	well and divided projects	experience
	Addressing customer needs	based on its region and	
	-	duration.	

Figure 6.19 Adapting the measurement	of the demographics from	the literature
inguice 0.15 Adapting the medsurement	or the active rupines from	the menutate

Source: (Kloppenborg, Demographic determinants of project success behaviours. Paper presented at PMI® Research Conference: Defining the Future of Project Management, 2010) (*) Firm's future is one of the outcomes that is excluded from the current research, so it is not mentioned in the table. The customer outcomes are also not fully covered in this study as explained earlier.

The study of Kloppenborg and his colleagues revealed that the shorter duration of projects is positively correlated with higher ability of the project manager to meet project specifications. It also revealed that project managers who work on their projects from within the same context of the project are more apt to meet its deadlines. In table 6.20, other studies on demographic factors are illustrated with their relevance to the current study:

Author &	Title	Demographics	Relationship Findings	Relevance to the current
Year				study
(Vallabh,	Influence of	Age, gender,	Gender has a major impact	Age, gender, education, and
2015)	demographic factors on	education, income	on the performance of a	experience are measured but
	business performance in	and experience of a	project and small-scale	income is excluded because
	small to medium	project manager	business.	it is out of the scope of the
	tourism enterprises			objectives of the current
	(SMTEs)		Similarly, the relationship	study
			between income and project	
			performance is high	
			(Wellmilla, January,2011)	
(Müller R. G.,	The Influence of	Nationality, the	When project managers	Nationality, age group,
2011)	Project Managers on	level of	work in the home country,	gender, certification is
	Project Success Criteria	competency, age,	the customers seem to be	measured in the current
	and Project Success by	gender,	more satisfied.Project	study. Competencies and
	Type of Project	certification, job	managers over 55 years old	intellectual abilities are out
		title and	give high significance to	of scope of the current study
		intellectual ability	team satisfaction while	
			working on a project	
			(Müller R. G., 2011)	
(Sharma,	Impact of	Work experience,	The demographic factors are	Experience and age of the
2012)	organisational climate	the designation that	negatively correlated with	project manager are
	and demographics on	the project	the team composition risk,	measured but the its effect
	project-specific risks in	manager holds and	control process risk and the	on team composition risks is

Figure 6.20 Project manager demographics that are studied in the literature

context to Indian	the age of the	dependability risk that is	out of scope of the current
software industry	project manager.	involved in a project	study
		(Sharma, 2012)	

Source: Literature review

According to the previous analysis of the literature, table 6.21 illustrates the demographics

measured in the current study:

Figure 6.21 Demographic of the project manager in the current study

Demographics of the project manager:	Intervals of scales
Nationality	UAE, GCC, Arab, American, European, Asian,
	African, Others
Age	18-20, 21-30, 31-40, 41-50, 51-60, above 60, prefer
	not to say
Gender	Male, Female, prefer not to say
For how long have you been continuously studying	Short courses, 1-3 months, 3-6 months, 6-12 months,
PM?	more than 1 year, & Others
Current education	Major and minor – open ended
Are you certified in project management?	Yes, No, Currently in process, other
Did you study project management as part of your	Yes, No
academic or professional education?	
Current level of education	Secondary education or equivalent, Upper secondary
	education, Bachelor or equivalent, master or
	equivalent, Doctoral or equivalent, others
Project manager experience:	Less than a year, 1-3 years, 3-6 years, 6-9 years, 10
How long have you been working as a project	years of more
manager?	
Project manager experience:	1 project, 1-3 projects, more than 3 projects.
How many projects you are currently managing?	
Study subject project – demographics:	
How long have you been working on the current	Less than a year, 1-3 years, more than 3 years
project?	
The customer of this project is	Public sector business customer, Private sector
	business customer, Mixed sector business customer,
	Individual customer, other
How long have you been managing the current	Less than a year, 1-3 years, 3-6 years, more than 6
project?	years.
Which part of the project are you managing?	Open ended question
Are you the only manager of the current project?	Yes, No, other.
What is the category of the number of workers in this	Less than 10 workers, 10-50 workers, 51 to 99
project?	workers, 100 to 500 workers, more than 500 workers
What kind of projects is the current one?	IT project, Construction project, Tourism project,
	Financial project, Educational project, Art project,
	Electronic project, Agricultural project,
	Manufacturing project, other
What is the final product of this project?	Open ended question
This project belongs to	Public sector, Private sector, Mixed sector, Other

Source: Adapted from the literature

6.7 Scaling and Coding

The study data collection instrument uses the five-point Likert scale to measure its research items. The reason for using the five-point Likert scale is because it is a balanced scale. No zero point is used in this scale because it is assumed that the level of project complexity will not equal zero and the level of knowledge creation from different resources will not equal zero. The Likert scale in the project complexity is measuring the level of importance of each item in contributing to the level of project complexity. The Likert scale is used to measure the level of agreement on the use of each source of knowledge creation for knowledge creation items. Data type is ordinal data and the intervals are assumed to have equal distances between every two intervals in reality, which is a limitation on the use of Likert scale. However, it is used in the studies measuring behaviours and perceptions of human resources such as project managers.

No	Questions	Variable names	Sub-constructs
	Project Complexity	numes	
1	In general, the importance of the effect of the project operational SIZE on complexity	Size1	Size
2	Number of investors in the current project	Size2	-
3	Number of suppliers of the current project	Size3	-
4	Number of workers of the current project	Size4	-
5	Duration of the current project	Size5	-
6	In general, the importance of the effect of VARIETY in the project operational system on complexity	Variety1	variety
7	Variety of information systems used in the current project	Variety2	-
8	Variety of geographical locations of the current project	Variety3	-
9	Variety and conflicts among project's goals	Variety4	-
10	Inter-dependencies between sites, departments, and companies for implementing the current project	Interd1	Interdependency
11	Inter-dependencies between information systems of the current project	Interd2	-
12	Inter-connectivity & feedback loops in the tasks & networks of the current project	Interd3	-

Figure 6.22 Number of items under each sub-construct before conducting EFA

13	In general, the importance of the effect of the Level of interdependency with other projects and systems on complexity	Interd4	
14	Availability of people, materials, & any resources due to sharing with other projects	Interd5	
15	Dependencies between schedules of implementation of the current project with other projects	Interd6	
16	Inter-dependencies between objectives of the current project	Interd7	
17	Processes inter-dependencies of the current project	Interd8	
18	Team communication and cooperation problems	Interd9	
19	Level of interrelation between project phases	Interd10	
20	In general, the importance of the effect of the complexity of Environmental and cultural contexts of the project on complexity	Envirol	Project Context
21	Networked environment (environmental complexity)	Enviro2	Dependence
22	Cultural configuration and variety in this project	Enviro3	
	Styles of Knowledge Creation		
1	Safety precautions enables me to stabilize my project performance. (RA)	RAKCS1	
2	Risk avoidance is my first priority in managing chaotic changes in my project performance. (RA)	RAKCS2	RAKCS
3	Controlling risks is not the first priority goal of this project. (RA-)	RAKCS3	
4	I practically ignore keeping contingency reserve for dealing with expected risks to increase my profits (RA-)	RAKCS4	
5	I keep contingency reserve only for dealing with expected risks that I am sure it will affect my project performance. (RA)	RAKCS5	
6	Changing the plan is not my favourite coping solution for unexpected changes. (RA)	RAKCS6	
7	I don't feel comfortable with changing the way I manage the project (INN-)	IKCS1	
8	I try to innovate something new to cope with chaotic changes in my project performance. (INN)	IKCS2	IKCS
9	Innovations is my best course of action to solve chaotic problems during project implementation. (INN)	IKCS3	
10	I depend on collecting information about competitors to create new knowledge. (INN)	IKCS4	
11	When I take critical decisions, I depend on the available databases more than my feelings and personal skills. (-INN)	IKCS5	
12	Feelings and skills are more important to me than databases and documents when creating new knowledge. (INN)	IKCS6	
13	I depend on others' experience to learn new things. (EXP)	EKCS1	
14	My Social networks help me in creating new knowledge. (EXP)	EKCS2	EKCS
15	Others' experience enables me to connect pieces of knowledge. (EXP)	EKCS3	
16	I use my experience for dealing with chaotic situations in project management. (EXP)	EKCS4	
17	My experience enables me to familiarize with a new change in the environment. (EXP)	EKCS5	
18	My performance in the past is an input for creating new knowledge. (EXP)	EKCS6	
19	I push the decision-making process to lower levels if I don't have enough information (SPEC)	SKCS1	SKCS
20	I used my educational background when managing this project. (SPEC)	SKCS2	
21	Depending on diversified specializations is ineffective in managing chaotic situations. (SPEC)	SKCS3	
22	I disregard thinking of what I have studied when dealing with chaotic changes in my project. (SPEC-)	SKCS4	
23	My study helped me to achieve my project goals (SPEC)	SKCS5	

24	I focus on one specialty to deal with new changes. (SPEC)	SKCS6	
	Project Performance		
1	The percentage of the out of budget cost relative to the planned cost is	Cost1	
2	The percentage of the raw material's cost relative to the total cost in the current project is	Cost2	Cost performance
3	The percentage of returns on investment of the current project is	Cost3	_
4	The percentage of resource utilization variance to plan in the current project is	Cost4	_
5	The percentage of cost savings in the current project is	Cost5	_
6	The percentage of variance between planned raw material costs and actual raw material costs is	Cost6	
7	The average cost / hour for the current project is	Cost7	_
8	Current Project Cost is	Cost8	
9	The percentage of cost variance to plan in the current project is	Cost9	_
10	The percentage of number of milestones missed relative to number of milestones planned in the current project is	Prod1	
11	The percentage of profit per employees' costs in the current project is	Prod2	
12	The average percentage of working hours per month in the current project is	Prod3	- Productivity
13	The average percentage of downtime to the total working time per day in the current project is	Prod4	performance and Quality
14	The Percentage of successful phase exit against milestones planned in the current project is	Prod5	performance
15	The percentage of errors detected during design and process reviews in the current project is	Q1	_
16	The percentage of customer satisfaction up to the current stage of the current project is	Q2	
17	The percentage of rework time in the current project is	Q3	
18	The number of training courses provided for the project manager of the current project is	Q4	
19	The defect rate in the current project is	Q5	
20	The project actual cycle time against the planned cycle time is	Time1	
21	The planning time needed for the current project is	Time2	Time performance
22	The number of days needed to supply the main resource in the current project is	Time3	_
23	The main resource waiting time in the current project is	Time4	
24	The percentage of overtime in the current project is	Time5	_
25	The dollar value of time variance in the current project is	Time6	_
26	The percentage of cost savings due to early delivery in the current project is	Time7	_
27	The average time required to process a request for corrective action in the current project is	Time8	

Coding of the items measuring project performance with justification

Table 6.23 illustrates the items used to measure the conformance or non-conformance to the planned performance of the project.

#	Item	Coding	Justification
1	The percentage of the out of budget cost relative to the planned cost is	Lower = 5 Slightly lower = 4 Conforming = 3	The lower the cost is the better as long as the goals are achieved

		Slightly higher = 2 Higher =1	
2	The percentage of the raw material's cost relative to the total cost in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower is the percentage of the raw material cost relative to the total cost is the better as long as the goal is achieved
3	The percentage of returns on investment of the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher =5	The higher the ROI is the better
4	The percentage of resource utilization variance to plan in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower the utilization is the better as long as the goals are achieved
5	The percentage of cost savings in the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher cost savings in the better as long as the goals are achieved
6	The percentage of variance between planned raw material costs and actual raw material costs is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower the variance is the better
7	The average cost / hour for the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower the average cost is the better as long as the goals are achieved
8	Current Project Cost is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher =1	The lower the project cost is the better as long as the goal is achieved
9	The percentage of cost variance to plan in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower is the variance the better as long as the goal is achieved
10	The percentage of number of milestones missed relative to number of milestones planned in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower number of missed milestones is the better
11	The percentage of profit per employees' costs in the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher the profit per employee is the better
12	The average percentage of working hours per month in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower number of working hours is the better as long as the goal is achieved

13	The average percentage of downtime to the total working time per day in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower downtime is the better because it is affecting the cost of the project and as long as the goal is achieved
_14	The Percentage of successful phase exit against milestones planned in the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher percentage of successful phase exit against milestones planned is the better
15	The percentage of errors detected during design and process reviews in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower number of errors detected during design and process reviews is the better because detecting more errors increases the cost.
16	The percentage of customer satisfaction up to the current stage of the current project is	Lower = 1 Slightly lower =2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher the customer satisfaction is the better
17	The percentage of rework time in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower is the percentage of the rework time is the better because it affects the cost of the project negatively
18	The number of training courses provided for the project manager of the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher the number of training courses is the better because it affects the project performance positively
<u>19</u>	The defect rate in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The lower the defect rate is the better
20	The planning time needed for the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less the planning time is the better as long as the goal is achieved
21	The project actual cycle time against the planned cycle time is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less actual time is the better because it saves project cost
22	The number of days needed to supply the main resource in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less the number of days needed to supply the main resource is the better because it saves time and cost
23	The main resource waiting time in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less resources waiting time is the better because it saves cost
24	The percentage of overtime in the current project is	Lower = 5 Slightly lower = 4	The less percentage of overtime is the better because it saves cost

		Conforming = 3 Slightly higher = 2 Higher = 1	
25	The dollar value of time variance in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less the variance in the dollar value is the better for performance and cost stability
26	The percentage of cost savings due to early delivery in the current project is	Lower = 1 Slightly lower = 2 Conforming = 3 Slightly higher = 4 Higher = 5	The higher cost savings due to early delivery is the better as long as the goal is achieved
27	The average time required to process a request for corrective action in the current project is	Lower = 5 Slightly lower = 4 Conforming = 3 Slightly higher = 2 Higher = 1	The less the average time required to process a request for corrective action is the better for performance stability

Source: Created by the researcher.

6.8 Descriptive Statistics for Sample Project Managers' Demographics

The research includes two types of demographic factors. One is related to the demographic classification of project managers and the other to the demographic classification of projects under study. As for the demographic factors related to the project manager, it includes nationality, age group, gender, education in the field of project management, current level of education, number of years of experience as a project manager, and the current number of projects managed currently (during the period of data sampling). The ranking of the sampling units according to the nationality gives the first rank to the Arab nationality project managers including UAE project managers, GCC project managers, and Arab project managers. All together represent about 95% of the sample. The second category is the category of the Asian project managers which represents about 5% of the sample size. Most of Arab project managers are neither UAE citizens nor GCC citizens, but they were Arabs. As for the age groups of the sampled project managers, the first category of the sample is the category of the project managers belonging to the age group between 31 to 40 years old. Next, comes the category of the younger project managers between 21 to 30 years old, and then comes the category of the

project managers between 41 to 50 years old, and finally the group of project managers between 51 to 60 years old. This is related to the focus on the small-sized to medium-sized projects where more than 75% of the sample size are between 21 to 40 years. Most of the sampled project managers are men, while the women form a minority, but they may or may not be related to the nature of project manager's work in construction projects or other engineering projects. 75% of the sample were not PMP certified and were having short courses, training only for less than a month. As for the level of education, about 60% of the sampled project managers have a bachelor degree or equivalent. Almost 25% of the sample have master degrees or equivalent, and the rest of the sample consists of secondary education and lower than bachelor. All categories of number of years of experience are represented in the sample 'less than a year', 'one to three years', 'three to six years', 'six to nine years', and 'ten years or above'. More than 50% were between 'one to three years' and 'three to six year's. Almost 60% of the sampled managers were working during the sampling period on two projects at the same time. About less than 30% of project managers were managing only one project, and less than 20% were managing three projects together at the same time. As for the project manager's areas of expertise, there were three main areas of specialization in this sample: the business specialization area, the engineering specialization area, and the IT specialization area. For the business specialization area, it included specialization in commerce, accounting, business administration, marketing, and finance. For the engineering specialization area, it included civil engineering, construction management, and construction engineering. For the IT specialization area, it included project managers specialized in science, computer engineering, design and decoration, and programming. The larger portion of the sample belongs to the business specialization with its sub-specialty fields, and the second specialization represented in the

sample is the engineering specialization with its sub-specialty fields. IT specialization with its sub-specialty fields comes in the third place after business and engineering specializations.

6.9 Descriptive Statistics for Sample Projects' Demographics

With regard to the sampled projects managed by managers, there are some demographic classifications for these projects. The research included 402 projects from the MENA region. The classification of these projects is based on the type of customers for each project, the period of time of managing the project the beginning to the moment of data collection, the number of workers in the project, and the industry to which the project pertains. The responding project manager was asked to think of one project only during the answering of the questionnaire in order to determine its demographics and its level of complexity, level of conformance in its performance, and the sources of knowledge creation the project manager uses to manage this current project at the time of data collection for this research. About 65% of the sampled projects are contracted with private sectors' customers the MENA region. Less than 20% are projects provided to various sector customers, and less than 20% is provided to public sector customers. Almost half of the sampled projects were managed for a period of time between one to three years. Nearly 35% of the sampled projects have been managed for one whole year from the beginning of the project until the data collection time. About 15% of the projects were managed for three years or more. Regarding the number of workers in each project, almost 50% of the sampled projects have between 10 to 50 workers in it. Having a range of 51 to 99 workers and having a range of 100 or more are almost equally represented in this sample of projects. Very few projects (about 5%) have less than 10 workers in it. There are nine industries found in the sample for which sampled projects belong. There industries are Information Technology,

constructions, tourism, finance, education, art, electronics, agriculture, and manufacturing. More than 50% of sampled projects belong to construction industry, and this may explain the reason for having most of the sampled managers males and minority managers females. The second half of projects belongs mainly to finance industry, manufacturing industry, and information technology industry.

6.10 Cross Tabulation Between Demographics of Project Managers and Demographics of Projects in the Sample

Age group	Number of projects managed by one manager simultaneously			Total
	1 project	2 projects	3 projects	
2(20to30)	22	43	20	85
3(30to40)	26	181	23	230
4(40to50)	43	21	0	64
5(50&above)	1	1	21	23
Total	92	246	64	402

Figure 6.24 Crosstabs of demographics of the sample

In table 6.24, it is obvious that in this sample the age group between 30 years old to 40 years old is the one that has the largest variety of managing various projects. More than 60% of this age group are managing two projects simultaneously. This shows the age group of the highest load on project managers in the sample of the MENA region projects.

6.11 Cross-Tabulation of KCSs

The following part shows matrix for each pair of knowledge creation styles and low, medium, and high-level interactions between every two KCSs with frequencies from the sample of the study. This part is an evidence on having more than on style when creating new knowledge; however, the study will use factorized separated knowledge creation styles that emerged from the exploratory factor analysis to analyse the moderation and mediation relationships between the independent and the dependent variables.



Most of the sample frequencies exist in the medium levels of both experiential KCS and innovative KCS (75.6%). Next, comes the high experiential with low innovative frequencies (13.2%).



Figure 6.26 Cross-percentages of RAKCS & IKCS

Most of the sample frequencies exist in the medium levels of both Risk-averse KCS and innovative KCS (57%). Next, comes the high risk-averse with low innovative frequencies (27.4%).

Specialized				
		low 1- 2	med 3	high 4-5
	low	43		173
	1-2	10.7%		43.0%
Innovative	med		202	
	3		50.2%	
	high	8		20
	4-5	2.0%		5.0%

Figure 6.27 Cross percentage of SKCS & IKCS

Most of the sample frequencies exist in the medium levels of both specialized KCS and innovative KCS (50.2%). Next, comes the high specialized with low innovative frequencies (43%).



Figure 6.28 Cross-percentages of RAKCS & EKCS

Most of the sample frequencies exist in the medium levels of both risk-averse KCS and experiential KCS (68.9%). Next, comes the low risk-averse with the high experiential frequencies (7.7%).

Specialized				
		low 1-2	med 3	high 4-5
Exportiontial	low	4		31
Experiential	1-2	1.0%		7.7%

med 3		298 74.1%	
high 4-5	15 3.7%		55 13 7%
	0 /0		

Figure 6.29 Cross-	percentage of	SKCS &	EKCS

Most of the sample frequencies exist in the medium levels of both specialized KCS and experiential KCS (74.1%). Next, comes the high specialized with the high experiential frequencies (13.7%).



Figure 6.30 Cross-percentages of SKCS & RAKCS

Most of the sample frequencies exist in the medium levels of both specialized KCS and riskaverse KCS (58%). Next, comes the high specialized with the high risk-averse frequencies (23.1%).

6.12 Pilot Studies

The quantitative study starts with conducting several pilot studies on small scales of respondents to investigate whether the main components of the study are feasible to study or not. Other purposes for which the pilot studies were conducted include testing the understanding of the research items, the sequence of items, the suitability of the scaling, the wording and length of items, the time spent to answer the full survey on average, and the validity and reliability of the data collection instrument design. Some components of the study were altered based on the results of the pilot studies and some other components were confirmed to be included in the full-scale study of this research. To be able to summarise the results of research pilot studies, the pilot studies are classified into the following three groups:

6.12.1 Pilot studies related to resources (time consumed, use of technology in collection)

Pilot study 1 (testing the response rate of 30 units to the full data collection instrument). The first version of the data collection instrument consisted of the sections and questions in appendix 1 and was distributed electronically to 30 respondents (project managers).

The feedback collected from respondents contains the following remarks:

- The questionnaire is too long and takes more than 45 minutes complete;

- The questionnaire asks about confidential data and needs permission from upper management to release performance indicators and measurements;

- The online surveying response rate was less than 30% (8 out of 30 respondents);

- The use of continuous 5-point scale is more understandable;

- The whole questionnaire is better to follow 5 intervals scaling;

- The ratio scale for collecting data on project performance will not help in comparing performance of different projects – better to use conformance point and above or below levels to be able to compare.

6.12.2 Pilot studies related to process (feasibility of key steps in collecting data by using the data collection tool)

Pilot study 2 (testing the steps of increasing the response rate) -10 respondents

The feedback collected from respondents contains the following remarks:

- Face-to-face collection of data achieves higher response rates than electronic collection and keeps an eye on non-verbal clues of the answer;
- Illustrating the purpose of the questionnaire in advance and sending a letter of confidentiality encourages project managers to respond;
- Adding the part of sharing the research results was of interest to the project managers, especially about knowing which style they belong to, so talking about the study as a brief introduction before starting is of value to the project manager;
- Being the only manager in the organisation and talking about one project of your choice as a project manager encouraged project managers to participate; they were asked to think of the performance of a certain project when answering the survey;
- Online face-to-face data collection tool worked well and contributed to the increase of the response rate;
- Response rate increased to 70%; however, the questionnaire is still taking more than 30 minutes to complete.

6.13 Reliability of Scaling and Common Bias Test

6.13.1 Reliability of scaling

Cronbach's Alpha test is run for each construct to test the reliability of the scale and measures what was designed to measure.

Items	size	variety	ID	EC	IKCS	EKCS	RAKCS	SKCS	Cost	Productivity	Q	Time
#cases	402	402	402	402	402	402	402	402	402	402	402	402
#items	5	4	10	3	6	6	6	6	9	5	5	8
Alpha	0.953	0.960	0.981	0.989	0.922	0.829	0.928	0.948	0.983	0.959	0.959	0.977
-												

Figure 6.31 Cronbach Alpha Test

Having all Cronbach's Alpha coefficients above 0.75 indicates the stability and consistency with which the data collection instrument measures the concept and indicates the goodness of a measure. The consistency increases after conducting more than one pilot study and this interprets having Conbach's Alpha above 95% for some sub-constructs. This is accompanied with the test of common bias which illustrates that there is no common bias in the data and this is double checked using one latent variable loading on Amos and the results are consistent and showing no common bias in the data.

6.13.2 Common bias test

After entering all research items in the dimension reduction test and loading all of them on one factor, only the cumulative percentage of total variance explained = 11.995%, which is less than 50%.

The conclusion is that there is no common bias in the data set of the sample of this study.

6.14 Data Normality Tests

Figure 6.32 Test of normality

	Kolmogor	ov-Smirne	DV ^a	Shapiro-W	/ilk	
	Statistic	Df	Sig.	Statistic	df	Sig.
size1	.181	402	.000	.913	402	.000
size2	.241	402	.000	.886	402	.000
size3	.252	402	.000	.873	402	.000
size4	.228	402	.000	.891	402	.000
size5	.171	402	.000	.915	402	.000
variety1	.208	402	.000	.908	402	.000
variety2	.197	402	.000	.913	402	.000
variety3	.168	402	.000	.916	402	.000
variety4	.185	402	.000	.910	402	.000
interdep1	.187	402	.000	.908	402	.000
interdep2	.169	402	.000	.916	402	.000
interdep3	.189	402	.000	.910	402	.000
interdep4	.162	402	.000	.914	402	.000
interdep5	.173	402	.000	.914	402	.000
interdep6	.205	402	.000	.900	402	.000
interdep7	.178	402	.000	.913	402	.000
interdep8	.173	402	.000	.912	402	.000
interdep9	.183	402	.000	.912	402	.000
interdep10	.192	402	.000	.871	402	.000
enviro1	.172	402	.000	.909	402	.000
enviro2	.174	402	.000	.906	402	.000
enviro3	.165	402	.000	.909	402	.000
innovative1	.238	402	.000	.858	402	.000
innovative2	.281	402	.000	.855	402	.000
innovative3	.299	402	.000	.849	402	.000
innovative4	.250	402	.000	.869	402	.000
innovative5	.329	402	.000	.826	402	.000
innovative6	.261	402	.000	.867	402	.000
experiential1	.263	402	.000	.834	402	.000
experiential2	.301	402	.000	.818	402	.000
experiential3	.308	402	.000	.788	402	.000
experiential4	.279	402	.000	.812	402	.000
experiential5	.276	402	.000	.813	402	.000
experiential6	.287	402	.000	.805	402	.000
riskaverse1	.273	402	.000	.847	402	.000

riskaverse2	.268	402	.000	.854	402	.000
riskaverse3	.267	402	.000	.849	402	.000
riskaverse4	.239	402	.000	.843	402	.000
riskaverse5	.230	402	.000	.831	402	.000
riskaverse6	.234	402	.000	.851	402	.000
specialized1	.190	402	.000	.906	402	.000
specialized2	.268	402	.000	.877	402	.000
specialized3	.257	402	.000	.882	402	.000
specialized4	.246	402	.000	.888	402	.000
specialized5	.242	402	.000	.888	402	.000
specialized6	.261	402	.000	.865	402	.000
cost1	.186	402	.000	.908	402	.000
cost2	.197	402	.000	.907	402	.000
cost3	.187	402	.000	.909	402	.000
cost4	.181	402	.000	.911	402	.000
cost5	.174	402	.000	.915	402	.000
cost6	.173	402	.000	.915	402	.000
cost7	.158	402	.000	.916	402	.000
cost8	.177	402	.000	.907	402	.000
cost9	.198	402	.000	.905	402	.000
productivity1	.173	402	.000	.912	402	.000
productivity2	.230	402	.000	.898	402	.000
productivity3	.203	402	.000	.911	402	.000
productivity4	.205	402	.000	.898	402	.000
productivity5	.210	402	.000	.891	402	.000
quality1	.172	402	.000	.914	402	.000
quality2	.204	402	.000	.904	402	.000
quality3	.217	402	.000	.903	402	.000
quality4	.188	402	.000	.909	402	.000
quality5	.181	402	.000	.913	402	.000
time1	.168	402	.000	.913	402	.000
time2	.178	402	.000	.915	402	.000
time3	.161	402	.000	.917	402	.000
time4	.167	402	.000	.916	402	.000
time5	.189	402	.000	.908	402	.000
time6	.170	402	.000	.912	402	.000
time7	.180	402	.000	.908	402	.000
time8	.184	402	.000	.909	402	.000

a. Lilliefors Significance Correction

Table 6.32 shows the statistical test results of normality. Both tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk) show that there is a significant difference between the means of the items in the data set and the normal distribution. Accordingly, the null hypothesis that says that there is no difference between the distribution of the data in the sample and the normal distribution will be rejected, and the alternative hypothesis will fail to be rejected. The data is not normally distributed; however, according to Jim Frost (2020) in his e-book "Hypothesis Testing; An Intuitive Guide for Making Data Driven Decisions" (Frost, 2020), using parametric tests for not normally distributed data has several advantages. One of these advantages is the ability to obtain credible and reliable results with distributions of continuous data that are skewed or non-normal. This occurs when there is adequate sample size for each targeted analysis. As for the current study, having more than 400 units is considered as statistically sufficient to run the parametric tests on the non-normally distributed data. The groups in the non-parametric tests must all have the same variability (dispersion) which is not conditional when parametric tests are used, and this is another advantage of using parametric tests for the non-normally distributed data, because it allows researchers to analyse groups with unequal variances. Moreover, the parametric tests have stronger power; therefore, if an effect exists in reality, the parametric analysis is more likely to detect it.

6.15 Exploratory Factor Analysis for Multivariate

6.15.1 The exploratory factor analysis for the constructs of the project complexity

The extraction of items in communalities analysis ranges between .739 and .998. The analysis of total variance explained by the items of the survey and the scree plot analysis indicate that the project complexity is measured in the current study by four constructs or factors. The first factor is responsible for about 38.297% of the total variance explained in complexity; the second

one is responsible for about 19.243%; the third one is responsible for about 15.424%; and the fourth one is responsible for about 15.424%. The total cumulative variance explained by the four factors = 85.735%. Table 6.21 shows a pattern matrix that indicates the factor loading for complexity constructs:

Pattern Matri	x			
	Factor			
	1	2	3	4
interdep3	.945			
interdep1	.944			
interdep2	.937			
interdep7	.931			
interdep6	.918			
interdep8	.916			
interdep4	.911			
interdep10	.899			
interdep9	.892			
interdep5	.881			
size3		.951		
size2		.945		
size4		.918		
size1		.875		
size5		.806		
variety3			.975	
variety2			.965	
variety4			.909	
variety1			.862	
enviro2				.999
enviro3				.980
enviro1				.972
Extraction Me	ethod: Princip	oal Axis Facto	oring.	

Figure 6.33 EFA for project complexity

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

6.15.2 Exploratory factor analysis for the knowledge creation styles

The analysis of communalities is relatively showing lower extractions compared to the complexity exploratory factor analysis. The extraction ranges between .390 and .843. This indicates the need for further research to improve the measurement of the knowledge creation style, and this is a study that used semi-inductive research to create this measurement; however, it is still statistically accepted to study the knowledge creation styles. The total variance is explained, and the scree plot analysis indicates that there are five constructs of knowledge creation styles found by the exploratory factor analysis of the knowledge creation styles items in the survey of the study. The first construct explains 19.946% of the total variance; the second one explains 17.985% of the total variance; the third factor explains 16.506% of the total variance; the fourth factor explains 11.128% of the total variance; and the fifth and last factor explains only 3.326% of the total variance. All five factors can explain a cumulative variance of 68.892%. Using the extraction method of principal axis factoring and the rotation method of Promax with Kaiser normalization and a cut-off value of 0.5, Table 6.34 indicates the factor loadings of knowledge creation styles:

Pattern Matrix						
	Factor					
	1	2	3	4	5	
specialized4	.908					
specialized3	.905					
specialized2	.887					
specialized5	.867					
specialized6	.827					
specialized1	.825					
riskaverse4		.877				

Figure 6.34 EFA for KCSs

riskaverse6	.865			
riskaverse3	.859			
riskaverse5	.851			
riskaverse2	.829			
riskaverse1	.693			
innovative3		.919		
innovative2		.903		
innovative6		.812		
innovative5		.794		
innovative4		.772		
innovative1		.716		
experiential2			.894	
experiential3			.818	
experiential1			.543	
experiential6				.874
experiential5				.790
experiential4				.577

Table 6.34 indicates that the experiential knowledge creation style is measured by two factors; one is related to the experience earned from other members in the team of the project and the second factor is related to the items measuring the personal experience the project manager creates from his own previous performance and history of success in project management. Each one of these two factors are created by three items and the rest of the knowledge creation styles are created by six items each as illustrated in the factor loadings table above. The researcher then forced the number of factors to become only four factors as proposed in the theoretical framework of the study; however, having two types of experience is coping with the contributions of the literature, but the researcher will try both ways of measuring EKCS by one factor or two factors and report the difference in the hypotheses testing part of this chapter.

6.15.3 EFA after forcing the extraction of factors to four factors of KCSs

The communalities analysis indicates extractions of items ranging between .357 and .844. The first factor can explain 19.931% of the total variance; the second factor can explain 17.899%, the third factor can explain 16.498%; and the fourth factor can explain 10.541% and the total cumulative variance explained by the four factors = 64.870%. This percentage is relatively less than using five factors of knowledge creation styles before forcing them into four factors. This paves the way for further research on measurement of knowledge creation styles in different contexts other than the MENA region. Using the extraction method of Principal Axis Factoring and the rotation method of Promax with Kaiser Normalization and the cut-off value of 0.50, table 6.35 illustrates the factor loadings of the four factors of knowledge creation styles.

Pattern Matrix					
	Factor				
	1	2	3	4	
specialized3	.910				
specialized4	.902				
specialized2	.893				
specialized5	.862				
specialized1	.836				
specialized6	.812				
riskaverse4		.874			
riskaverse6		.868			
riskaverse5		.855			
riskaverse3		.854			
riskaverse2		.824			
riskaverse1		.696			
innovative3			.920		
innovative2			.903		
innovative6			.812		
innovative5			.795		

Figure 6.35 Modified EFA for KCSs

innovative4	.771
innovative1	.715
experiential4	.725
experiential3	.719
experiential6	.675
experiential2	.670
experiential5	.663
experiential1	.570

6.15.4 Exploratory factor analysis of the project performance constructs

The communalities analysis shows extractions of items ranging between .695 and .915 and the total cumulative variance explained by the items of project performance is 84.553%. The scree plot analysis indicates that there are four factors explaining the variance in the project performance. The first factor can explain 28.9% of the total variance; the second factor explains 24.976% of the total variance; the third factor can explain 17.145% of the total variance; and the fourth factor can explain 13.533% of the total variance. Using the extraction method of Principal Axis Factoring and the rotation method of Promax with Kaiser Normalization and the cut-off value of 0.50, table 6.24 illustrates the loadings of questionnaire items of project performance to the four factors or constructs.

Figure 6.36 EFA for project performance

Pattern M	atrix				
	Factor				
	1	2	3	4	
cost1	.958				
cost3	.952				
cost2	.949				
cost7	.948				
cost8	.930				
cost4	.917				
cost6	.914				
cost9	.912				
cost5	.885				
time7		.937			
time8	.935				
---------------	------	------	------		
time5	.934				
time6	.924				
time4	.918				
time1	.904				
time3	.899				
time2	.885				
quality3		.954			
quality2		.932			
quality1		.927			
quality4		.882			
quality5		.849			
productivity3			.957		
productivity2			.948		
productivity1			.931		
productivity4			.873		
productivity5			.836		

6.16 Cluster Analysis for the Independent and the Dependent Factors

In the cluster analysis of this study, the separability of the measured spectra is based on the magnitude of reflectance and shape of the spectral response. The method of producing the hierarchical clusters in this study is based on joining spectra sequentially according to similarity. First, the two most similar spectra form one cluster and then the next closest spectra join this cluster. The hierarchy of building clusters consists of a process of joining spectra to spectra, then spectra to clusters, and then clusters to clusters. The following graph shows this hierarchy of spectra and clusters:



6.16.1 Cluster analysis for the complexity items – the independent variable

Figure 6.37 Cluster analysis for the complexity items – the independent variable





Figure 6.38 Cluster analysis for the complexity items – the dependent variable

Figures 6.37 and 6.38 of the dependent and the dependent variable illustrate the cluster analysis tree diagrams and reveal the distinction in groups of spectra separable on the basis of spectral shape and magnitude of reflectance. The results of the cluster analysis are supporting the results of the exploratory factor analysis. The distance scale at the bottom of the tree diagram is a normalized Euclidean distance that is the root mean square discrepancy between objects

(spectra) across attributes (spectral reflectance). Moving from left to right denotes an increasing degree of difference between spectra where a small Euclidean distance suggests that the spectra are most similar. On the left, there are as many clusters as spectra, while on the right there is only one cluster. Therefore, arbitrarily, a vertical line is drawn through the clusters at a specific Euclidean distance to determine the number of clusters present.

In the process of finding clusters the researcher is to some extent subjective because the cluster analysis is described in terms of subjectivity. The cluster analysis shows distinct clusters of constructs of size, variety, interdependency, and environmental complexity for the complexity constructs. The cluster analysis also indicates distinct clusters of time performance and cost performance and to an accepted extent between productivity performance and quality performance. The researcher can name each item as a spectrum and can easily claim having the same number of spectra under each cluster as the same as the results found by the factor analysis loadings. As a conclusion, the overall results of the cluster analysis suggest good level of separability based on measured reflectance. Further investigation research may cover the separability between the quality performance cluster and the productivity performance cluster; however, they have subjective degree of acceptance as shown in the current research's cluster analysis.

6.17 Correlation Matrix for Research Constructs



Figure 6.39 Correlation matrix

	Pearson Correlation	015	1											
Size	Sig. (2-tailed)	.766												
	Ν	402	402											
	Pearson Correlation	010	090	1										
Variety	Sig. (2-tailed)	.841	.072											
	Ν	402	402	402										
	Pearson Correlation	005	.081	.026	1									
Environment	Sig. (2-tailed)	.916	.103	.606										
	Ν	402	402	402	402									
	Pearson Correlation	.085	.023	.030	.032	1								
SKCS	Sig. (2-tailed)	.088	.652	.545	.517									
	Ν	402	402	402	402	402								
	Pearson Correlation	.105*	022	018	047	077	1							
RAKCS	Sig. (2-tailed)	.035	.664	.713	.346	.124								
	Ν	402	402	402	402	402	402							
	Pearson Correlation	018	.000	031	.002	034	.003	1						
IKCS	Sig. (2-tailed)	.725	.998	.530	.971	.497	.949							
	Ν	402	402	402	402	402	402	402						
	Pearson Correlation	063	048	.047	036	087	151**	.114*	1					
EXP1	Sig. (2-tailed)	.208	.334	.345	.471	.081	.002	.022						
	Ν	402	402	402	402	402	402	402	402					
	Pearson Correlation	033	012	.042	.033	.046	089	.073	.592**	1				
EXP2	Sig. (2-tailed)	.512	.817	.399	.509	.354	.076	.143	.000					
	Ν	402	402	402	402	402	402	402	402	402				
	Pearson Correlation	040	010	059	.014	055	063	073	008	016	1			
Cost	Sig. (2-tailed)	.429	.844	.239	.780	.275	.209	.144	.865	.754				
	Ν	402	402	402	402	402	402	402	402	402	402			
	Pearson Correlation	075	062	083	039	.039	066	044	.037	.056	.006	1		
Time	Sig. (2-tailed)	.135	.211	.097	.441	.441	.184	.378	.459	.264	.911			
	Ν	402	402	402	402	402	402	402	402	402	402	402		
	Pearson Correlation	012	096	.096	.076	085	.102*	.091	032	006	051	022	1	
Quality	Sig. (2-tailed)	.813	.055	.054	.127	.090	.040	.069	.522	.903	.312	.658		
	Ν	402	402	402	402	402	402	402	402	402	402	402	402	
	Pearson Correlation	023	050	.083	.044	005	029	.010	.045	021	.008	.007	.121*	1
Productivity	Sig. (2-tailed)	.647	.320	.096	.381	.928	.567	.837	.369	.680	.869	.889	.015	
	Ν	402	402	402	402	402	402	402	402	402	402	402	402	402

*. Correlation is significant at the 0.05 level (2-tailed).

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



6.18 Summary of Significant Correlation Relationships with Coefficients

Table 6.40 illustrates a summary of the significant relationships according to the correlation analysis among research constructs:

Figure 6.41Correlation analysis results

#	Factors correlated	Correlation coefficient	Sig.
1	PC-I with RAKCS	0.105	0.035*
2	RAKCS with EXKCS - Self	-0.151	0.002**
3	INNKCS with EXKCS - Self	0.114	0.022*
4	EXKCS-self with EXKCS-others	0.592	0.000**
5	RAKCS with PP-Q	0.102	0.04*
6	PP-Q with PP-P	0.121	0.015*

(*) Significant at level of confidence of 95%

(**) Significant at level of confidence of 99%

Table 6.41 indicates the following:

RAKCS has a positive relationship with interdependency complexity (coefficient of correlation = 0.105) (sig. 0.035)

- 2- EKCS has a negative relationship with RAKCS (coefficient of correlation= -0.143) (sig. 0.004)
- 3- EKCS has a positive relationship with IKCS (coefficient of correlation= 0.111) (sig. 0.026)
- 4- Quality performance has a positive relationship with RAKCS (coefficient of correlation=
 0.102) (sig. 0.040)
- 5- Productivity performance has a positive relationship with quality performance (coefficient of correlation= 0.121) (sig. 0.015)

6.19 T Test for the Dependent Variables of the Study

In order to test the difference to the mean of each one of the dependent items of the study and how far they are from the mean which represents the conformance to the planned performance in this research and has got the value of (3) on a Likert continuous scale, the researcher conducted a T test analysis. The results of the test are illustrated in table 6.27:

			Std.					Confidence	Interval of
		Std.	Error			Sig. (2-	Mean	the Differer	nce 95%
	Mean	Deviation	Mean	Т	df	tailed)	Difference	Lower	Upper
cost1	2.89	1.255	.063	-1.749	401	.081*	109	23	.01
cost2	2.89	1.230	.061	-1.865	401	.063*	114	24	.01
cost3	2.90	1.243	.062	-1.685	401	.093*	104	23	.02
cost4	2.91	1.200	.060	-1.538	401	.125	092	21	.03
cost5	3.04	1.166	.058	.770	401	.442	.045	07	.16
cost6	3.10	1.120	.056	1.826	401	.069*	.102	01	.21
cost7	3.09	1.190	.059	1.551	401	.122	.092	02	.21
cost8	3.06	1.263	.063	.908	401	.364	.057	07	.18
cost9	3.11	1.213	.060	1.850	401	.065*	.112	01	.23
productivity1	3.01	1.224	.061	.122	401	.903	.007	11	.13
productivity2	3.21	1.080	.054	3.972	401	.000**	.214	.11	.32
productivity3	3.11	1.088	.054	1.972	401	.049**	.107	.00	.21
productivity4	3.25	1.011	.050	4.984	401	.000**	.251	.15	.35
productivity5	3.28	.982	.049	5.640	401	.000**	.276	.18	.37
quality1	2.91	1.197	.060	-1.500	401	.134	090	21	.03

Table 6.27 One sample T test

quality2	3.02	1.082	.054	.369	401	.713	.020	09	.13
quality3	3.02	1.125	.056	.355	401	.723	.020	09	.13
quality4	3.07	1.052	.052	1.327	401	.185	.070	03	.17
quality5	3.05	1.081	.054	1.015	401	.311	.055	05	.16
time1	2.92	1.233	.061	-1.295	401	.196	080	20	.04
time2	3.04	1.118	.056	.714	401	.476	.040	07	.15
time3	3.05	1.143	.057	.829	401	.408	.047	06	.16
time4	3.12	1.141	.057	2.098	401	.037**	.119	.01	.23
time5	3.14	1.235	.062	2.342	401	.020**	.144	.02	.27
time6	3.14	1.208	.060	2.354	401	.019**	.142	.02	.26
time7	3.15	1.217	.061	2.500	401	.013**	.152	.03	.27
time8	3.17	1.238	.062	2.740	401	.006**	.169	.05	.29

(*) Significant at a level of confidence of 90%

(**) Significant at a level of confidence of 95%

Table 6.27 of T test analysis shows that there is a significant difference between the mean and the standard deviation for certain items which reflects non-conformance to the planned performance, and this is an indicator on the existence of the non-conformance problem. The analysis also shows that the performance success measured by the conformance between the planned performance and the implemented one is not stable, and for other items in the sample, there is no significant variation between the planned performance and the implemented one, and again this reflects that there are certain determinants that may affect the ability of the project manager to reach the conformance or the non-conformance to the planned performance during implementation. These determinants in the research could be related to the project manager's style of creating new knowledge and using it to create this conformance and keep it as an indicator of performance success, or it could be related to the project itself, such as the project complexity level and how it affects the project manager's ability to achieve the conformance and the implemented one. It could also be the interaction between the determinants related to the project manager and the determinants related to the

project itself as to what is studied in the present research through studying and analysing the possible moderation and mediation relationships between the project determinants and project manager's determinants of project performance.

6.20 Confirmatory Factor Analysis

6.20.1 Confirmatory analysis for the main construct of complexity

Initial confirmatory analysis for project complexity as one main construct



Figure 6.42 The initial CFA for the main construct of complexity

The model fit is not statistically accepted in the initial model. Interdependency item no. 1 and size item no. 4 are removed from the initial model to improve the model fit. Using modification indexes, the reviewed model is as follows:

Final confirmatory factor analysis for complexity as one main construct



Figure 6.43 The final CFA for the main construct of complexity

The model fit is significantly acceptable, and the construct is valid for hypotheses testing. Interdependency items no. 5 and 10, size items no. 1 and 5, and variety items no. 1 and 3 were removed for better model fit.

6.20.2 Confirmatory analysis for the sub-constructs of complexity



Initial confirmatory factor analysis for interdependency sub-construct

Figure 6.44 Initial CFA for sub-construct of interdependency

The model fit is not statistically accepted in the initial model. Using modification indexes the reviewed model is as follows:





The model fit is significantly acceptable, and the construct is valid for hypotheses testing. Interdependency items no. 5 is removed for better model fit.

Initial confirmatory factor analysis for the sub-construct of size



The model fit is not statistically accepted in the initial model. Using modification indexes, the reviewed model is as follows:

The final confirmatory factor analysis of sub-construct of size:



The model fit is significantly acceptable, and the construct is valid for hypotheses testing. *Initial confirmatory factor analysis for the variety sub-construct*



Figure 6.48 Initial CFA for sub-construct of variety

From the initial confirmatory factor analysis of the variety sub-construct, it is statistically accepted to use this construct in testing research hypothesis. The initial confirmatory factor analysis for the variety sub-construct is the final confirmatory factor analysis for it.

For the environmental complexity confirmatory factor analysis, the construct is not statistically accepted because of the small number of items measuring this construct (only 3 items). The complexity as a main factor in the confirmatory factor analysis will be measured using the sub-

constructs interdependency, size, and variety, and the environmental complexity will be excluded as sub-construct, as illustrated in the graph below.

6.20.3 Confirmatory factor analysis for the project performance sub-constructs

The following part illustrates the confirmatory factor analysis for the sub-constructs of the project performance, which is the dependent variable in this study

Initial confirmatory analysis for the cost performance of the project



Figure 6.49 indicates that the chi square is significant; therefore, the model fit indicators show that the initial model is not statistically acceptable.

The finalized confirmatory factor model and model fit results are illustrated below

The finalized confirmatory factor analysis of cost performance of the project





The chi square of the finalized confirmatory factor analysis is insignificant, and the indicators of the model fit are improved in the finalized model. Items no. 5,6,7, and 9 of the cost sub-construct were removed to improve the model fit with a minimum number of items.

The initial confirmatory factor analysis of the time performance of the project



The statistical indicators of the initial confirmatory factor analysis are showing significant Chi-square, and this is not statistically acceptable for using this construct in the structural equation modelling. The following model shows the finalized confirmatory factor analysis for the time performance of the project:

The finalized confirmatory factor analysis for the time performance of the project



Figure 6.52 the improvement in the model fit of the time construct. Items no. 2,3, and 8 were removed to improve the model fit of the sub-construct.

Initial confirmatory analysis for the productivity performance of the project.



The statistics in the table above shows that the chi square is significant, and the model fit indicators are not acceptable.

The Finalized confirmatory factor analysis for construct of the productivity of the project



The model fit is improved as illustrated in figure 6.29; as a result, this is the finalized confirmatory analysis for productivity to be used in the structural equation modelling. Item no. 5 is removed to improve the model fit.

Initial confirmatory factor analysis for the quality construct



Figure 6.30 shows unaccepted model fit indicators.

Finalized confirmatory factor analysis for the quality performance of the project



Figure 6.56 shows the improvement in the model fit indicators and that chi square becomes insignificant, which means this is the finalized construct and the valid one for usage in the structural equation modelling. Item no. 5 is removed to improve the model fit.

6.20.4 Confirmatory factor analysis for the knowledge creation styles

In the following part of the study, the initial and finalized confirmatory factor analysis models are illustrated to show the sub-constructs validity for each one of the knowledge creation styles of the study:

Initial confirmatory factor analysis for the experiential knowledge creation style



Figure 6.57 shows unaccepted model fit indicators.

Finalized confirmatory factor analysis for the experiential knowledge creation style



Figure 6.58 shows the improvement in the model fit indicators and that chi square becomes insignificant, which means this is the finalized construct and the valid one for usage in the structural equation modelling. Item no. 6 is removed to improve the construct validity using a smaller number of items.

Initial confirmatory factor analysis for the innovative knowledge creation style



Figure 6.59 shows the insignificant RMSEA indicator and the significant chi square one, which reflects that the model has no fit.

Finalized confirmatory factor analysis for the innovative knowledge creation style



After removing items 1,2 of the IKCS construct the chi square becomes insignificant, and the RMSEA becomes significant, which reflects the model fit for this construct. *Initial confirmatory factor analysis for the risk averse knowledge creation style*



Figure 6.61 shows that the model does not fit because chi square is significant, and the RMSEA indicator is insignificant. In the following graph, a refined attempt is illustrated to improve the model fit.

Finalized confirmatory factor analysis for the Risk averse knowledge creation style



Figure 6.62 shows the improvement in the model fit for the risk averse knowledge creation construct.

Initial confirmatory factor analysis for the specialized knowledge creation style construct



The indicators in figure 6.63 shows that Chi-square is significant, and the RMSEA is insignificant. This indicates there is no model fit. Further improvement on this construct validity is illustrated in the finalized CFA below.

Finalized confirmatory factor analysis for the specialized knowledge creation style



The refined model illustrates better indicators for model fit. The chi square is insignificant, and the RMSEA is significant, and the item no. 5 is removed from the construct for better construct validity.

6.21 Structural Equation Modelling

After finalizing the construct validity for the sub-constructs and the main constructs of the study, the following graph indicates the initial structural equation modelling for the main variables of the study:

6.21.1 SEM for the main impact of mediation



Initial SEM for the study



In figure 6.65, the model fit is showing the significance of the chi square. Another trial is illustrated below to improve the model fit of the SEM.

Finalized SEM of the study



Figure 6.66 Finalized SEM for the main mediation model

Detailed model fit indicators:

Chi-square	Df	Р	RMR	GFI	AGFI	NFI	CFI	RMSEA
452.672	468	.686	0.038	0.939	0.926	0.965	1.000	0.000

The model fit indicators show insignificant chi square and significant RMSEA.

Table 6.28 Regression weights for the main SEM model of mediation	on
---	----

			Estimate	S.E.	C.R.	Р
EKCS	<	Complexity	010	.024	440	.660
RAKCS	<	Complexity	.082	.036	2.284	.022
IKCS	<	Complexity	009	.036	240	.811
SKCS	<	Complexity	.066	.047	1.397	.163
Performance	<	Complexity	021	.057	373	.709
Performance	<	SKCS	080	.061	-1.316	.188

			Estimate	S.E.	C.R.	Р
Performance	<	IKCS	.139	.081	1.722	.085
Performance	<	EKCS	162	.203	801	.423
Performance	<	RAKCS	.201	.091	2.196	.028

Table 6.28 of regression estimates illustrates the significant full mediation impact of the RAKCS on the relationship between project complexity and project performance at level of confidence of 95%. It also illustrates the significant impact of IKCS on the project performance at level of confidence of 90%.

The risk-averse knowledge creation style has a significant effect on the project performance and is, at the same time, significantly affected by the project complexity, and this is statistically acceptable in the presence of all other knowledge creation styles. The innovative knowledge creation style is found to be affecting the project performance, which may give an indicator on a moderation effect of innovative knowledge creation style rather than a mediation knowledge creation style.

The conclusion to draw is that on the level of testing the mediation effects of knowledge creation styles on the relationship between complexity and performance, there is significantly full mediation effect of risk averse knowledge creation style on the relationship between project complexity and project performance.

6.22 The Model of Mediation and Moderation on the Level of the Main Constructs of Complexity and Project Performance



Figure 6.67 The model of mediation and moderation on the level of main constructs

In figure 6.67, the RAKCS mediates the relationship between the project complexity and the project performance, and the IKCS moderates this relationship.

The statistics of CMIN = 3767.846, NPAR= 327, GFI= 0.828, and RMR = 2.875 all are indicating soundness of fit of the model. The following table indicates the significance of the regression weights and the estimated coefficients of the prediction model.

		Estimate	S.E.	C.R.	Р	Label
RAKCS <	Complexity	.014	.007	2.032	.042	par_37
performance <	Complexity	008	.010	765	.444	par_36
performance <	RAKCS	.196	.090	2.181	.029	par_38
performance <	Interaction var.	.104	.056	1.856	.063	par_39
performance <	IKCS	.162	.098	1.641	.101	par_43

Figure 6.68 Regression weights for the main model of significant mediation and moderation impacts

Figure 6.68 shows that the RAKCS has a significant impact on the project performance at the level of confidence of 95%% (Sig. .029) and is affected by the project complexity at a level of confidence of 95% (Sig. = .042). In light of the mediation impact of the RAKCS, the IKCS is moderating the relationship between the project complexity and the project performance at a

level of confidence of 90% (Sig. = .063. increasing the level of complexity by one unit increases the level of creating risk averse knowledge by 1.4%, then increasing this risk averse knowledge creation increases the conformance of the actual project performance to the planned one by 19.6%. The increase in the interaction between the innovative knowledge creation and the complexity of the project by one unit increases the conformance of the planned one by 10.4%.

6.23 Testing Moderation Using SEM for Sub-Constructs

In the following part, the study explains the significant moderated relationships between subconstructs of project complexity and project performance by the knowledge creation styles.

6.23.1 Moderation impact of SKCS on the relationship between size complexity and cost performance

Initial SEM - SKCS moderates the relationship between size complexity and cost performance



Figure 6.70

The initial model of testing the SEM for the moderation impact of specialized knowledge creation style on the relationship between size complexity and cost performance shows significant chi square which reflects lack of model fit.

Finalized SEM for the moderation impact of SKCS on the relationship between size complexity and cost performance



performance

After deleting cost items no. 6,7,8, and 9, the model fit indicators improved, and the Chisquare is insignificant as illustrated in the table above. Table 6.30 shows the significance of the interaction variable as evidence on the existence of moderation effect of the SKCS on the relationship between size complexity and cost performance of the project.

		Estimate	S.E.	C.R.	Р
Cost11 <	SKCSxSize	.142	.061	2.308	.021
Cost11 <	Size11	008	.051	151	.880

Figure 6.72 Regression weights for finalized SEM for the moderation impact of SKCS on the relationship between size complexity and cost performance

6.23.2 Moderation impact of innovative knowledge creation style on the relationship between environmental complexity and time performance



Figure 6.73 Moderation impact of innovative knowledge creation style on the relationship between environmental complexity and time performance

The model fit is statistically acceptable as indicated in the table above. Accordingly, IKCS has a significant moderation impact on the relationship between the environmental complexity and the time performance of the project. Figure 6.74 demonstrates the regression estimates of the moderation impact:

			Estimate	S.E.	C.R.	Р
Time11 <	<	INN	083	.086	969	.332
Time11 <	<	Enviro	027	.051	538	.590



Figure 6.74 Regression weights for moderation impact of innovative knowledge creation style on the relationship between environmental complexity and time performance

Figure 6.74 shows the significance of the interaction variable between IKCS and

environmental complexity of the project, and this significance is at the level of confidence of

99%. (p=0.004).

6.23.3 Testing the moderation impact of innovative knowledge creation style on the relationship between environmental complexity and cost performance of the project



Chi-square	df	Р	TLI	CFI	RMSEA
140.965	124	0.141	0.998	0.999	0.018

Figure 6.75 Testing the moderation impact of innovative knowledge creation style on the relationship between environmental complexity and cost performance of the project

Figure 6.75 illustrates a statistical evidence on the model fit and the validity of the SEM model to test the moderation impact of the IKCS on the relationship between environmental complexity and cost performance of the project.

Figure 6.76 shows the regression estimates of the moderation impact in the above SEM model:

		Estimate	S.E.	C.R.	Р
Cost11 <	INN	082	.087	939	.348
Cost11 <	Enviro	.011	.051	.223	.824
Cost11 <	INNxENV	.168	.062	2.733	.006

Figure 6.76 Regression weights for testing the moderation impact of innovative knowledge creation style on the relationship between environmental complexity and cost performance of the project

Figure 6.76 shows that the interaction variable between IKCS and Environmental complexity is significant at a level of confidence of 99% (P=0.006), which means that the IKCS is significantly moderating the relationship between the environmental complexity and the cost performance of the project.

6.23.4 SEM for the moderation impact of SKCS on the relationship between environmental complexity and time performance of the project



Figure 6.46 SEM for the moderation impact of SKCS on the relationship between environmental complexity and time performance of the project

Figure 6.46 shows that the SEM has a statistically accepted model fit. The following table shows the regression estimates of the moderation impact of the SKCS on the relationship between environmental complexity and time performance of the project:

 Estimate
 S.E.
 C.R.
 P

 Time <---</td>
 SKCS
 .034
 .055
 .609
 .542

		Estimate	S.E.	C.R.	Р
Time <	SKCSxENV	.094	.047	2.014	.044
Time <	Enviro	030	.039	751	.453

Figure 6.77 Regression weights of SEM for the moderation impact of SKCS on the relationship between environmental complexity and time performance of the project

Figure 6.77 indicates that the interaction variable between SKCS and time performance of the project is significant at level of confidence of 95% (P=0.044) and, thus, there is significant moderation impact of the specialized knowledge creation style on the relationship between environmental complexity and time performance of the project.

6.23.5 SEM for testing the moderation impact of RAKCS on the relationship between interdependency on the project and its quality performance



Figure 6.78 SEM for testing the moderation impact of RAKCS on the relationship between interdependency on the project and its quality performance

Figure 6.78 shows a statistically accepted significant that there is model fit in the above SEM analysis. The following table illustrates the regression estimates of the model:

		Estimate	S.E.	C.R.	Р
Q <	RAKCS11	.177	.088	2.024	.043
Q <	ID	015	.045	338	.735

	Estimate	S.E.	C.R.	Р
Q < RAxID	.181	.049	3.675	***

Figure 6.79 Table 6.34 Regression weights of SEM for testing the moderation impact of RAKCS on the relationship between interdependency on the project and its quality performance

Figure 6.79 illustrates that the interaction variable between RAKCS and project interdependency is significant at a level of confidence of 99% (P is less than 0.001). This means that the RAKCS has a significant moderation impact on the relationship between interdependency and quality performance of the project.





Figure 6.80 Figure 6.48 SEM for testing the moderation impact of the IKCS on the relationship between interdependency and productivity performance of the project

Figure 6.80 shows statistically accepted evidence on the model fit of this SEM analysis. The

following table shows the regression estimates of the model:

		Estimate	S.E.	C.R.	Р
Prod <	ID	027	.052	510	.610
Prod <	INN	.042	.081	.520	.603
Prod <	INNxID	.124	.059	2.103	.036

Figure 6.81 Regression weights of SEM for testing the moderation impact of the IKCS on the relationship between interdependency and productivity performance of the project

The regression estimates in the table above illustrates a significant interaction variable between the IKCS and the interdependency of the project at level of confidence of 95% (P=0.036). This means that the IKCs has a significant moderation impact on the relationship between the interdependency of the project and the productivity performance of the project.

6.23.7 SEM for the moderation impact of the experiential knowledge creation style of project managers depending on the experience of other people on the relationship between project interdependency and the quality performance of the project.



Figure 6.82 SEM for the moderation impact of the experiential knowledge creation style of project managers depending on the experience of other people on the relationship between project interdependency and the quality performance of the project

Figure 6.82 illustrates the significance of the model and that it has statistical goodness of fit indicators. The following table illustrates the estimates of the regression analysis of the above model:

_		Estimate	S.E.	C.R.	Р
Q <	EXP1	091	.113	808	.419
Q <	EXP1xID	126	.053	-2.385	.017
Q <	ID	010	.046	225	.822

Figure 6.83 Regression weights of SEM for the moderation impact of the experiential knowledge creation style of project managers depending on the experience of other people on the relationship between project interdependency and the quality performance.

Figure 6.83 illustrates the significance of the interaction variable between the experiential knowledge creation style and the interdependency of the project at a level of confidence of 95% (P=0.017). This means that the experiential knowledge creation style of depending on the experience of other people in the team significantly moderates the negative relationship between the interdependency and the quality performance of the project

performance of the project.

6.23.8 SEM for the moderation impact of the experiential knowledge creation style of project managers depending on the experience of other people on the relationship between project size and the quality performance of the project.



Figure 6.84 SEM for the moderation impact of the experiential knowledge creation style of project managers depending on the experience of other people on the relationship between project size and the quality performance of the project.

Figure 6.84 shows a statistically significant model goodness of fit.

Table 6.37 Regression weights of SEM for the moderation impact of the experiential knowledge creation style of project managers depending on the experience of other people on the relationship between project size and the quality performance of the project

_		Estimate	S.E.	C.R.	Р
Q <	EXP1	154	.091	-1.691	.091
Q <	EXP1xSize	.093	.047	1.964	.050
Q <	Size	104	.045	-2.320	.020

Table 6.37 shows that the interaction variable between the experiential knowledge creation style of the project managers who depend on the experience of the team of the project and the size of the project is significant at a level of confidence of 95% (P=0.05). This means that the EXPKCS1 is significantly moderating the relationship between the project size and the quality performance of the project. The table also illustrates that the experiential knowledge creation style (1) has a significant negative effect (-0.154) on the quality performance of the project. The size of the project also has a significant negative effect on the quality performance (-0.104) of the project at level of confidence of 99% (P=0.020). It may be concluded that the interaction between the experiential knowledge creation style and the size of the project moderates the negative impact of the project size on the quality performance of the project. It is easier to moderate the negative effect of the big size on the low conformance between the planned quality and the implemented one by having a project manager style who can create new knowledge from the experience of other people in his or her team.

6.24 Summary of the Significant Moderation Impacts of KCSs on the Relationships Between Complexity Sub-Constructs and Project Performance Sub-Items

The graph below illustrates the summary of the moderation impacts of the knowledge creation styles on the relationships between sub-constructs of independent variable and sub-constructs of dependent variable in this study.

6.24.1 Moderation model created by SEM analysis



Figure 6.85 Moderation model created by SEM analysis

Variety has relationships with performance constructs, and these relationships are moderated by knowledge creation styles but at level of confidence of 90%. The graph illustrates only the significant moderation effects at level of confidence of 95% or 99%.

6.24.2 Summary of results of testing moderation for sub-constructs using SEM

#	Factors	F	Р	Beta	Т	Р	
1	IKCS moderation						
1.c	Interdependency						
1.c.4	Productivity	1.411	0.239	0.101	1.995	0.047	
1.d	Environmental Complexity						
1.d.1	Time	3.263	0.021	0.148	2.900	0.004	

Table 6.38 Summary of results of testing moderation for sub-constructs using SEM
1.d.2	Cost	2.853	0.037	0.129	2.502	0.013		
2	RAKCS moderation	•	•	•	•	•		
2.c	Interdependency							
2.c.3	Quality					0.001		
3	SKCS moderation							
3.a	Size							
3.a.2	Cost	1.775	0.151	0.106	2.017	0.004		
3.d	Environmental Comp	lexity						
3.d.1	Time	1.767	0.153	0.100	2.008	0.045		
5	EKCS (1) moderation	l						
5.a	Size							
5.a.3	Quality	2.994	0.031	0.107	2.133	0.032		
5.c	Interdependency							
5.c.3	Quality	1.692	0.168	-0.117	-2.106	0.045		

6.25 Testing Moderation Impact of Knowledge Creation Styles Using Hayes Process Regression (2013)

In the following part, the sub-constructs used to test the SEM for moderation impact of knowledge creation styles will be re-tested using Hayes (2013) regression analysis for moderation. Then, plotted moderation impacts for the high, medium, and low impacts of the interaction variable will be illustrated for better understanding of moderation impact.

6.25.1 The IKCS moderates the relationship between environmental complexity and time performance



Figure 6.86 The model of The IKCS moderates the relationship between environmental complexity and time performance

R	R-sq	MSE	f.	DF1	DF2	<i>p</i> .
-0.15	0.02	0.98	3.26	3	398	0.02

The model summary in the table above illustrates the significance of the model at level of confidence of 95% (p=0.03).

Variables	Coeff.	SE	<i>t</i> .	<i>P</i> .	LLCI	ULCI
constant	.00	.05	.00	1.00	10	.10
Time	04	.05	82	.42	14	.06
IKCS	03	.05	63	.53	13	.07
Int_1	.15	.05	2.90	.00	.05	.24

 Table 6.40 Regression weights of the IKCS moderates the relationship between environmental complexity and time performance

The model in the table above shows that the interaction variable is significant at a level of confidence of 99% (P=0.00), which means that the innovative knowledge creation style has a significant moderation impact on the relationship between the environmental complexity and the time performance of the project.

The BootLLCI for the interaction variable = 0.03 and the ULCI for it = .24, so there is no zero between the upper and the lower limits, and this means that the interaction variable is significant according to the Bootstrap analysis.

Plot chart of the regression estimates of low-moderate-high levels of environmental complexity

on time performance corresponding to low-moderate-high levels of IKCS as a moderator

performa	nce corresponding to	low-moderate-high effects	of IKCS as a
8:2	0:18 -0.00	DOB	0.07
-0:2	low	mod	high
low	0.16	0.03	-0.18
••••• moderate	0.08	0.01	-0.1
🗕 🗕 high	-0.09	-0.03	0.07

Figure 6.87 Figure 6.53 Plot chart of the regression estimates of low-moderate-high levels of environmental complexity on time performance corresponding to low-moderate-high levels of IKCS as a moderator

In figure 6.87, it is shown that for the projects that are low in IKCS (line) as environmental complexity increases, the conformance between planned and actual time performance decreases. For projects that are moderate in IKCS (dot line), there is still negative relationship between environmental complexity and time conformance, but it becomes weaker. For projects that have high IKCS (dash line), the increase in the environmental complexity leads to increase in the time conformance of the project.

6.25.2 The IKCS moderates the relationship between environmental complexity and cost performance



Figure 6.88 Figure 6.54 Model of the IKCS moderates the relationship between environmental complexity and cost performance

R	R-sq	MSE	f.	DF1	DF2	<i>p</i> .
.15	.02	.99	2.85	3.00	398.00	.04

The model summary in the table above illustrates the significance of the model at level of

confidence of 90% (p=0.04).

Variables	Coeff.	SE	t.	<i>P</i> .	LLCI	ULCI

constant	.00	.05	.00	1.00	10	.10
Cost	.01	.05	.25	.80	09	.11
IKCS	06	.05	-1.27	.20	16	.03
Int_1	.13	.05	2.50	.01	.03	.22

The model in the table above shows that the interaction variable is significant at a level of confidence of 99% (P=0.01), which means that the innovative knowledge creation style has a significant moderation impact on the relationship between the environmental complexity and the cost performance of the project. The Bootstrap analysis shows that the BootLLCI for the interaction variable = 0.03 and the boot ULCL for it = .22, and there is no zero value between the upper and lower limits, which means that the interaction variable is significant.

Plot chart of the regression estimates of low-moderate-high levels of environmental complexity on time performance corresponding to low-moderate-high levels of IKCS as a moderator



Figure 6.89 Plot chart of the regression estimates of low-moderate-high levels of environmental complexity on time performance corresponding to low-moderate-high levels of IKCS as a moderator

The plot chart in figure 6.89 illustrates that for the projects that have low IKCS moderation impact (line), the more environmental complexity the project has is related to less conformance to the planned cost in the project performance. For the projects that have moderate level of IKCS (dot line), there is a remaining negative impact of the environmental complexity on the cost conformance. However, it starts to become a weaker relationship. For projects that have high IKCS (dash line), the relationship between the environmental complexity and the cost performance starts to become a positive relationship in which the increase in the environmental complexity leads to an increase in the cost conformance in the project performance, and this makes sense.

6.25.3 IKCS moderates the relationship between project interdependency and productivity performance of the project



Figure 6.90 Model of IKCS moderates the relationship between project interdependency and productivity performance of the object

Table 6.43 Model summary of IKCS moderates the relationship between project interdependency and productivityperformance of the project

R	R-sq	MSE	f.	DF1	DF2	<i>p</i> .
.10	.01	1.00	1.41	3.00	398.00	.24

The model summary in table 6.43 illustrates the significance of the model at level of confidence

of 90% (p=0.04).

Table 6.44 Regression weights of IKCS moderates the relationship between project interdependency and productivity performance of the project

Variables	Coeff.	SE	t.	<i>P</i> .	LLCI	ULCI
Constant	.00	.05	.03	.97	10	.10
Productivity	02	.05	44	.66	12	.08
IKCS	.01	.05	.24	.81	09	.11
Int_1	.10	.05	1.99	.05	.00	.20

The model in table 6.44 shows that the interaction variable is significant at a level of confidence of 99% (P=0.01), which means that the innovative knowledge creation style has a significant moderation impact on the relationship between the environmental complexity and the cost performance of the project.

The Bootstrap analysis of the interaction variable in the model shows that the BootLLCI of the interaction variable = .001 and that the BootULCI of it = .19 and there is no zero between the two limits. This indicates the significance of the interaction variable according to the results of the Bootstrap analysis.

Plot chart of the regression estimates of low-moderate-high levels of interdependency on productivity performance corresponding to low-moderate-high levels of IKCS as a moderator



Figure 6.91 Plot chart of the regression estimates of low-moderate-high levels of interdependency on productivity performance corresponding to low-moderate-high levels of IKCS as a moderator

It is indicated in the plot chart in figure 6.57 that the projects that have low IKCS (line) for its managers, there is negative relationship between project interdependency and project productivity performance. The more interdependency in these projects, the less is the conformance to the planned productivity in its performance. In projects that have moderate level of IKCs (dot line) of managers (dot line), less strong negative relationship exists between its interdependency and its conformance to planned productivity. For the high IKCS managers, their projects are expected to have positive relationship between the interdependency level and the productivity conformance level. Thus, when there are high innovative knowledge creators to manage the project, they can have a project with increasing interdependency in a way that leads to increasing the conformance of the role played by the innovative knowledge creator in managing the project.

6.25.4 RAKCS moderates the relationship between project interdependency and project quality



Figure 6.92 Model of RAKCS moderates the relationship between project interdependency and project quality

R	R-sq	MSE	f.	DF1	DF2	<i>p</i> .
.19	.04	.97	4.98	3.00	398.00	.00

Table 6.45 Model summary of RAKCS moderates the relationship between project interdependency and project quality

The model summary in table 6.45 illustrates the significance of the model at level of confidence

of 90% (p=0.00).

Table 6.46 Coefficients of the model of RAKCS moderates the relationship between project interdependency and project quality

Variables	Coeff.	SE	<i>t</i> .	<i>P</i> .	LLCI	ULCI
constant	02	.05	33	.74	11	.08
Quality	02	.05	38	.71	12	.08
RAKCS	.11	.05	2.26	.02	.01	.21
Int_1	.16	.05	3.22	.00	.06	.25

The model in table 6.46 shows that the interaction variable is significant at a level of confidence of 99% (P=0.00), which means that the risk averse knowledge creation style has a significant moderation impact on the relationship between the interdependency and the quality performance of the project. The Bootstrap analysis of the interaction variable in the model shows that the BootLLCI of the interaction variable = .06 and that the BootULCI of it = .26 and there is no zero between the two limits. This indicates the significance of the interaction variable according to the results of the Bootstrap analysis.

Plot chart of the regression estimates of low-moderate-high levels of interdependency on quality performance corresponding to low-moderate-high levels of RAKCS as a moderator



Figure 6.93 Plot chart of the regression estimates of low-moderate-high levels of interdependency on quality performance corresponding to low-moderate-high levels of RAKCS as a moderator

The plot graph in figure 6.93 indicates that the projects that have low risk averse knowledge creators such as project managers (line), there is negative relationship between interdependency and project quality. The more interdependency there is in the project, the less is the conformance to the planned quality in its performance. For the projects that have moderate risk averse knowledge creation levels by its managers (dot line), there is no relationship between the interdependency and the quality performance of the project because the relationship is illustrated by a straight horizontal line which reflects no relationship. For the projects that have high risk averse knowledge creation by its managers (dash line), there is positive relationship between its interdependency and its conformance to quality. In high risk averse knowledge creation projects, more interdependency is leading to more success in its quality performance and closer performance quality to the planned one.

6.26.5 The moderation impact of the EKCS on the relationship between size complexity and quality performance of the project



Figure 6.94 The moderation impact of the EKCS on the relationship between size complexity and quality performance of the project

R	R-sq	MSE	f.	DF1	DF2	<i>p</i> .
.15	.02	.99	2.99	3.00	398.00	.03

The model summary in the table above illustrates the significance of the model at level of

confidence of 90% (p=0.03).

Table 6.48 Coefficients of the model of the moderation impact of the EKCS on the relationship between size complexityand quality performance of the project

Variables	Coeff.	SE	<i>t</i> .	<i>P</i> .	LLCI	ULCI
constant	.00	.05	.09	.93	09	.10
Quality	10	.05	-2.09	.04	20	01
RAKCS	04	.05	77	.44	14	.06
Int_1	.10	.05	2.15	.03	.01	.19

The model in the table above shows that the interaction variable is significant at a level of confidence of 95% (P=0.03), which means that the experiential knowledge creation style 910 has a significant moderation impact on the relationship between the size and the quality performance of the project.

The Bootstrap analysis of the interaction variable in the model shows that the BootLLCI of the interaction variable = .001 and that the BootULCI of it = .18 and there is no zero between the two limits. This indicates the significance of the interaction variable according to the results of the Bootstrap analysis.

Plots chart of the regression estimates of low-moderate-high levels of size on quality performance corresponding to low-moderate-high levels of EKCS as a moderator



Figure 6.95 Plot chart of the regression estimates of low-moderate-high levels of size on quality performance corresponding to low-moderate-high levels of EKCS as a moderator

The plot chart in figure 6.95 illustrates that the projects with low experiential knowledge creation depending on the experience of other members in the team (line), the project has negative relationship between its size complexity and its level of conformance between planned quality indicators and actual performance ones. The more the size complexity is the less is the conformance in the quality performance of the project and vice versa. For the projects that have moderate experiential knowledge creation by its managers when they depend on the experience of others, (dot line) there is weaker negative relationship between the size complexity and the quality performance. Creating knowledge using others' experience minimizes the impact of the size complexity on the quality performance of the project. For projects that have a high level of experiential knowledge creation (dash line), the size complexity does not have any significant impact on the increase or decrease of the quality performance of the project (dash line is horizontal).

6.26.6 The moderation impact of EKCS on the relationship between interdependency and quality performance of the project



Figure 6.96 The model of the moderation impact of EKCS on the relationship between interdependency and quality performance of the project

Table 6.49 The Model summary of the moderation impact of EKCS on the relationship between interdependency andquality performance of the project

R	R-sq	MSE	f.	DF1	DF2	р.
.11	.01	1.00	1.53	3.00	398.00	.21

The model summary in table 6.49 illustrates the insignificance of the model (p=0.21). Accordingly, this means that Hayes regression analysis does not support the previous results found by the regression analysis.

6.26.7 The moderation impact of SKCS on the relationship between environmental complexity and time performance of the project



Figure 6.97 Figure 6.63 The model of the moderation impact of SKCS on the relationship between environmental complexity and time performance of the project

Table 6.50 The model summary of the moderation impact of SKCS on the relationship between environmental complexity and time performance of the project

R	R-sq	MSE	f.	DF1	DF2	р.
.11	.01	.99	1.77	3.00	398.00	.15

The model summary in table 6.50 illustrates the significance of the model at level of confidence

of 90% (p=0.15) A accordingly, this means that Hayes regression analysis does not support the

previous results found by the regression analysis.

6.26.8 The moderation impact of SKCS on the relationship between size complexity and cost performance of the project



Figure 6.98 The model of the moderation impact of SKCS on the relationship between size complexity and cost performance of the project

Table 6.51 The model summary of the moderation impact of SKCS on the relationship between size complexity and cost performance of the project

R	R-sq	MSE	f.	DF1	DF2	<i>p</i> .
.11	.01	.99	1.77	3.00	398.00	.15

The model summary in table 6.51 illustrates the significance of the model at level of confidence

of 90% (p=0.15). Accordingly, this means that Hayes regression analysis does not support the

previous results found by the regression analysis.

6.26.9 Summary of the moderation impacts of knowledge creation styles based on Hayes regression analysis



Figure 6.99 Figure 6.65 Moderation model Using Hayes Analysis

6.27 Testing Mediation Using SEM on the Level of Sub-Constructs



Figure 6.100 Testing mediation impacts using SEM on the level of sub-constructs

Figure 6.100 illustrates that the model fit indicators are showing goodness of fit.

			Estimate	S.E.	C.R.	Р
SKCS	<	Interdependency	.073	.038	1.938	.053
RAKCS	<	Interdependency	.073	.028	2.603	.009
Cost	<	Interdependency	.001	.046	.032	.974
Quality	<	Interdependency	014	.046	297	.766
Quality	<	SKCS	143	.059	-2.414	.016
Quality	<	RAKCS	.183	.086	2.133	.033
Cost	<	RAKCS	184	.087	-2.107	.035

Figure 6.101 Regression weights of testing mediation impacts using SEM on the level of sub-constructs

Figure 6.101 illustrates that interdependency impacts the SKCS at a level of confidence of 90% (Sig. = .053) and impacts RAKCS at a level of confidence of 99%. On the other hand, the SKCS impacts the quality performance at a level of confidence of 95% (Sig. = .016), and the RAKCS

impacts the quality performance at a level of confidence of 95% (Sig. = .033) and impacts the cost performance level of confidence of 95% (Sig. - .035). At the same time, the interdependency has no significant impact on both cost performance and quality performance of the project. This leads to the conclusion that the SKCS fully mediates the relationship between the interdependency and the quality performance and that the RAKCS fully mediates the relationship between the interdependency and both the quality performance and the cost performance of the project.

6.28 Testing the Mediation Impacts Using Hayes Process Regression (2013)

6.28.1 Testing the mediation impact of RAKCS on the relationship between interdependency and quality performance of the project using Hayes process analysis

Outcome variable is RAKCS								
R	R-sq	MSE	F	Dfl	Df2	р		
.11	.01	.93	4.50	1.00	400.00	.03		
Determinants	Coeff.	SE	t	p	LLCI	ULCI		
Constant	.00	.05	.00	1.00	09	.09		
Interdependency	.10	.05	2.12	.03	.01	.20		
Outcome variable is Q	uality							
R	R-sq	MSE	F	Dfl	Df2	p		
.10	.01	.96	2.22	2.00	399.00	.11		
Determinants	Coeff.	SE	t	p	LLCI	ULCI		
Constant	.00	.05	.00	1.00	10	.10		
Interdependency	02	.05	46	.65	12	.07		
RAKCS	.11	.05	2.09	.04	.01	.21		
Outcome variable is Q	uality (total ef	fect model)						
R	R-sq	MSE	F	Dfl	Df2	p		
.01	.00	.97	.06	1.00	400.00	.81		
Determinants	Coeff.	SE	t	p	LLCI	ULCI		
Constant	.00	.05	.00	1.00	10	.10		
Interdependency	01	.05	24	.81	11	.09		

Table 6.53 Significance of testing the mediation impacts using Hayes process regression (2013)

Bootstrap results for regression model parameters:

Table 6.54 Bootstrap results for the regression model parameters for testing the mediation impacts using Hayes process regression (2013)

Outcome variable is RAKCS							
Determinants	Coeff.	BootMean	BootSE	BootLLCI	BootULCI		
Constant	.00	.00	.05	09	.09		
Interdependency	.10	.10	.05	.01	.20		

Outcome variable is Quality							
Determinants	Coeff.	BootMean	BootSE	BootLLCI	BootULCI		
Constant	.00	.00	.05	09	.10		
Interdependency	02	02	.05	13	.08		
RAKCS	.11	.11	.05	.01	.21		

Tables 6.53 and 6.54 show the significance of the RAKCS as a mediator of the impact of interdependency on the project quality performance, and the Bootstrapping analysis is statistically significant.

6.28.2 Testing the mediation impact of RKCS on the relationship between the interdependency and the cost performance using Hayes process analysis

Table 6.55 Hayes process analysis results of testing the mediation impact of RAKCS on the relationship between interdependency and the cost performance

Outcome variable is RAKCS								
R	R-sq	MSE	F	Df1	Df2	р		
.11	.01	.93	4.50	1.00	400.00	.03		
Determinants	Coeff.	SE	t	р	LLCI	ULCI		
Constant	.00	.05	.00	1.00	09	.09		
Interdependency	.10	.05	2.12	.03	.01	.20		
Outcome variable is C	ost							
R	R-sq	MSE	F	Dfl	Df2	p		
.07	.01	.99	1.02	2.00	399.00	.36		
Determinants	Coeff.	SE	t	р	LLCI	ULCI		
Constant	.00	.05	.00	1.00	10	.10		
Interdependency	03	.05	66	.51	13	.07		
RAKCS	06	.05	-1.19	.24	16	.04		
Outcome variable is C	ost (total effec	t model)						
R	R-sq	MSE	F	Dfl	Df2	p		
.04	.00	.99	.63	1.00	400.00	.43		
Determinants	Coeff.	SE	t	р	LLCI	ULCI		
Constant	.00	.05	.00	1.00	10	.10		
Interdependency	04	.05	79	.43	14	.06		

Bootstrap results for regression model parameters:

 Table 6.56 Bootstrap results for regression model parameters of Hayes process analysis results of testing the mediation impact of RAKCS on the relationship between interdependency and the cost performance

Outcome variable is RAKCS							
Determinants	Coeff.	BootMean	BootSE	BootLLCI	BootULCI		
Constant	.00	.00	.05	10	.09		
Interdependency	.10	.10	.05	.01	.20		

Hayes analysis results illustrated in above tables do not provide a statistical evidence to support the mediation impact of RAKCS on the relationship between interdependency and cost performance of the project.

6.28.3 Testing the mediation of the SKCS on the relationship between interdependency and quality performance of the project using Hayes process analysis

 Table 6.57 Results of testing the mediation of the SKCS on the relationship between interdependency and quality performance of the project using Hayes process analysis

Outcome variable is S	KCS					
R	R-sq	MSE	F	Dfl	Df2	p
.09	.01	.95	2.98	1.00	400.00	.08
Determinants	Coeff.	SE	t	p	LLCI	ULCI
Constant	.00	.05	.00	1.00	10	.10
Interdependency	.08	.05	1.73	.08	01	.18
Outcome variable is Q	uality					
R	R-sq	MSE	F	Dfl	Df2	p
.08	.01	.96	1.41	2.00	399.00	.24
Determinants	Coeff.	SE	t	p	LLCI	ULCI
Constant	.00	.05	.00	1.00	10	.10
Interdependency	.00	.05	09	.93	10	.09
SKCS	08	.05	-1.66	.10	18	.02
Outcome variable is Q	uality (total ef	fect model)				
R	R-sq	MSE	F	Dfl	Df2	p
.01	.00	.97	.06	1.00	400.00	.81
Determinants	Coeff.	SE	t	p	LLCI	ULCI
Constant	.00	.05	.00	1.00	10	.10
Interdependency	01	.05	24	.81	11	.09

Bootstrap results for regression model parameters:

 Table 6.58 Bootstrap results for regression model parameters for testing the mediation of the SKCS on the relationship

 between interdependency and quality performance of the project using Hayes process analysis

Outcome variable is RAKCS							
Determinants	Coeff.	BootMean	BootSE	BootLLCI	BootULCI		
Constant	.00	.00	.05	10	.09		
Interdependency	.08	.09	.05	01	.18		

Hayes analysis results illustrated in above tables do not provide a statistical evidence to support

the mediation impact of SKCS on the relationship between interdependency and quality

performance of the project.

6.29 Refined Research Constructs

According to the SEM and Hayes analysis justifications are introduced to the number of items

under each construct to reach better goodness of fit. Hence, the constructs under complexity and

project performance have new correlation matrix after deleting some items.

The following table illustrates which items were excluded after SEM analysis; the excluded

items are shaded in grey colour:

6.29.1 The questionnaire after refining the model fit of testing moderation and mediation – showing the excluded items

This is a required question

The Effect of Project Operational Size, Variety, Interdependency, and environment on Complexity- Rate each of the following factors according to its importance in contributing to the level of complexity of the current project. 1 = bich importance 5 = low importance

	1 = mgn importance $5 = 100 importance$	nce					
#	Statement	1	2	3	4	5	Item Name
1	In general, the importance of the effect of the						Size 1
	project operational size on complexity						
2	Number of investors in the current project						Size 2
3	Number of suppliers of the current project						Size 3
4	Number of workers of the current project						Size 4
5	Duration of the current project						Size5
6	In general, the importance of the effect of variety in						Variety 1
	the project operational system on complexity						
7	Variety of information systems used in the current						Variety 2
	project						
8	Variety of geographical locations of the current						Variety 3
	project						
9	Variety and conflicts among project's goals						Variety 4
1	Inter-dependencies between sites, departments, and						Interdependenc
0	companies for implementing the current project						y 1
1	Inter-dependencies between information systems of						Interdependenc
1	the current project						y 2
1	Inter-connectivity & feedback loops in the tasks &						Interdependenc
2	networks of the current project						y 3
1	In general, the importance of the effect of the Level						Interdependenc
3	of interdependency with other projects and systems						y 4
	on complexity						
1	Availability of people, materials, & any resources						Interdependenc
4	due to sharing with other projects					<u> </u>	y 5
1	Dependencies between schedules of implementation						Interdependenc
5	of the current project with other projects					<u> </u>	у б
1	Inter-dependencies between objectives of the						Interdependenc
6	current project						у 7

1	Processes inter-dependencies of the current project			Interdependenc
7				y 8
1	Team communication and cooperation problems			Interdependenc
8				y 9
1	Level of interrelation between project phases			Interdependenc
9				y 10
2	In general, the importance of the effect of the			Environmental
0	complexity of Environmental and cultural contexts			complexity 1
	of the project on complexity			
2	Networked environment (environmental			Environmental
1	complexity)			complexity 2
2	Cultural configuration and variety in this project			Environmental
2				complexity 3

Styles of K	Knowl	edge	Creat	ion	- to	what	exter	nt de	o yo	ı agı	ee	abou	t eac	h of	the	fo	llov	ving	state	emen	ts?	Rand	omi	zed
1= strongly	y agre	e5	= str	ongl	y di	sagre	e																	

20	0, 0						
#	Statement	1	2	3	4	5	Item Name
1	Safety precautions enables me to stabilize my						RAKCS1
	project performance						
2	Risk avoidance is my first priority in managing						RAKCS2
	chaotic changes in my project performance						
3	Controlling risks is not the first priority goal of this						RAKCS3
	project						
4	I practically ignore keeping contingency reserve for						RAKCS4
	dealing with expected risks to increase my profits						
5	I keep contingency reserve only for dealing with						RAKCS5
	expected risks that I am sure it will affect my						
	project performance						
6	Changing the plan is not my favourite coping						RAKCS6
	solution for unexpected changes						
7	I don't feel comfortable with changing the way I						IKCS1
	manage the project						
8	I try to innovate something new to cope with						IKCS2
	chaotic changes in my project performance						
9	Innovations is my best course of action to solve						IKCS3
1.0	chaotic problems during project implementation						
10	I depend on collecting information about						IKCS4
	competitors to create new knowledge						WIGG #
11	My Social networks help me in creating new						IKCS5
10	knowledge						WORK
12	Feelings and skills are more important to me than						IKCS6
	databases and documents when creating new						
12	knowledge						EKO01
13	I depend on others' experience to learn new things						EKCSI
14	when I take critical decisions, I depend on the						EKCS2
	available databases more than my feelings and						
15							EKC62
15	Unlers experience enables me to connect pieces of						EKC53
16	knowledge						EVCC4
10	i use my experience for dealing with chaotic						EKC54
17	My experience another me to familiarize with a new						EVCS
1 /	why experience enables me to raminarize with a new shange in the environment						EKCSS
10	My performance in the part is an input for such						EVCSC
18	my performance in the past is an input for creating						EKCS0
	new knowledge	1	1	1	1	1	

19	I push the decision-making process to lower levels if I don't have enough information This is a required question			SKCS1
20	I used my educational background when managing			SKCS2
	this project			
21	Depending on diversified specializations is			SKCS3
	ineffective in managing chaotic situations			
22	I disregard thinking of what I have studied when			SKCS4
	dealing with chaotic changes in my project			
23	My study helped me to achieve my project goals			SKCS5
24	I focus on one specialty to deal with new changes			SKCS6

Project Performance - to what extent do you rate the conformance between the planned performance and the actual one for each of the following items. 1 = 1 + 2 = 1 +

			-				
#	Statement	1	2	3	4	5	Item Name
1	The percentage of the out of budget cost relative to the						Cost 1
	planned cost is						
2	The percentage of the raw material's cost relative to the total						Cost 2
	cost in the current project is						
3	The percentage of returns on investment of the current						Cost 3
	project is						
4	The percentage of resource utilization variance to plan in						Cost 4
	the current project is						
5	The percentage of cost savings in the current project is						Cost 5
6	The percentage of variance between planned raw material						Cost 6
	costs and actual raw material costs is						
7	The average cost / hour for the current project is (cost)						Cost 7
8	Current Project Cost is						Cost 8
9	The percentage of cost variance to plan in the current						Cost 9
	project is (cost)						
10	The percentage of number of milestones missed relative to						Productivity
	number of milestones planned in the current project is						1
	(productivity)						
11	The percentage of profit per employees' costs in the current						Productivity
	project is (productivity)						2
12	The average percentage of working hours per month in the						Productivity
	current project is (productivity)						3
14	The average percentage of downtime to the total working						Productivity
	time per day in the current project is (productivity)						4
15	The Percentage of successful phase exit against milestones						Productivity
	planned in the current project is (productivity)						5
16	The percentage of errors detected during design and process						Quality 1
	reviews in the current project is (quality)						o 11 o
17	The percentage of customer satisfaction up to the current						Quality 2
10	stage of the current project is (quality)						
18	The percentage of rework time in the current project is						Quality 3
10	(quality)						
19	The number of training courses provided for the project						Quality 4
	manager of the current project is (quality)		_	<u> </u>	 		
20	The detect rate in the current project is (quality)						Quality 5
21	The project actual cycle time against the planned cycle time						Time 1
	is (time)						
22	The planning time needed for the current project is (time)	1			1	1	Time 2

23	The number of days needed to supply the main resource in		Time 3
	the current project is (time)		
24	The main resource waiting time in the current project is		Time 4
	(time)		
25	The percentage of overtime in the current project is (time)		Time 5
26	The dollar value of time variance in the current project is (time)		Time 6
27	The percentage of cost savings due to early delivery in the current project is (time)		Time 7
28	The average time required to process a request for corrective action in the current project is (time)		Time 8

Figure 6.102 Project Manager's Knowledge Creation Styles and Both Project Complexity and Project Performance

6.29.2 New correlations among constructs after excluding some items in light of improving the SEM goodness of fit

The following correlation matrix in table 6.60 is the matrix of the new constructs after excluding

the previous items due to the SEM goodness of fit achievement:

Correlations

		Interd.	Size	Variety	Enviro.	Cost	Time	Quality	Prod.	SKCS	RAKCS	RAKCS IKCS
Interd.	Pearson	1										
	Correlation	1										
	Sig. (2-tailed)											
	Ν	402										
Size	Pearson	- 015	1									
	Correlation	015	1									
	Sig. (2-tailed)	.766										
	Ν	402	402									
Variety	Pearson	- 010	- 090#	1								
	Correlation	.010	.0901	1								
	Sig. (2-tailed)	.841	.072									
	Ν	402	402	402								
Envir.	Pearson	005	.081	.026	1							
	Correlation	1000	1001	.020								
	Sig. (2-tailed)	.916	.103	.606								
	Ν	402	402	402	402							
Cost	Pearson	040	010	059	.014	1						
	Correlation					-						

	Sig. (2-tailed)	.429	.844	.239	.780								
	Ν	402	402	402	402	402							
Time	Pearson Correlation	075	062	083#	039	.006	1						
	Sig. (2-tailed)	.135	.211	.097	.441	.911							
	Ν	402	402	402	402	402	402						
Quality	Pearson Correlation	012	096#	.096#	.076	051	022	1					
	Sig. (2-tailed)	.813	.055	.054	.127	.312	.658						
	Ν	402	402	402	402	402	402	402					
Prod.	Pearson Correlation	023	050	.083#	.044	.008	.007	.121*	1				
	Sig. (2-tailed)	.647	.320	.096	.381	.869	.889	.015					
	N	402	402	402	402	402	402	402	402				
SKCS	Pearson Correlation	.086#	.023	.030	.034	055	.039	084#	006	1			
	Sig. (2-tailed)	.085	.642	.548	.501	.270	.430	.094	.903				
	N	402	402	402	402	402	402	402	402	402			
RAKCS	Pearson Correlation	.105*	021	019	046	063	066	.102*	030	072	1		
	Sig. (2-tailed)	.035	.675	.711	.356	.207	.189	.040	.552	.148			
	Ν	402	402	402	402	402	402	402	402	402	402		
IKCS	Pearson Correlation	017	.000	031	.001	074	044	.091#	.011	036	.002	1	
	Sig. (2-tailed)	.728	.999	.529	.984	.139	.383	.070	.833	.469	.974		
	Ν	402	402	402	402	402	402	402	402	402	402	402	
EKCS	Pearson Correlation	052	032	.051	001	012	.063	023	.011	026	143**	.111*	1
	Sig. (2-tailed)	.296	.527	.303	.992	.805	.209	.646	.827	.600	.004	.026	
	Ν	402	402	402	402	402	402	402	402	402	402	402	402

Correlation is significant at the 0.10 level (2 tailed)

*. Correlation is significant at the 0.05 level (2-tailed).

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

The following graph in figure 6.67 illustrates the summary of significant correlation relationships among the new constructs:



Figure 6.103 Summary of significant correlation relationships among the new constructs

Correlation analysis results

Table 6.61 illustrates a summary of the significant relationships according to the correlation analysis among research constructs:

#	Factors correlated	Correlation	Sig.
		coefficient	
1	PC-I with RAKCS	0.105	0.035*
2	RAKCS with EXKCS - Self	-0.151	0.002**
3	INNKCS with EXKCS - Self	0.114	0.022*
4	EXKCS-self with EXKCS-others	0.592	0.000**
5	RAKCS with PP-Q	0.102	0.04*
6	PP-Q with PP-P	0.121	0.015*
7	Variety with PC-Size	090	.072
8	Variety with PP-Time	-0.083	0.097
9	Variety with PP-Q	0.096	0.054
10	Size with PP-Q	-0.096	0.055
12	Variety with PP-Productivity	0.083	0.096
13	SKCS with PC-I	0.086	0.085

Tabla 6 61 Significant	t corrolations among	, constructs aftar re	fining the CENA	acadracc of fit
1 0018 0.01 3191111100110	correlations among	i constructs after re	cinning the Selvi	yoouness of fit

14	SKCS with PP-Q	-0.084	0.094
15	RAKCS with PC-I	0.105	0.035
16	IKCS with PP-Q	0.091	0.070

(*) Significant at level of confidence of 95%(**) Significant at level of confidence of 99%

Table 6.61 illustrates the following:

- RAKCS has a positive relationship with interdependency complexity (coefficient of correlation = 0.105) (sig. 0.035)
- 2- EKCS has a negative relationship with RAKCS (coefficient of correlation= -0.143) (sig. 0.004)
- 3- EKCS has a positive relationship with IKCS (coefficient of correlation= 0.111) (sig.
 0.026)
- 4- Quality performance has a positive relationship with RAKCS (coefficient of correlation= 0.102) (sig. 0.040)
- 5- Productivity performance has a positive relationship with quality performance (coefficient of correlation= 0.121) (sig. 0.015)

For the following part of accepted hypotheses, they are accepted at a level of confidence of 90%:

- 6- Variety has a negative relationship with size complexity (correlation coefficient = -.090) (Sig. = .072)
- 7- Variety has a negative relationship with time performance (Correlation coefficient = -0.083) (Sig. = 0.097)
- 8- Variety has a positive relationship with the quality performance of the project (Correlation coefficient = 0.096) (Sig. = 0.054)
- 9- Size complexity has a negative relationship with the quality performance of the project (Correlation coefficient = -0.096) (Sig.= 0.055)

- 10- Variety has a positive relationship with the productivity performance of the project (Correlation coefficient = 0.083) (Sig. = 0.096)
- 11-SKCS has a positive relationship with the interdependency of the project (Correlation coefficient = 0.086) (Sig.=0.085)
- 12-SKCS has a negative relationship with the quality performance of the project (Correlation coefficient = -0.084) (Sig.= 0.094)
- 13- RAKCS has a positive relationship with the interdependency of the project (Correlation coefficient = 0.105) (Sig.= 0.035)
- 14- IKCS has a positive relationship with the quality performance of the project

((Correlation coefficient= 0.091) (Sig.=0.070).

6.30 Testing Moderation for Sub-Constructs Using Regression Models

In figure 6.104, significant relationships of KCSs moderation impacts investigated on the relationships between the independent sub-constructs and the dependent ones:

#	Factors	Beta of	T of int.	P of int.
		Int. (US)		
1	IKCS moderates			
1.c	Interdependency on			
1.c.3	Productivity	0.101	1.995	0.047**
1.d	Environmental complexity on			
1.d.1	Time	0.148	2.900	0.004**
1.d.2	Cost	0.129	2.502	0.013**
2	RAKCS moderates			
2.c	Interdependency on			
2.c.4	Quality	0.153	3.224	0.001**
3	SKCS moderates			
3.a	Size on			
3.a.2	Cost	0.102	2.017	0.044**
3.b	Variety on			
3.b.1.	Time	096	-1.805	0.072*
3.d	Environmental Complexity on			
3.d.1	Time	0.100	2.008	0.045**
4	EKCS moderates			
4.a	Size on			
4.a.4	Quality	0.081	1.781	0.076*

4.b	Variety on			
4.b.4	Quality	-0.076	-1.702	0.090*
4.d	Environmental Complexity on			
4.d.2	Cost	0.102	1.961	0.051*
5	EKCS 1 moderates			
5.a	Size on			
5.a.1	Time	-0.087	-1.902	0.058*
5.a.4	Quality	0.107	2.133	0.032**
5.b	Variety on			
5.b.4	Quality	-0.089	-1.874	0.062*
5.c	Interdependency on			
5.c.4	Quality	-0.117	-2.106	0.045**
6	EKCS 2 moderates			
6.a	Size on			
6.a.3	Productivity	-0.079	-1.685	0.093*
(*) Signifi	cant at a level of confidence of 90%			

(**) Significant at a level of confidence of 95%

Figure 6.104 Testing moderation for sub-constructs using regression models

Figure 6.104 illustrates the possible moderation impacts of knowledge creation styles on the relationships between the complexity constructs and the project performance constructs. The last part of the table illustrates that the possibility of splitting the EKCS into two sub-constructs EKCS1 rests upon the experience of others in the project team, and EKCS2 rests upon self-experience in the past as a source of new knowledge creation. Then, there is the testing of these two sub-constructs and their moderation impacts on the relationships between complexity constructs and project performance constructs. Only the significant constructs are illustrated in table 6.62. The following graph illustrates the model of significant positive and negative moderation impacts according to the table above:



Figure 6.105 The model of significant positive and negative moderation impacts of KCSs on sub-constructs' relationships according to the regression analysis results

The model in figure 6.105 shows that the four knowledge creation styles have a moderation impact on the relationships between complexity sub-constructs and project performance sub-constructs. This is found at different levels of confidence and is done in light of considering the EKCS as one style.

After considering the EKCS as two sub-constructs -one is related to the experience built from other people and the other one is the knowledge created from self-experience of the project manager- Figure 6.69 is showing moderation impacts on the relationships between complexity constructs and performance ones were found:



Figure 6.106 Moderation impacts of sub-constructs of EKCS on relationships between sub-constructs of project complexity and sub-constructs of project performance

Figure 6.106 illustrates that the creation of new knowledge using experience of other members in the project team can significantly and negatively impact the relationship between interdependency and quality performance, size and time performance, and variety and quality performance, and can also positively moderate the relationship between the size of the project and its quality performance. The graph also illustrates that creating new knowledge from self-experience has a significant negative moderation impact on the relationship between size of the project and its productivity performance.

#	Factors	F	Р	Beta of Int. (US)	T of int.	P of int.
1.a	IKCS					
1.a.1	Size	0.000	0.999	0.000	0.001	0.999
1.a.2	Variety	0.397	0.529	-0.31	-0.630	0.529
1.a.3	Interdependency	0.121	0.728	-0.017	-0.348	0.728
1.a.4	Environmental Complexity	0.000	0.984	0.001	0.020	0.984
1.b	RAKCS				•	
1.b.1	Size	0.176	0.675	-0.021	-0.420	0.675
1.b.2	Variety	0.137	0.711	-0.019	-0.370	0.711
1.b.3	Interdependency	4.497	0.035	0.105	2.121	0.035**
1.b.4	Environmental Complexity	0.855	0.356	-0.046	-0.925	0.356
1.c	SKCS	•		•	•	
1.c.1	Size	0.217	0.642	0.023	0.465	0.642
1.c.2	Variety	0.362	0.548	0.030	0.602	0.548
1.c.3	Interdependency	2.981	0.085	0.086	1.727	0.085*
1.c.4	Environmental Complexity	0.454	0.501	0.034	0.674	0.501
1.d	EKCS	•		•	•	
1.d.1	Size	0.400	0.527	0.032	0.633	0.527
1.d.2	Variety	1.062	0.303	0.051	1.031	0.303
1.d.3	Interdependency	1.096	0.296	0.052	1.047	0.296
1.d.4	Environmental Complexity	0.000	0.992	0.001	0.011	0.992
1.e	EKCS1	•		•	•	
1.e.1	Size	0.835	0.361	-0.046	-0.914	0.361
1.e.2	Variety	0.809	0.369	0.045	0.900	0.369
1.e.3	Interdependency	1.483	0.224	-0.061	-1.218	0.224
1.e.4	Environmental Complexity	0.592	0.442	-0.038	-0.770	0.442
1.f	EKCS2	•		•	•	
1.f.1	Size	0.050	0.822	-0.011	-0.225	0.822
1.f.2	Variety	0.698	0.404	0.042	0.835	0.404
1.f.3	Interdependency	0.385	0.535	-0.031	-0.620	0.535
1.f.4	Environmental Complexity	0.294	0.588	0.027	0.542	0.588
2.a	IKCS	•		•	•	
2.a.1	Time	0.763	0.383	-0.044	-0.874	0.383
2.a.2	Cost	2.196	0.139	-0.074	-1.482	0.139
2.a.3	Productivity	0.045	0.833	0.011	0.211	0.833
2.a.4	Quality	3.306	0.070	0.091	1.818	0.070*

6.31 Testing Mediation for Sub-Constructs Using Regression Analysis

2.b	RAKCS					
2.b.1	Time	1.734	0.189	-0.066	-1.317	0.189
2.b.2	Cost	1.595	0.207	-0.063	-1.263	0.207
2.b.3	Productivity	0.355	0.552	-0.030	-0.596	0.552
2.b.4	Quality	4.243	0.040	0.102	2.060	0.040**
2.c	SKCS					
2.c.1	Time	0.623	0.430	0.039	0.789	0.430
2.c.2	Cost	1.221	0.270	-0.055	-1.105	0.270
2.c.3	Productivity	0.015	0.903	-0.006	-0.122	0.903
2.c.4	Quality	2.823	0.094	-0.084	-1.680	0.094*
2.d	EKCS					
2.d.1	Time	1.586	0.209	0.063	1.259	0.209
2.d.2	Cost	0.061	0.805	-0.012	-0.247	0.805
2.d.3	Productivity	0.048	0.827	0.011	0.218	0.827
2.d.4	Quality	0.211	0.646	-0.023	-0.460	0.646
2.e	EKCS1					
2.e.1	Time	0.524	0.469	0.036	0.724	0.469
2.e.2	Cost	0.018	0.894	-0.007	-0.133	0.894
2.e.3	Productivity	0.788	0.375	0.044	0.887	0.375
2.e.4	Quality	0.452	0.502	-0.034	-0.672	0.502
2.f	EKCS2					
2.f.1	Time	1.067	0.302	0.052	1.033	0.302
2.f.2	Cost	0.203	0.653	-0.022	-0.450	0.653
2.f.3	Productivity	0.160	0.689	-0.020	-0.400	0.689
2.f.4	Quality	0.001	0.972	-0.002	-0.036	0.972

(*) Significant at level of confidence of 95% (**) Significant at level of confidence of 90%

Figure 6.107 Significant and non-significant results of testing mediation for sub-constructs using regression analysis

6.32 Summary of the Moderation and Mediation Impacts of KCSs on the Relationships Between Complexity Sub-Constructs and Project Performance Sub-Constructs – (using SEM, REG, and Hayes)

What is the moderation impact of knowledge creation styles on the relationship between

complexity constructs and project performance constructs?

What is the mediation impact of knowledge creation styles on the relationship between

complexity constructs and project performance constructs?

6.32.1 Comparison between significantly evidenced moderation impacts by SEM, Regression analysis, and Hayes process analysis

Table 6.64 Comparison between significantly evidenced moderation impacts by SEM, Regression analysis, and Hayes process analysis

#	Moderation impacts of KCSs	SEM	REG.	Hayes
---	----------------------------	-----	------	-------

1	IKCS moderates the relationship between interdependency and productivity	Y	Y	Y
2	IKCS moderates the relationship between environmental complexity and time	Y	Y	Y
3	IKCS moderates the relationship between environmental complexity and cost	Y	Y	Y
4	RAKCS moderates the relationship between interdependency and quality	Y	Y	Y
5	SKCS moderates the relationship between size and cost	Y	Y	Ν
6	SKCS moderates the relationship between environmental complexity and time	Y	Y	N
7	SKCS moderates the relationship between variety and time	Ν	Y	Ν
8	SKCS moderates the relationship between variety and quality	Ν	Y	Ν
9	SKCS moderates the relationship between environmental complexity and cost	Ν	Y	N
10	EKCS(1) moderates the relationship between size and quality	Y	Y	Y
11	EKCS(1) moderates the relationship between interdependency and quality	Y	Y	N
12	EKCS(1) moderates the relationship between size and time	Ν	Y	Ν
13	EKCS(1) moderates the relationship between variety and quality	Ν	Y	Ν
14	EKCS(2) moderates the relationship between size and productivity	Ν	Y	Ν

According to the table 6.64, there is statistical evidence from three analysis tools on five moderation impacts of knowledge creation styles. Creating new knowledge from innovative resources can significantly impact the relationship between interdependency and productivity, environmental complexity and cost, and environmental complexity and time. Creating new knowledge using risk-averse resources like precautional data, for example, will moderate the relationship between interdependency of the project and its quality performance. Finally, the creation of new knowledge by depending on the experience of other members in the project team is significantly moderating the relationship between the project size and its quality performance.

6.32.2 Comparison between significantly evidenced mediation impacts by SEM, Regression analysis, and Hayes process analysis

Table 6.65 Comparison between significantly evidenced mediation impacts by SEM, Regression analysis, and Hayes process analysis

1	RAKCS fully mediates the relationship between interdependency	Y	Y	Y
	and quality performance of the project			
2	RAKCS fully mediates the relationship between interdependency	Ν	Ν	Y
	and cost performance of the project			
3	SKCS fully mediates the relationship between interdependency	Y	Ν	Y
	and quality performance of the project			

According to table 6.65, among the three methods of analysing the mediation impact of KCSs, it is obvious that the full mediation impact of the RAKCS on the relationship between the interdependency of the project and its quality performance is significantly evidenced in the three methods, structure equation modelling, regression analysis, and Hayes process analysis. The work on the creation of the knowledge from risk averse resources like precautional ones is a mediator with which a relationship exists between the change in the level of interdependency of the project and its change in the level quality conformance. Risk-averse impacts both the independent and the dependent variable in this relationship. More interdependency leads to more risk-averse knowledge creation and more risk-averse knowledge creation leads to more conformance to the planned quality in the implemented performance of the project.

6.33 Predicting the Project Performance

In the following section we are trying to answer the following research questions:

What independent factors predict what dependent factors of the study?

Does the prediction power significantly change after adding the knowledge creation style variables to the prediction model?

To answer these two research questions, in this section the researcher is using hierarchical regression to test the change in the ratio of explanation of the performance sub-constructs after adding the knowledge creation styles above and beyond the sub-constructs of the project complexity:

6.33.1 Variety and size complexity predict the quality performance of the project in light of SKCS

		Quality performance
Pearson Correlation	Quality	1.000
	Size	096
	Variety	.096
	SKCS	084
Sig. (1-tailed)	Quality	
	Size	.027
	Variety	.027
	SKCS	.047
Ν	Quality	402
	Size	402
	Variety	402
	SKCS	402

Table 6.66 Correlation matrix among size, variety, SKCS, and quality performance

The correlation matrix in table 6.66 shows that the increase in the size complexity of the project is correlated with the decrease of the conformance to the planned quality in the project performance at a level of confidence of 95% (sig.= 0.027). When variety in the system components of the project increases, the conformance to the planned quality of the project increases at a level of confidence of 95% (sig.= 0.027). Specialized knowledge creation style has a negative correlation with the conformance to the planned quality in the project performance. The higher in the level of creating new knowledge from specialization sources by the project manager, the lower is the ability to have the actual quality performance the same as the planned one. This is statistically accepted at a level of confidence of 95% (sig.= .047).

6.33.2 Adding SKCS to the prediction model of size and variety to predict the change in quality performance

A hierarchical regression model is used to test the significance of the change in the ratio of explanation of the regression model of having size and variety as determinants of the quality performance of the project and then adding the specialized knowledge creation style above and beyond the complexity sub-constructs to the model. The following table illustrates the significance of the change in the R square after adding SKCS:

Table 6.67 The significance of the change in the prediction power of the quality performance after adding the SKCS

				Std. Error	Change Statistics				
		R	Adjusted R	of the	R Square	F			Sig. F
Model	R	Square	Square	Estimate	Change	Change	df1	df2	Change
1	.130 ^a	.017	.012	.99400324	.017	3.427	2	399	.033
2	.155 ^b	.024	.017	.99164020	.007	2.904	1	398	.089
a. Predi	a. Predictors: (Constant), variety, size								
b. Predictors: (Constant), variety, size, SKCS									

c. Dependent Variable: quality

Table 6.67 demonstrates that the first regression model has a significant change from zero by using both size and variety as complexity determinants of the quality performance of the project at level of confidence of 95% (Sig. = .033). Then after adding the SKCS as a determinant of the quality performance of the project, the change in the ratio of explanation increased by 0.7% which is significant at a level of confidence of 90% (Sig.= .089).

Table 6.68 Analysis of variance table for the regression models of predicting the quality performance of the pro	ject by
size, variety, and SKCS	

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.771	2	3.386	3.427	.033 ^b
	Residual	394.229	399	.988		
	Total	401.000	401			
2	Regression	9.627	3	3.209	3.263	.021°
	Residual	391.373	398	.983		
	Total	401.000	401			

a Dependent	Variable.	quality
u. Dependent	v un uone.	quanty

b. Predictors: (Constant), variety, size

c. Predictors: (Constant), variety, size, SKCS

In the analysis of variance in table 6.68 shows that both models are significant and are statistically accepted at a level of confidence of 95% to predict the change in the quality performance of the project. The following table illustrates the coefficients of the two models of the hierarchical regression:

	Unstandardized		Standardized		
	Coefficients		Coefficients	_	
Model *	В	Std. Error	Beta	t	Sig.
(Constant)	-1.536E-17	.050		.000	1.000
Size	088	.050	088	-1.764	.079
Variety	.088	.050	.088	1.768	.078
(Constant)	-2.048E-17	.049		.000	1.000
Size	086	.050	086	-1.723	.086
Variety	.091	.050	.091	1.826	.069
SKCS	086	.051	084	-1.704	.089

Table 6.69 Coefficients of the regression models of predicting the quality performance by size, variety, and SKCS

(*) Dependent variable is quality performance of the project.

Table 6.69 illustrates the first model of regression without the impact of the SKCS, and the quality performance of the project is predicted by size and variety at a level of confidence of 90%. There is a negative relationship between the size of the project and the conformance to the quality performance of the project. When the size of the project increases by 1 unit, the quality conformance of the project decreases by 8.8%. The model also shows that when the variety of the project system components increases by 1 unit, the conformance to the quality of the project increases in the same direction by 8.8%. However, variety as a construct measuring complexity and its increase means increasing the level of complexity of the project, but in the sample of this study, the increase in the variety affects positively the conformance to the planned
quality. The researcher expects more clarity if the sample of the research includes large-sized projects as well. The sample is applied on small and medium sized projects, and maybe there is a curve line relationship in which the variety increases the conformance to the planned quality. After a certain point of variety, it turns to become negatively related with the control over the quality performance of the project. This is another area of further research in the future. If we look at the second model in the hierarchy of regression, we can notice the impact of SKCS in the prediction model. The coefficient or beta of size's effect on quality performance remains negative, significant at level of confidence of 90% (Sig. = .086) but has lower value. When the size of the project increases by 1 unit, the quality conformance decreases by 8.6%. In the case of analyzing the effect of variety on quality conformance, we will find that an increase in the variety by 1 unit will increase the quality conformance by 9.1% in the same direction, and this is statistically accepted at a level of confidence of 90% (Sig. = .069), so the effect of variety becomes significantly higher when there is an impact of SKCS on quality conformance. The SKCS itself has a negative significant relationship with the quality conformance at a level of confidence of 90% (Sig. = .089) This means that when the project manager uses specialized sources to create new knowledge and increase this behaviour by 1 unit, the quality conformance may decrease by 8.6%, and sometimes this is because of the possible contradiction between theoretical aspects of specialization and implementation aspects of quality conformance which may result in a decrease in the quality performance of the project. This is due to overspecialization knowledge creation that is somehow isolated from the practical issues of implementation in the project.

6.33.3 Variety predicts the quality performance of the project in light of RAKCS

Change Statistics

				Std. Error					
		R	Adjusted R	of the	R Square	F			Sig. F
		Square	Square	Estimate	Change	Change	df1	df2	Change
1	.096ª	.009	.007	.99662191	.009	3.723	1	400	.054
2	.142 ^b	.020	.015	.99238176	.011	4.425	1	399	.036
a. Pre	a. Predictors: (Constant), variety								
b. Pr	o. Predictors: (Constant), variety, RAKCS								

c. Dependent Variable: Quality

Figure 6.108 Significance of the change of the prediction power of quality performance by adding the RAKCS to the prediction model

Table 6.108 illustrates that the first model is changing the ratio of explanation from zero to 0.9%, and this is not a statistically accepted significant change at a level of confidence of 95% However, it is statistically accepted at a level of confidence of 90% (Sig.= 0.054). After adding the RAKCS, the change in the ratio of explanation of the model from 0.9% to 2% is a statistically significant change at a level of confidence of 95% (Sig.= 0.036). As a conclusion, the RAKCS is significantly increasing the ability to explain the variance in the quality performance of the project when added to the variety determination of the quality performance. Table 6.71 illustrates the analysis of variance for the two models:

Model		Sum of Squares	df	Mean Square	F	Sig.			
1	Regression	3.698	1	3.698	3.723	.054 ^b			
	Residual	397.302	400	.993					
	Total	401.000	401						
2	Regression	8.056	2	4.028	4.090	.017°			
	Residual	392.944	399	.985					
	Total	401.000	401						
a. Deper	a. Dependent Variable: Quality								
b. Predic	ctors: (Constant)	, Variety							

c. Predictors: (Constant), Variety, RAKCS

Figure 6.109 Analysis of variance of predicting the quality performance by variety and RAKCS

In the analysis of variance, it is obvious that the model of explaining the change in the quality performance is not significant at a level of confidence of 95%. However, it is accepted at a level of confidence of 90%.

The same model becomes significant at a level of confidence of 95% after adding the change in the risk averse knowledge creation style as a determinant to the change in the quality performance of the project to the variety of the project. (Sig.= 0.017). The coefficients of variance in independent variables of both models are illustrated in the following table:

				Standardize									
		Unstandardiz	ed	d			95.0% C	Confidence					
		Coefficients		Coefficients		Interval for B C		Correlations		Collinearity Statistics			
			Std.				Lower	Upper	Zero-				
Model		В	Error	Beta	t	Sig.	Bound	Bound	order	Partial	Part	Tolerance	VIF
1	(Constant)	-1.531E-17	.050		.000	1.000	098	.098					
	Variety	.096	.050	.096	1.930	.054	002	.194	.096	.096	.096	1.000	1.000
2	(Constant)	-2.137E-17	.049		.000	1.000	097	.097					
	Variety	.098	.050	.098	1.976	.049	.001	.195	.096	.098	.098	1.000	1.000
	RAKCS	.108	.051	.104	2.104	.036	.007	.208	.102	.105	.104	1.000	1.000

Table 6.72 Coefficients of predicting the quality performance by variety and RAKCS

a. Dependent Variable: Quality

Table 6.72 of coefficients illustrates that change in the quality performance of the project by one unit is due to the change in the variety of the project by 9.6% in the first model and 9.8% in the second one in addition to the change in the RAKCS by 10.8% in the second model.

6.33.4 Size predicts the quality performance of the project, and RAKCS is added to the prediction model

Table 6.73 The significance of change in the prediction power of quality performance by adding RAKCS to size

Model R

Change Statistics

				Std. Error						
		R	Adjusted R	of the	R Square	F			Sig. F	
		Square	Square	Estimate	Change	Change	df1	df2	Change	
1	.096ª	.009	.007	.99664133	.009	3.707	1	400	.055	
2	.139 ^b	.019	.014	.99279370	.010	4.106	1	399	.043	
a. Pre	a. Predictors: (Constant), Size									
b. Pre	b. Predictors: (Constant), Size, RAKCS									

c. Dependent Variable: Quality

The model summary in table 6.73 illustrates that the change in the ratio of explanation from zero to .09% is significant at a level of confidence of 90% (Sig. = .055) and that after adding the risk averse knowledge creation style to the model, there is a significant change in the ratio of explanation in the new model at a level of confidence of 95%.

Table 6.74 Analysis of variance of the regression models of predicting the quality performance by size and RAKCS

Mode	el	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.682	1	3.682	3.707	.055 ^b
	Residual	397.318	400	.993		
_	Total	401.000	401			
2	Regression	7.730	2	3.865	3.921	.021°
	Residual	393.270	399	.986		
_	Total	401.000	401			
a. De	pendent Variabl	e: Quality				
b. Predictors: (Constant), Size						

d. Predictors: (Constant), Size, RAKCS

The analysis of variance in table6.74 illustrates the significance of the first model to predict the change in the quality performance of the project and that this model is significant at a level of confidence of 90% (Sig. = .055). It also illustrates that the second model is significant to predict the change in the quality performance of the project at a level of confidence of 95%, and this

means that adding the change in the level of RAKCS to the change in the project size increases the ability to predict the change in the quality performance of the project.

							95.0%						
		Unstandar	dized	Standardized			Confide	nce				Collinearit	у
		Coefficien	ts	Coefficients	-		Interval for B Corre		Correla	Correlations		Statistics	
			Std.				Lower	Upper	Zero-				
Mo	del	В	Error	Beta	t	Sig.	Bound	Bound	order	Partial	Part	Tolerance	VIF
1	(Constant)	-1.399E- 17	.050		.000	1.000	098	.098					
	Size	096	.050	096	- 1.925	.055	194	.002	096	096	- .096	1.000	1.000
2	(Constant)	-2.143E- 17	.050		.000	1.000	097	.097					
	Size	094	.050	094	- 1.890	.059	191	.004	096	094	- .094	1.000	1.000
	RAKCS	.100	.050	.100	2.026	.043	.003	.198	.102	.101	.100	1.000	1.000

Table 6.75 Coefficients of prediction models of quality performance by size and RAKCS

a. Dependent Variable: Quality

The coefficients table 6.75 illustrates that there is negative significant relationship between the project size as an independent variable and the project quality performance as a dependent variable in this model. Adding the RAKCS to the model significantly adds to the ability to predict the change in the quality performance of the project beyond having the size of the project as a determinant of the quality performance of the project. An increase in the size of the project by one unit on the continuous Likert scale of measuring size of the project will lead to a decrease in the quality conformance of the project by 9.4%. At the same time, the change in the creation of new knowledge based on risk-averse assets by one unit leads to an increase in the conformance between the planned quality and the implemented one in the project performance by 10%.

6.33.5 The prediction of the project performance by knowledge creation styles using hierarchical regression

In this section, the researcher attempts to answer the following research questions:

What knowledge creation styles predict the project performance?

What hierarchical relationships between KCSs significantly exist to determinate the change in

the project performance?

The SKCS is a determinant of the quality performance of the project and the IKCS is added to the prediction model

				Std. Error	Change Statistics				
		R	Adjusted R	of the	R Square	F			Sig. F
Model	R	Square	Square	Estimate	Change	Change	df1	df2	Change
1	.084ª	.007	.005	.99773458	.007	2.823	1	400	.094
2	.121 ^b	.015	.010	.99511994	.008	3.105	1	399	.079
a. Pred	a. Predictors: (Constant). SKCS								

Table 6.76 Model summary of the prediction of quality performance by adding the IKCS to the SKCS

b. Predictors: (Constant), SKCS, INNKCS

Table 6.76 illustrates that the change in the ratio of explanation of the change in the quality performance of the project is significantly a change by the specialized knowledge creation style as a predictor at a level of confidence of 90% (Sig. = .094) and that adding the determinant of innovative knowledge creation to predict the change in the quality performance of the project adds a significant change in the ratio of explanation of the change in the quality performance. This change is significant at a level of confidence of 90% (Sig.= .079).

Model		Sum of Squares	df	Mean Square	F	Sig.				
1	Regression	2.810	1	2.810	2.823	.094 ^b				
	Residual	398.190	400	.995						
	Total	401.000	401							
2	Regression	5.885	2	2.942	2.971	.052°				
	Residual	395.115	399	.990						
	Total	401.000	401							
a. Deper	a. Dependent Variable: Quality									
b. Predic	ctors: (Constant), S	SKCS								

Table 6.77 Analysis of variance of the models of predicting quality performance by adding IKCs to SKCS

c. Predictors: (Constant), SKCS, INNKCS

The analysis of variance table no. 6.77 illustrates the significance of the first model with one predictor which is the SKCS and also the significance of the second model after adding a second predictor which is the IKCS. The table above illustrates that both models are significant at a level of confidence of 90% (Sig.= .094, and .052 respectively).

Unstandardized		Standardized			95.0% Confidence					Collinearity			
		Coefficients		Coefficients		Interval for B		Correlat	Correlations		Statistics		
							Lower	Upper	Zero-				
Mod	el	В	Std. Error	Beta	t	Sig.	Bound	Bound	order	Partial	Part	Tolerance	VIF
1	(Constant)	-1.321E-17	.050		.000	1.000	098	.098					
	SKCS	084	.050	084	-1.680	.094	182	.014	084	084	084	1.000	1.000
2	(Constant)	-2.020E-17	.050		.000	1.000	098	.098					
	SKCS	081	.050	081	-1.620	.106	178	.017	084	081	080	.999	1.001
	INNKCS	.088	.050	.088	1.762	.079	010	.185	.091	.088	.088	.999	1.001

Table 6.78 Coefficients of the prediction models of quality performance by adding IKCS to SKCS

a. Dependent Variable: Quality

Table 6.78 illustrates the model of predicting the change in the quality performance of the project by the change in the specialized knowledge creation by the project manager. An increase in the specialized knowledge creation by one unit decreases the level of conformance to quality

performance by 8.4%, and this is statistically accepted at a level of confidence of 90%. After adding the IKCS to the previous model, the negative significant impact of SKCS on the change in the quality performance and at the same time the IKCS has a positive significant impact on the quality performance of the project. In light of the existence of the SKCS impact on the quality performance, an increase in the IKCS of project managers will increase the quality performance of the project by 8.8%. This means that more specialized knowledge creation is not practically impacting closer gap between the planned quality to the implemented one. However, the innovative knowledge creation can practically decrease this gap between the planning and the implementation of quality of the project, and the logic justification of this impact is that the chaotic change during implementation is positively responsive to the change in the innovative creativity of the project manager. Referring back to the specialization will impact the quality performance negatively because it is considered to an extent as contextually written and that the context of each project has its changes and suitable actionability. Knowledge by definition is the contextual actionable information, and this explains the contradiction of effects of SKC and IKC on the quality performance of the project.

6.33.6 The IKCS predicts the quality performance of the project, and the RAKCS is added to the prediction model

					Change Statis	tics				
			Adjusted R	Std. Error of	R Square				Sig. F	
Model	R	R Square	Square	the Estimate	Change	F Change	df1	df2	Change	
1	.091ª	.008	.006	.99713726	.008	3.306	1	400	.070	
2	.137 ^b	.019	.014	.99310393	.010	4.256	1	399	.040	
a. Predi	a. Predictors: (Constant), INNKCS									
b. Pred	b. Predictors: (Constant), INNKCS, RAKCS									

Table 6.79 The model summa	ary of the quality performance	by adding the RAKCS to the IKCS
----------------------------	--------------------------------	---------------------------------

c. Dependent Variable: Quality

ANOV	ANOVA									
Model		Sum of Squares	df	Mean Square	F	Sig.				
1	Regression	3.287	1	3.287	3.306	.070 ^b				
	Residual	397.713	400	.994						
_	Total	401.000	401							
2	Regression	7.484	2	3.742	3.794	.023°				
	Residual	393.516	399	.986						
	Total	401.000	401							
a. Depe	a. Dependent Variable: Quality									

Figure 6.110 Analysis of variance of prediction models of quality performance by adding RAKCS to the IKCS

b. Predictors: (Constant), INNKCS

c. Predictors: (Constant), INNKCS, RAKCS

Table 6.81 Coefficients of regression models of predicting the quality performance by adding RAKCS to IKCS

		Unstandardiz	zed	Standardized			95.0% C	onfidence				Collinearit	у
		Coefficients		Coefficients	-		Interval f	for B	Correla	tions		Statistics	
			Std.				Lower	Upper	Zero-				
М	odel	В	Error	Beta	t	Sig.	Bound	Bound	order	Partial	Part	Tolerance	VIF
1	(Constant)	-2.101E-17	.050		.000	1.000	098	.098					
	INNKCS	.091	.050	.091	1.818	.070	007	.188	.091	.091	.091	1.000	1.000
2	(Constant)	-2.857E-17	.050		.000	1.000	097	.097					
	INNKCS	.090	.050	.090	1.822	.069	007	.188	.091	.091	.090	1.000	1.000
	RAKCS	.102	.050	.102	2.063	.040	.005	.200	.102	.103	.102	1.000	1.000

a. Dependent Variable: Quality

The following section addresses the following question:

How do KCSs impact the relationship between complexity and performance?

6.33.7 Sequence of significant impacts among KCSs in the relationship between project complexity and project performance using SEM



Figure 6.111 Sequence of significant impacts among KCSs in the relationship between project complexity and project performance using SEM

The SEM model in figure 6.111 illustrates a sequence of significant relationships of knowledge creation style of project managers when dealing with the impact of complexity on the project performance. The Chi square of the model = 576.491 at degrees of freedom of 562 and its probability level = .327 which means it is insignificant. The indicators of goodness of fit are illustrated in table 6.82:

 Table 6.82 Model fit indicators of Sequence of significant impacts among KCSs in the relationship between project

 complexity and project performance using SEM

RMR	GFI	AGFI	NFI	TLI	CFI	RMSEA
.039	.927	.914	.963	.999	.999	.008

The indictors in table 6.82 show the goodness of fit and that this model is significant for prediction.

The following significant regression weights are estimated by this model:

			Estimate	S.E.	C.R.	Р
RAKCS	<	Complexity	.074	.037	1.998	.046
EKCS	<	RAKCS	073	.029	-2.522	.012
IKCS	<	EKCS	.195	.117	1.670	.095
performance	<	RAKCS	.184	.086	2.145	.032
performance	<	IKCS	.140	.082	1.718	.086
performance	<	Complexity	028	.058	487	.626

Table 6.83 Regression weights of Sequence of significant impacts among KCSs in the relationship between project complexity and project performance using SEM

The model in table 6.83 illustrates that the relationship between the main variables in the study which are the complexity and the performance of the project in this sample is negative but is not strong enough to be significant. After adding the impacts of the knowledge creation styles to the model, it was found that the complexity is significantly and positively affecting the risk averse knowledge creation, so the more complex is the project, the more is the tendency to use the knowledge creation behaviour by the project manager. Then, when the risk averse knowledge creation increases, it significantly increases the experiential knowledge creation by the project manager. Therefore, more experiential assets are then used after taking precautional assets into consideration to build new knowledge. After that, the increase in the use of experiential knowledge creation will increase the use of the innovative knowledge creation (at a level of confidence of 90% because Sig. = .095), which means more use of experiential assets opens the door for the increase in the use of innovative knowledge creation assets. The riskaverse in this model is an important mediator between the project complexity and the project performance because the increase in the use of risk-averse knowledge creation assets increases the conformance between the planned performance and the actual one by the project manager. At the same time, the use of innovative knowledge creation assets has a positive impact on the project performance (significantly accepted at a level of confidence of 90% because Sig. = .086), which means that the increase in the use of innovative knowledge creation assets increases the

ability to close the gap between the planned performance and the actual one and to minimize the deviation in the performance control reports of the project, which may be referring to the ability of the innovative knowledge creator to respond faster to the chaotic changes in the context of each project. This model illustrates an explanation of a mechanism of using knowledge creation styles and the possible interactions and impacts of each style on other ones in a project management team and is an area for further future research.

The significant sequence of KCSs relationships between the main independent and the dependent variables in this study is illustrated in the following diagram:



Figure 6.112 The significant sequence of KCSs relationships between the main independent and the dependent variables

At this point of analysis, another question arises about the exclusion of the SKCS from this sequence and where it has the impact in this sequence.

The researcher referred to the findings of Berkley about the increase in the specialization and diversity of certification and how it increases the complexity of the project and expected an impact on the complexity of the project by the SKCS. This expectation is valid and has a statistical evidence as shown in the SEM model in figure 6.72:



Figure 6.113 Figure 6.72 SEM showing that the significant impact of SKCS on RAKCS is fully mediated by interdependency

Figure 6.113 indicates the statistics of the goodness of fit of the model. The following table indicates the estimated regression weights of the model relationships and its significance:

Table 6.84 weights of SEM of sequence of impacts of SKCS on Interdependency on RAKCS on project performance

			Estimate	S.E.	C.R.	Р
Interdependency	<	SKCS	.115	.061	1.882	.060
RAKCS	<	Interdependency	.081	.036	2.272	.023
performance	<	RKCS	.221	.093	2.386	.017

The model in table 6.84 illustrates that the SKCS has a significant positive impact on the interdependency as one of the sub-constructs of complexity at a level of confidence of 90% (Sig.= 0.06) Therefore, the more creation of specialized knowledge- especially if accompanied with diversification according to Berkley- the more is the complexity of interdependency in the project. Then, the interdependency impacts the RAKCS at a level of confidence of 95% (Sig. = .023), and finally the RAKCS impacts the project performance at a level of confidence of 95% (Sig. = 0.017). Hence, the more use of risk averse knowledge creation, the more is the conformance in the project performance, the more is the complexity of the project, the more is

the use of the risk averse knowledge creation behaviour, and the more is the use of specialized knowledge behaviours higher in the dependency in the project.

6.34 Chapter summary

The quantitative study is designed to answer few research questions by testing few research hypotheses. Table 6.85 links the research questions to the testing results of the hypotheses in this chapter:

#	Research question	Hypothesis (s)	Results of hypotheses testing	Answer of the research question
1	Which knowledge creation styles mediate the relationship between the project complexity and the project performance?	H1: Complexity has a significant impact on performance H2: complexity has significant impact on RAKCS H3: RAKCS has a significant impact on performance	H1: rejected H2: accepted H3: accepted	RAKCS fully mediates the relationship between complexity and performance
2	Which knowledge creation styles moderate the relationship between the project complexity and the project performance?	H4: IKCS has a significant impact on performance H5: interaction between IKCS and complexity has a significant impact on performance	H4: accepted H5: accepted	IKCS moderates the relationship between complexity and performance
3	Which knowledge creation styles moderate the relationships between the complexity sub- constructs and the performance sub- constructs?	 H6: As the value of the IKCS increases the relationship between the interdependency and the productivity increases. H7: As the value of the IKCS increases the relationship between the environmental complexity and the cost performance increases. H8: As the value of the IKCS increases the relationship between the 	H6: accepted H7: accepted H8: accepted H9: accepted H10: accepted H11: accepted H12: accepted H13: accepted H14: accepted H15: accepted H16: accepted H17: accepted H18: accepted H19: accepted H19: accepted H20: accepted	IKCS moderates the relationship between interdependency and productivity. IKCS moderates the relationship between environmental complexity and cost performance. IKCS moderates the relationship between environmental complexity and time performance EKCS moderates the relationship between environmental complexity and cost

Table 6.85 Summary of results of the quantitative study

environmental	EKCS moderates the
complexity and the	relationship between
time performance	variety and quality
increases.	performance
H9: As the value of	EKCS moderates the
the EKCS increases	relationship between
the relationship	size and quality
between	performance
environmental	EKCS moderates the
complexity and cost	relationship between
performance	interdependency and
increases.	productivity
H10: As the value of	RAKCS moderates
the EKCS increase the	the relationship
relationship between	between
project variety and	interdependency and
quality performance	quality performance
decreases.	SKCS moderates the
H11: As the value of	relationship between
the EKCS increases	variety and time
the relationship	performance
between the project	SKCS moderates the
size and the quality	relationship between
performance	environmental
increases.	complexity and time
H12: As the value of	EKCS(1) moderates
the RAKCS increases	the relationship
the relationship	between variety and
between	quality performance
interdependency and	EKCS (1) moderates
quality performance	the relationship
increases.	between size and
H13: As the value of	quality performance
the SKCS increases	EKCS (1) moderates
the relationship	the relationship
between the size of	between size and time
the project and the	performance
cost performance	EKCS (1) moderates
decreases	the relationship
H14: As the value of	between
the SKCS increases	interdependency and
the relationship	quality performance
between project	EKUS (2) moderates
variety and time	the relationship
performance	between size and
decreases.	productivity.
the SVCS increases	
the relationship	
hetween	
opvironmontal	
complexity and time	
complexity and time	
H16. As the value of	
the EKCS (1)	
increases the	
relationship between	
variety and quality	
variory and quanty	

r		<u> </u>		
		performance		
		decreases		
		H17: As the value of		
		the EKCS (1)		
		increases the		
		relationship between		
		size and quality		
		performance increases		
		H18: As the value of		
		the FKCS (1)		
		increases the		
		relationship between		
		project size and time		
		performance		
		decreases.		
		H19: As the value of		
		the EKCS (1)		
		increases the		
		relationship between		
		interdependency and		
		quality performance		
		decreases.		
		H20: As the value of		
		the EKCS (2)		
		increases the		
		relationship between		
		project size and		
		project productivity		
		project productivity		
		dooroosos		
4	X 71, 1, 1,, 1, 1,	decreases.	1101	
4	Which knowledge	H21: Interdependency	H21: accepted	RAKCS fully
4	Which knowledge creation styles	decreases. H21: Interdependency has indirect effect on	H21: accepted H22: accepted	RAKCS fully mediates the
4	Which knowledge creation styles mediate the	H21: Interdependency has indirect effect on quality performance	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between
4	Which knowledge creation styles mediate the relationships	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS.	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency
4	Which knowledge creation styles mediate the relationships between the	H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality
4	Which knowledge creation styles mediate the relationships between the complexity sub-	H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the	H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub-	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and
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4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS which in	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn leasened the cost	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn lessened the cost	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
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4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn lessened the cost performance of the project.	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn lessened the cost performance of the project. H23: The	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn lessened the cost performance of the project. H23: The interdependency has	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn lessened the cost performance of the project. H23: The interdependency has indirect effect on	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn lessened the cost performance of the project. H23: The interdependency has indirect effect on quality performance	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn lessened the cost performance of the project. H23: The interdependency has indirect effect on quality performance through the SKCS.	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance
4	Which knowledge creation styles mediate the relationships between the complexity sub- constructs and the performance sub- constructs?	decreases. H21: Interdependency has indirect effect on quality performance through the RAKCS. That is the increase in interdependency leads to increase in the RAKCS which in turn leads to heightened quality performance H22: Interdependency has indirect effect on cost performance through RAKCS. That is the increase in the level of interdependency leads to increase in the RAKCS, which in turn lessened the cost performance of the project. H23: The interdependency has indirect effect on quality performance through the SKCS. That is the increase in	H21: accepted H22: accepted H23: accepted	RAKCS fully mediates the relationship between the interdependency and the quality performance RAKCS fully mediates the relationship between the interdependency and the cost performance SKCS fully mediates the relationship between the interdependency and the quality performance

		interdependency leads to increase in the SKCS which in turn lessened the quality performance of the project.		
5	What independent factors predict what dependent factors of the study?	 H24: Quality performance is significantly affected by the size and variety of the project H25: Quality performance is significantly predicted by the variety of the project H26: Quality performance is significantly predicted by the size complexity of the project. 	H24: accepted H25: accepted H26: accepted	Size and variety predict the change in the quality performance Variety predicts the change in the quality performance Size predicts the change in the quality performance
6	Does the prediction power significantly change after adding the knowledge creation style variables to the prediction model?	H27: Adding change in the RAKCS to the change in the variety of the project to predict the change in the quality performance increases the ratio of explanation of the model significantly H28: Adding the change in the RAKCS to the change in the size complexity of the project to predict the quality performance of the project	H27: accepted H28: accepted H29: accepted	Adding RAKCS significantly increases the prediction power of the variety to predict quality performance Adding RAKCS significantly increases the prediction power of the size to predict quality performance Adding EKCS significantly increases the prediction power of the variety and size

		increases the ratio of the explanation of the model significantly H29: Adding the change in the SKCS to the change in both the variety and the size of the project to predict the change in the quality performance of the project increases the ratio of explanation of the model significantly		to predict quality performance
7	What knowledge creation styles predict the project performance?	H30: SKCS significantly predicts the change in the quality performance of the project H31: IKCS significantly predicts the change in the quality performance	H30: accepted H31: accepted	SKCS significantly predicts the quality performance IKCS significantly predicts the quality performance
8	What hierarchical relationships between KCSs significantly exist to determine the change in the project performance?	H32: Adding the change in the level of IKCS to the change in the level of SKCS to predict the change in the quality performance significantly increases the ratio of explanation of the prediction model H33: Adding the change in the level RAKCS to the change in the level of IKCS to predict the quality performance significantly increases the ratio of explanation of the predict of the prediction model	H32: accepted H33: accepted	Adding IKCS significantly increases the prediction power of SKCS to predict quality performance Adding RAKCS significantly increases the prediction power of IKCS to predict the change in quality performance
9	How do KCSs impact the relationship between complexity and performance?	H34: The increase in the value of complexity leads to increase in the value of RAKCS H35: The increase in the value of RAKCS leads to a decrease in the value of EKCS. H36: The increase in the value of EKCS leads to an increase in the value of IKCS.	H34: accepted H35: accepted H36: accepted H37: accepted	Change in project complexity leads to change in the RAKCS which in turn leads to change in EKCS which in turn leads to change in IKCS, which in turn leads to change in project performance

H37: an ii	ncrease in	
the value	of IKCS	
leads to an	n increase in	
the value	of project	
performar	nce	

Source: Created by the researcher from hypotheses testing results of the quantitative analysis chapter.

Chapter Seven: Discussion

7.1 The Gap in the Literature

Instability is characterized by inconvenience and lack of time, whereas stability is relatively more convenient and is characterized by relative availability of time (Biscaro & Comacchio, 2018). This is supported by the association that was found in the literature between performance and knowledge creation. As long as there is not regularity in performance over time, then there may not be one way of creating knowledge. In other words, regularity of performance is not stable over time. This means that systemization of knowledge creation cannot always lead to regular performance and performance success. This contradicts the findings of (Floricel, 2016) who developed different knowledge production strategies to deal with complexity of projects. A strategy is a plan that has an amount of calculated flexibility to respond to performance instability (Khattak & Mustafa, 2019); however, managers who implement the same strategy have different results of performance stability (Gasik, 2011). This may or may not happen because of the knowledge created by each manager to control the level of performance success as it will be discussed in the current study (Mba & Agumba, 2018).

(Arumugam et al., 2013) claimed that uncertainty of performance that is defined as the situation in which the probability of events is unknown is determined by uncertainty, complexity and dynamism, and it is perceived by managers. This point of view mixes between knowledge certainty and complexity; however, there may be two independent variables that affect each other.

(Yee et al., 2020) found that there are mainly five measurements of performance, namely flexibility, reliability, quality, speed, and cost. In the current study, the focus is on the stability of controlling deviations and achieving performance success by measuring conformance

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between the actual performance and the planned one. Conformance in time, cost, quality, is consistent with the findings of Yee (2020).

In addition, to these findings, this study measures the conformance in productivity as an important indicator besides the previous three ones. There is an argument related to flexibility as an indicator of performance. The degree of coping with the planned performance and conformance to it indicates flexibility of the plan compared to the actual performance of the project. The deviation may be positive or negative, and there are many changes occur as found in the qualitative study, and these changes may lead to deviations (L. D. Nguyen et al., 2019).

Companies and projects are mainly guided by financial performance measures such as cost and productivity (Watanabe R., 2017), and this adds to the significance of measuring a fourth construct of project performance which is productivity (Larsen et al., 2018).

In other research (Rahman & Adnan, 2020), higher level of strategic measurements such as benchmarking are added to reveal the effect of knowledge creation on competitiveness, but in the current study the focus shifts to the functional operational performance and at the stages of the project life cycle that occur before the final submission to the end user and its final consequences (Makui et al., 2018). This current study considers that the knowledge creation style of the managers affects the project performance success in terms of cost, time, productivity, and quality (Biscaro & Comacchio, 2018). This will lead to the measurement of benchmarking afterwards as a suggestion for further research in the future. The current study then uses mixed measurement of the project performance between financial measures and nonfinancial ones. The cost is relatively one of the financial measurements of the project performance (Dixit & Saurabh, 2019).

What is the role of the style of knowledge creation in conformance in the project performance? The answer to this question requires more research. The rapid changing environment gives

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higher value to the information and the knowledge creation from this information (Hussain, 2004). The proposition is that the manager who created knowledge for chaotic performance behaves differently from the manager who creates knowledge for ordinary one. The nature of a strategy is that it relatively contains stable components than unstable ones for a period of time that is commonly not less than a year (Reeves, 2011, July-August). This gives higher importance to the style of the manager in responding to changes with and after rapid and continuous knowledge creation behaviours. This proposed association between the behaviour of the manager and the situation of project performance may lead to a new theory that tells about the style of behaviour that is disposed to bringing instability to stability in the project performance (Alaloul et al., 2016).

The literature also uncovers the limitation on the classification of the cognitive behavioural activities into two types only; the analytical behaviour and the intuitive one. In fact, this research revealed that there are significant classifications of project managers according to their cognitive behavioural styles and this classification is a better solution to the problem of classifying the implicit knowledge creation cognitive activity that is still ambiguous in the previous research results.

7.2 Knowledge Creation Dynamics and Reflection on the Aim of the Study

The use of knowledge assets as an input to the process of project implementation is subject for improved output assets (Adzmi & Hassan, 2018). This means that the sources of building new knowledge that is specialized, for example, can produce better level of specialized assets to be used in the future in other projects to create new contextual and actionable knowledge (Khattak & Mustafa, 2019). Each project has its own environment and contextual dynamics and changes,

and the actionable knowledge needed for each project is like a fingerprint and can lead to a continuous creation of new knowledge (Larsen et al., 2018).

The whole point of the research is to reach the conformance in the project performance. The researcher aims to describe the project that has a higher ability to conform to the planned performance. The conformance idea itself belongs to Quality, and this explains strong mediation of RA with Quality performance.

Project complexity is a contextual factor that impacts the functioning of project management as (Vidal L., 2008) (Vidal, 2011) emphasises when talking about the measurement of complexity. The need for measuring complexity vis-à-vis the system components, project size complexities, and variety of operational functions is increasing, especially after getting into the knowledge era and big data analysis. Project managers are affected by and are affecting the level of project complexity. The interrelationship between the project complexity and the project manager's behaviour is still in need of further research. If the relationship between the project complexity and the project manager's behaviour is studied analytically, it may lead to better performance results of projects. What leads to better and more stable project performance? Is it the specialization in project management? Is it the innovative behaviours of project managers? Is it the avoidance of risks as much as possible? Is it the dependency on previous cumulative experiences? Is it a mix of all these factors combined? The answers to these questions are the scope of the current research. The importance of answering this question is relatively increasing in the light of competition and seeking the maximization of profits in rapidly changing market environments. Change is opposing stability, and the environment is continuously and rapidly changing and is full of dynamics. The stability of the conformance in the project performance represents a challenge for the project manager all the time. To achieve this stability of performance, the project managers behave differently. They do not use the same knowledge

creation process to overcome this challenge. This explains the variation in the performance stability from project manager to another. The relationship between project teams' behaviours and knowledge creation is increasingly important in latest research (Oluikpe, 2015).

7.3 Comparing Moderation between Complexity and Project Performance with the Literature

The following table shows a comparison between Floricel framework of testing moderation relationships (2016) and the current research framework of testing moderation relationships between project complexity and project performance:

(Floricel, 2016)	Current study (2020)
Efficacy of Planning strategies moderate the relationship between project complexity and project performance	Knowledge creation styles moderate the relationship between the project complexity and the project performance
Focus is on planning stage	Focus on implementation control stage
Dependent variables: project completion – project innovation – project operation and project value	Dependent variables: project cost control – project time control – project productivity control – project quality control
Moderating the effect of project complexity on the project performance by knowledge	Moderating the effect of project complexity on the project performance by knowledge
Stage of the dependent variables is the customer delivery stage.	Stage of the dependent variable is the performance control stage (comparison between planned and implemented). Complexity and control are concurrent variables.
The moderators build capabilities to developing and applying preventive measures and corrective actions to keep projects on track – however focus on control process is not highlighted	More focus on keeping performance on track by measuring performance conformance to the plan (control)
The capabilities of control are built by putting into place knowledge production processes and contractual organisations	Focus is only on the knowledge creation styles of project managers
Efficacy planning strategies help improve the project performance only if they match a particular complexity affecting the project performance. Assume complexity has negative effect on performance	Assume complexity may or may not have a significant effect on the project performance control. But high or low moderation variable's effect may change the significance of this relationship.

Measuring project complexity based on generic	Measuring complexity based on Vidal (2011) measurement
abstraction, and practical classifications of	with testing in the domain results.
specifics in domain.	

Source: Created by the researcher using the results of current study and a previous one *Figure 7.1 Comparison between Floricel's study of project performance (2016) and the current study (2020)*

7.4 Discussion of the Results of Hypotheses Testing and Reflection on Previous Research

The aim of the study is to measure the knowledge creation styles of the project managers and the moderation and/or mediation impacts they have on the relationship between the project complexity and the project performance. To achieve the aim of the study, the quantitative study starts with the steps of creating the measurement of the research constructs and sub-constructs. Evidence on the probability of the existence of four styles is collected from previous research, then items of the measurement are adapted from the evidence and the findings of the qualitative study and then tested for its validity by the judgement of experts and in pilot studies, and then statistically tested for its reliability to measure the targeted concepts of the conceptual framework of the study. After, the completion of the EFA sub-constructs were titled and correlation matrix between the new constructs was created. Descriptive statistics of the sample adds to the clarification of the characteristics of these constructs. Deviations were tested by one sample T-test to prove the need to test the hypothesized relationships, and then cluster analysis adds to the validity of the constructs built by the EFA. SEM for testing direct and indirect relationships between project complexity and project performance were conducted and validated by another two statistical methods: Regression and Hayes Process regression.

7.5 The Relationship between Project Complexity and Project Performance

The impact of the project complexity on the project performance in the current study is negative but not strong enough to become significantly accepted at the level of confidence of 95%. When comparing this result with the previous studies measuring the impact of the project complexity on the project performance, the researcher finds the following:

Study	Title	Relationship	Conclusion
(Antoniadis, 2011)	Socio-organo complexity and project performance	Complexity during the PLC in the construction sector and the project performance in constructions sector	Negative significant relationship
(Floricel, 2016)	Complexity, uncertainty- reduction strategies, and project performance	Structural and dynamic complexity and project performance	Negative direct relationship between project complexity and project performance (moderated by knowledge creation)
(Luo, He, Xie, Yang, & Wu, 2017)	Investigating the Relationship between Project Complexity and Success in Complex Construction Projects	Project complexity and project success in constructions sector (SEM analysis)	Organisational complexity has positive relationship with project success however, environmental complexity has negative relationship with project success
(Nguyen, 2019)	Effect of project complexity on cost and schedule performance in transportation projects	Relationship between project complexity and project performance using hierarchical regression analysis in transportation sector	Project complexity has a significant impact on the schedule growth, but has no significant impact on the cost growth of the project performance (resources allocation is a moderator)
(Miterev, 2012)	The Nature of the Relationship between Project	Qualitative study on the relationship between project complexity and	There is positive qualitative logical generalized relationship

Table 7.2 Comparing the measurement of project performance to the previous studies in the literature

(Complexity and	time delays of projects	between project
F	Project Delay: Case	ERP projects –	complexity and time
s	study of ERP	qualitative critical case	delays and project failure
s	system	structure study	in ERP projects
i	implementation		
p	projects		

Source: Adapted from previous studies by the researcher.

The results of the analysis of the relationship between the project complexity and the project performance in the literature shows the following indicators:

- Most of the results provide evidence on negative relationships between project complexity and project performance; however, on the level of subconstructs, there is some evidence on the existence of positive relationship between project complexity and project performance. This is similar, for example, to the positive relationship between the organisational complexity and the project success. The current research has the same negative relationship between the main constructs but not statistically strong enough to become significant. Most of the previous research using the SEM analysis and even regression ones indicated that the impacts of the project complexity on the project performance are not relatively high but sometimes ranging between significant and non-significant. The current research objectively value both the significant and non-significant relationships between complexity and performance of projects.

- The analysis is on the level of project complexity and project performance, and in other research, it is on the levels of sub-constructs under project complexity and project performance. This is exactly what was conducted in the current research.

Previous research focused on one sector only in the study of the relationship between complexity and performance whether on the main level or on the sub-construct level. In the current study, there are many sectors in the sample, and the focus in on one region not one sector and is to be followed by more in-depth investigations on the level of each sector and this may

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justify the insignificant impact of project complexity in the current study on the project performance due to the diversifications of sectors which means that the impact of complexity on performance may be significant in one sector and non-significant in another. This is illustrated in the area of suggestions for further research in the conclusion chapter of the current study.

Most of the previous studies on the relationship between complexity and performance of projects are generalized ones and have used SEM, hierarchical regression, correlation, regression, EFA, or Hayes Process (2013) and these are the same statistical methods used in the current study with additional construct validity of qualitative study by collecting primary data using other tools like the surveys, in addition to the interviews and using the critical case study approach to be able again to generalize the results of the qualitative study as conducted by (Miterev, 2012).



Source: Adapted from (Luo, He, Xie, Yang, & Wu, 2017) to indicate the positive and relatively weak relationship between the organisational complexity and project success.

Figure 7.2 The impact of complexity on performance in the literature



Source: Adapted from (Luo, He, Xie, Yang, & Wu, 2017) to indicate the negative and relatively weak relationship between environmental complexity and project success.

Figure 7.3 Figure 7.2 The Impact of environmental complexity on performance in the literature

7.6 Discussing Mediation of the Relationship between Project Complexity and Project Performance

There is one mediator found and is statistically accepted on the level of the main relationship between the project complexity and the project performance. This mediator is the RAKCS. The risk averse knowledge creation style of project managers is increasingly required to create actionable knowledge for the high complexity contexts of projects. When this risk averse knowledge is created, it is in turn leading to higher levels of conformance between the planned performance and the actual one. It is important to note that this mediation of the RAKS holds significant between the main independent and dependent variables of the study even after adding the impacts of the other knowledge creation styles to the prediction model. This means that when there is a need to form a team of project managers to work on a project, it is important to start to benefit from a risk averse style in the team and ask other members from other styles to start creating their knowledge in light of his or her contribution to the performance stability not before that because the RAKCS is relatively and significantly contributing to the success of the knowledge creation impacts of other styles in the team as well on the conformance and success of project performance. On the level of sub-constructs relationships, there are two knowledge creation styles that are significantly mediating the relationship between sub-constructs of project complexity and sub-constructs of project performance. The risk averse is a significant mediator of the relationship between the project interdependency and the project quality performance. Also, RAKCS is a mediator of the relationship between the project interdependency and the project interdependency and the cost performance of the project. The SKCS performs similar mediation role like RAKCS in the relationship between the project interdependency and the quality performance of the project. It is relatively important to notice that the type of mediation impact on both the main constructs level and the sub-constructs one is a full mediation. This is compatible with the justification of the existence of weak correlation in specific sectors in the previous studies between complexity and performance, the contradiction in the direction of this relationship on the level of sub-constructs of complexity and performance in the previous studies, and the existence of non-significant impacts of complexity sub-constructs and project performance in the previous studies (Hartono, Wijaya, et al., 2019).

Risk-averse is found to be considered as a cultural approach or a management policy in previous studies; however, the current study contributes to the body of knowledge by the classification of project managers into styles of behaviours of creating new actionable and contextual knowledge as mediators and/or moderators of the impact of project complexity on project performance. That is why the inductive approach is used in creating the measurement of the knowledge creation style but with reference to close results in the literature (Girardi et al., 2018). It is obvious that the use of a team of RAKCS and SKCS will significantly mediate the impact of interdependency on the quality performance of the project and this is compatible and validated by another statistical result in the current study that reveals that the diversification of specializations increases and directly impacts the interdependency of the project and increases

the need for the risk averse knowledge creation to have better conformance in the project performance. Another further research about the potential positive interaction between RAKCS and SKCS is needed to add to the body of knowledge in this area. The RAKCS mediates the impact of the interdependency on the conformance to the cost performance of the project, and this means that there is a risk caused by the increase of the dependency of the current project on other departments and projects in the organisation by using similar resources or having overlapped schedules of implementation or dealing with the same vendors. If this happens, the need to create risk averse increases to have better control over the cost of the project. Otherwise, the delays of implementation may cause deviations in cost of implementation. This is compatible and validated by the findings of the qualitative study of the present research.

7.7 Discussing Moderation of the Relationship between Project Complexity and Project Performance

The steps of analysing the moderation relationships are conducted at the main level of the relationship between complexity and project performance and revealed that IKCs moderates the impact of the project complexity on the project performance. Moderation impact of KCSs is also analysed at the level of sub-constructs of project complexity and project performance and revealed that the relationship between increasing the interdependency of the project and increasing its productivity is achieved through increasing the innovative knowledge creation in the project by the project manager. This means that the manager, by using the innovative out of the box sources and assets of knowledge that are mainly coming from extrinsic sources related to the customers and to the competition in the market for the purpose of trying new solutions and getting better results faster and easier, is interacting with the increase of the project

interdependency but leads to higher level of conformance to the productivity indicators of the project.

The results also reveal that when there is increase in the level of environmental complexity of the project, there is a need to create innovative actionable contextual knowledge by the project manager to increase the conformance to the cost performance and time performance of the project. The interaction is clear in this result between the innovative knowledge creation and the contextual and environmental complexity of the project that cannot be dealt with by avoiding risks only, for example. Furthermore, this interaction between the innovative knowledge creation and the environmental and system complexity can be done in the light of the mediation impact of risk-averse knowledge creation, and this is compatible with the results of Harvard business review research done by (Shafieezadeh et al., 2020) about going too risk averse and how this impacts the growth and success of companies. EKCS is similar to the IKCS in moderating the impact of environmental complexity on cost performance of the project. This means that the increase in the environmental complexity of the project interacts with the experiential assets of knowledge that the project managers depend on to create new actionable contextual knowledge. The previous experience and history of success of similar or semi-similar projects is a tool for moderating the impact of environmental complexity on the conformance between planned costs and implemented ones. This indicates the possibility of conducting further research on the positive interaction between the IKCS and the EKCS in the project management team to improve the performance results and success of the project. This is also compatible with the results of other hypotheses about the sequence of impacts of KCSs in the quantitative research of the current study. In the current study, there is a sequence of influences of RAKCS on EKCS on IKCS between the project complexity and the project performance and this validates the results of the moderation impacts of these three styles in this study. This

validation of sequence of relationships for these three styles opens the door for further research about the interaction among the three style and cooperation to create collaborative new knowledge to improve the project performance in projects that are managed by teams rather than individual managers. The scope of the current study is on the study of the individual style of the project manager based on the individual behavioural choices rather than the team behavioural choices. In addition to the EKCS's of moderating the environmental complexity impact on cost performance, it is interacting with the variety of the system of the project and its conformance to the planned quality.

Less variety in the system requires higher level of experiential knowledge creation behaviour to take the suitable actions to increase the conformance to the planned quality of the project. Weaker relationship between the system variety and quality performance of the project exists when there is significant increase in the level of experiential knowledge creation actions by the project manager.

EKCS significantly interacts with the size of the project too. The larger the project, the more need for experiential knowledge creation assets and actionable contextual based behaviours to increase conformance to the planned quality.

Experience of the project manager is looked at in the literature as a demographic variable of the project manager or as a component of the project management, and it interacts with the project complexity as found by (Dias, Performance and Leadership Style: When Do Leaders and Followers Disagree?, 2017), however, in the current study, it is an asset for creating a type of new contextual tailored knowledge for the current project by the project manager depending on experiential assets. This also applies to the thinking of the innovative sources of new knowledge. Innovation in the literature varies between a component of project performance and is determined by the project complexity as found in the study of (Floricel, 2016).

In the International Journal of Innovation, Management, and Technology, (Lebcir, 2011) found that the project complexity is dynamically affecting the cycle time to innovate a new process that needs a trial for the first time and requires rework until it reaches stability and acceptance. This indicates that there is a process of creating innovative knowledge that requires time and can positively impact the conformance to planned time and that innovation is not always an outcome variable but a processing one as well and highlights the needs for innovative assets to create this actionable knowledge by project managers. RAKCS is a mediator and could represent a moderator in the relationship between interdependency and quality performance of the project if it acts alone as a project management style (C. Wang et al., 2021). It is interacting with the level of interdependency and changing the strength of the relationship between the project interdependency and the quality performance, and this gives this style relatively special importance to start with it at the beginning of the project phases of planning and implementation. The same applies to the interpretation of the results related to the EKCS, but in addition to this moderation impact, the current study goes with splitting the EKCS into two sub-constructs based on the assets from which the project manager builds the new knowledge. The first one is based on the self-experience assets of the project manager, and the second one is built on the experience assets found from communicating and cooperating with other members in the team. This is compatible with the findings of the previous studies about the importance of cooperation and communication and their significant impacts on project performance and interaction with the project complexity. Experiential knowledge has two resources: one is created by learning from others' experiences (Arumugam, 2013) (Brix J., 2017) (Forés, 2016) and another one is created by using self-experiential assets (Camelo-Ordaz, The influence of human resource management on knowledge sharing and innovation in Spain: the mediating role of affective commitment., 2011) (Badewi, 2016) (Grantcharov, 2003) (Haleblian, 2006). It is evidenced in the current study that the experiential assets built from the learning of others' experiences is relatively more important and has more significant impacts on relationships between subconstructs of complexity and project performance, compared to the self-experiential assets. EKCS that depends on others' experience is significantly moderating the impact of project variety and size, and interdependency on project quality performance as well as the impact of project size on time conformance. Experience learned from others creates actionable contextual knowledge to have more control over the quality and the time of planning and implementation by interacting with different levels of sizes and system varieties as well as levels of interdependencies of the project on other projects, and this gives special importance to the further study of team dynamics and group learning and their impacts on the knowledge creation and project performance in future research.

The dependency on self-experiential sources and assets of the project manager is significantly creating new knowledge tailored to the project at hand to interact with the change in the project size and the project level of conformance to the planned productivity. Experienced project managers are more apt to control the level of productivity of larger sized projects in this research.

As for the SKCS, they believe in the certification and the body of theoretical knowledge as an important asset from which they can create new knowledge (De Carvalho, 2015). They also believe that diversification of specializations helps them to deal with chaotic changes and new situations for the purpose of achieving the conformance goals for their projects' performances (Mosavi, 2012) (Thomas, 2008) (Bonaccorsi, 2007) (Austin, 2003). In the current study, when the level of the knowledge creation from specialized sources increases in the project, the negative impact of project size in conformance to cost and the negative impact of the project variety on the conformance to time decreases significantly. Larger-sized projects may cause

deviations between the planned costs and the actual ones and more system variety among the system components of the project may cause deviations between the planned time and the actual one. The creation of actionable contextual knowledge from the library resources and certification contents enables the project manager to have higher level of control over these kinds of deviations. Not only that but also the deviations between planned time and actual one that is caused by the higher levels of environmental complexity in the projects are affected by the significant moderation impact of the SKCS on this relationship and gives the manager higher control over it. There is consistency between the findings of the current study about the dependency on certification to create new knowledge and the findings of (Bereiter, 2014) who believed that more certification may lead to better levels of innovative solutions to situational problems, and deviations are a type of problems that may be affected by the specialization of the project manager.

7.8 Discussing Prediction of Change in the Project Performance

To be able to predict the change in the project performance, the researcher used the project complexity constructs analysis of direct impacts, the significant change in the prediction power of complexity constructs by adding knowledge creation styles' impacts, and direct impacts of knowledge creation styles. The aim was to determine and predict the change in the project performance and the sequential prediction of the knowledge creation styles of the change in the project performance.

7.8.1 Direct impacts between independent and dependent variables
There is statistical evidence in the current study as well as in the literature about the direct relationships between the independent variable (complexity) and the dependent one (project performance). In the current study, the size and variety of the project directly predicts the change in the level of conformance to the quality of the project. There is a significant prediction power of these two sub-constructs of structural complexity on the deviation in the quality performance of the project; however, it is not a relatively high prediction power but significant though. This is consistent with the findings of other previous research in the literature. The following table compares between the direct impact coefficients of types of complexities in the previous research and in the current study:

Table 7.3 Comparing direct impacts of complexity on project performance in the literature to the current study

Direct impacts and coefficients of SEM	Direct impacts and coefficients of SEM
(from: (Luo, He, Xie, Yang, & Wu, 2017)) Investigating the	(from the current study 2020)
Relationship between Project Complexity and Success in Complex	Project complexity, knowledge creation
Construction Projects - impacts on performance success (impacts on	styles, and project performance (impacts
time-cost-quality-H&S- Environmental performance – participant	on project performance time-cost-quality-
satisfaction – user satisfaction – commercial value)	productivity)
Direct impact of information complexity31	Direct impact of size complexity on
	quality performance 006
Direct impact of task complexity .11	quality performance090
Direct impact of technological complexity01	
Direct impact of organizational complexity .10	Direct impact of variety complexity on
	productivity performance .083
Direct impact of environmental complexity11	Direct impact of variety complexity on
	time performance083
Direct impact of goal complexity23	Direct impact of variety complexity on
	time performance .096

Source: Created by the researcher to compare between the positive and negative direct significant impacts of complexity constructs.

The table above reveals that there is a similarity between the current research and the previous studies in diversification of directions of direct impacts of complexity constructs on the project performance constructs. The difference between the current study and the previous one is that the current study analysed the direct impacts of sub-constructs of complexity on sub-constructs of performance not the main construct of performance only because the current study is not

focused on one sector. Rather, it focuses on the MENA region which exerts variations on the level of sub-constructs that deserve interpretation. Some of the direct impacts are positive and others are negative but, in both directions, they are relatively representing weak but significant impacts, and this is consistent with the previous study in the literature as illustrated in the table above.

7.8.2 Increasing the prediction power of the project performance

The current study uncovers significant changes in the prediction powers of direct determinants of the project performance by adding the knowledge creation styles to the prediction models. This is an indicator on the higher ability to control the project performance after considering the impact of the change in the knowledge creation style of the project manager in performance success. This RKCS and the EKCS add a significant change in the prediction power of the impact of the change in the project size and the project system variety on the change in conformance between the planned quality and the actual one of projects. This represents a significant contribution of the current study; however, the change in the prediction power is relatively weak, but it is still statistically significant and is generalized to all similar projects in the MENA region, which means that the adding of risk averse and experiential assets to the project for the purpose of creating new actionable and contextual knowledge to increase the level of quality conformance is one of the significant considerations during the planning and the implementation phases of the project to be able to have better control within different unstable and chaotic situations.

7.8.3 Sequential and non-sequential prediction of project performance by knowledge creation styles

The innovative knowledge creation 366ehavior of the project manager and the specialized one directly and significantly predict the change in the level of conformance of the actual quality performance of the project and the planned one. This means that the use of specialized knowledge as well as innovative one can significantly create tailored contextual behaviours of knowledge creation that can predict the change in the quality performance of the project, and this is consistent with the weak regression coefficients found in the literature on the project performance, but on the level of a sub-construct of project performance which is the quality performance of the project. However, these coefficients are significant at the level of confidence of 95% and belong to significant prediction models that are generalized to all the small and medium sized projects in the MENA region. Predicting the quality performance by the SKCS and the IKCS is done separately without testing the sequence of predicting impacts of these styles on the change in quality performance. Then, the study reveals that if a sequence on the level of prediction of sub-constructs of project performance.

The current study contributes to the body of knowledge by finding a significant and generalizable sequence of knowledge creation styles predictions of quality project performance using the hierarchical regression statistical method. The study found that adding the IKCS to the SKCS changes the prediction power of quality project performance significantly, then adding the RAKCS to the IKCS changes the prediction power of quality project performance significantly. This means that there is a sequence of significant prediction impacts starting with RAKCS to IKCS to SKCS on the quality performance of the project and that this sequence is a generalized one from the sample of the study to its whole population.

On the level of the main relationship between project complexity and project performance, this sequence of prediction impacts using the KCSs in a hierarchical regression model is significant at the level of confidence of 95% and is generalized to the whole population of the current study. The SKCS does not belong to this sequence of predictions and affects the level of complexity which, in turn, predicts the change in the level of RAKCS. This, in turn, predicts the change in the level of EKCS which, in turn, predicts the change in the level of the IKCS which, in turn, predicts the change in the level of conformance in the project performance. This sequence is important in deciding the right flow of operations among project management team members and is a new area for further research in the future. This sequence is generalized to the whole population and is considered as a contribution of the current study to the body of knowledge in the area of the relationship between complexity, knowledge creation, and project performance.

7.9 Knowledge Creation is a Dynamic Loop Process

The graph below illustrates a comparison of the relationship between knowledge and innovation in the literature. On the left-hand side, the study of Watanabe's model illustrates the study of the management innovation as a determinant of tacit and explicit knowledge which, in turn, affects the corporate performance, whereas on the right-hand side, Floricel's study shows that new knowledge and existing knowledge interact with the project complexity to determine the change in innovation as one of the constructs of the project performance. This reinforces the point of view of the researcher that the knowledge creation is a dynamic process for which innovative assets are used and then innovation outputs are produced to represent a loop of improvement in the level of innovation. This applies to the other assets used to create new knowledge in the project. The difference between the current study and these two studies is the framework of the study that positions the innovative knowledge creation as a style of behaviour to use assets for the purpose of creating actionable and contextual knowledge for having better and more stable control over the project performance and to keep the conformance between the planned performance and the actual one before submitting the final product of the project to the customer.



Sources: (Floricel, 2016); (Watanabe R., 2017)

Figure 7.4 The innovation is an input and an output of KC in the literature

7.10 Discussion of Findings of Qualitative Propositions and Reflection on Previous Research

In the qualitative study, there are classifications of project managers regarding their points of view about the creation of new knowledge, why, when, and how they create it. About the timing of creating new knowledge, a group of project managers believe it is better to create new knowledge when there is stability in the environment because a great deal of time is available for knowledge creation. Another group of project managers believes that the creation of new

knowledge emerges from the chaotic unstable environments and happens for the purpose of bringing back the conformance and stability of performance during the planning and the implementation processes. This group of managers perceives the period of fluctuations and deviations as a more valuable source of knowing what corrective actions would work and how to build the needed knowledge for it. The structuring of the qualitative study in the current study is designed in light of previous qualitative studies in the area of the relationship between the project complexity and the project performance. One of the main pieces of research in the literature about the non-conformance in the time performance of the project that is represented by the delays of implementation that are determined by the level of complexity of the project is relevant to the current study (Miterev, 2012).

The typology source of sampling strategies of qualitative studies used in the current study (Müller R. G., 2011) was similarly used, and the critical case study type of sampling chosen to permit the logical generalization and the maximum application of information to other cases in the population is used. The same complexity theoretical requirements were used (size of the project system, variety of the project system, interactions and interdependencies within the system, context and environment dependency of the project system), but the consequences of complexity are excluded. The justification of this exclusion is that the calculations of the level of the project complexity on a constant sum quantum belonging to the same organisation as (Vidal, 2011) are modified to tolerate more diversification of projects in different contexts and situations of creating knowledge and in different organisations, so only one project for one project manager was studied in each organisation. Regarding the dimensions of qualitative study of the project performance, they included cost and quality as in previous research and changed duration to time, and replaced the allocation of resources and added value by productivity. This is done after checking the quantitative studies in the area of project performance to be able to

triangulate the same dimensions from qualitative findings to quantitative ones on the level of sub-constructs, in addition to the level of main variables of the study.

The study of (Miterev, 2012) extended the work to the testing of the project failure after its submission to the final customer and revealed that one of the reasons found in this study of project failure was the losing of control over implementation, which is a logical reason to justify the focus of the current study on the impact of the knowledge creation and its interaction with the project complexity on the conformance and control of project performance during the implementation process and before submitting the product of the project to the final customer. Moreover, the fact that the study of Miterev and Nedelcu showed evidence from 9 projects on instability of performance during the implementation process and the current study has increased the qualitative sample to 101 interviews and triangulated it with quantitative study results for higher accuracy, for better depth of investigations, and for generalization of research results and contributions.

7.11 Triangulation of Research Results between Qualitative and Quantitative Findings

In this part of the research, a discussion of the similarities and contradictions between the quantitative and qualitative studies adds to the validation of the contribution of this study. The conducting of the qualitative study contributed to the creation of adapted measurements of knowledge creation styles, project complexity, and project performance. In the qualitative study, each knowledge creation style was described differently. In brief, the specialized knowledge creation style is mostly used when starting a new project for the first time, when there is lack of previous experience, and when the focus is on the achievement of certain KPIs, and the project manager likes to have a kind of balance between the time and the cost

performance of the project. It is important to mention that the SKCS prefers to have the RAKCS support to improve the planning skills at the beginning of the project. SKCS gives special importance to the certification and the professional education as a key for better execution of the project plan. Specialized knowledge creation moderates the relationship between the project interdependency and the performance quality and this is a quantitative finding that correlates with the relationship with the achievement of the KPIs and with the findings of (Samra & Shaalan, 2016) about the role of the SKCS in increasing the complexity and, in turn, impacting the performance success.

As for the IKCs, they consider deviations in the performance as opportunities of improvement and accept them, especially when they are backed up by the RAKCS, and this is a point of similarity between the qualitative and the quantitative studies where in both findings there is preference of the mediation of the RAKCS between the complexity of the project and the performance. The IKCS is associated with the environmental complexities in the qualitative study and related significantly to the environmental complexity in the quantitative study, which is another point of similarity between the quantitative and the qualitative findings. Another point of similarity is finding association between the IKCS and the quality performance in the qualitative study and, at the same time, a significant correlation relationship between them in the quantitative findings of this study. Additionally, the qualitative study has a more in-depth description of the IKCS. It includes targeting facilitation of implementation and speeding it up over time because of trying new standards and structures of implementation. This means that the IKCS targets the decrease of technical mistakes in the implementation and the increase of the technical value at the same time. The IKCS thinks out of the box and looks after the increase of the profits by increasing customer satisfaction and even exceeding his or her [customer] expectations. When IKCS tries to change the methods of implementation, they also consider the

savings in time and cost. The description of the EKCS in the qualitative study is surprisingly linked to the RAKCS and this gives more value to the risk averse knowledge creation for the purpose of achieving conformance between the actual performance and the planned one. The IKCS in the quantitative part of this study is found as a moderator in the relationship between the project interdependency on other projects and the level of conformance in productivity of the project. In general, the IKCS managers perceive themselves according to the qualitative findings as higher in productivity than others because they exert extra effort as they said. They think out of the box and they accept the non-conformance and work in the environmental complexity to find opportunities of improvement. Furthermore, they are moderators in the relationship between environmental complexity and both time and cost in the quantitative study; therefore, the consistency between the findings of qualitative and quantitative studies is clear regarding this style.

EKCS values the repetition in achieving better performance control, not only controlling the performance but also dealing with larger sized projects. EKCS prefers to prepare environments before starting the implementation of the project to control the possible expected conflicts. EKCS managers are better in planning and in discovering possible deviations and have early detection abilities, and because of the experience they have in similar or semi-similar projects in the past, they can implement their projects as scheduled and even faster with less costs, mistakes, and waste. The justification for this is that they have experienced ready-tested solutions for cost control and for minimization of inputs to production. In the quantitative study, there is statistical evidence that the EKCS moderates the relationship between environmental complexity and conformance to the cost of the project. This is justified in the qualitative description of this style as mentioned before. The EKCS also is able to implement the project with better level of conformance to the standards, schedule, and quality in the qualitative study,

and is a moderator of the relationship between the conformance to the quality and both the variety of the system and the size of the project. It is clear that the EKCS can control larger sized projects in both qualitative and quantitative studies.

In the qualitative study, the RAKCS is found to be able to relate the precautions against risks to the demand and supply in the market and the lack of project development, and they have significant impact on the safety of the project. RAKCS managers believe that risk management saves time; however, they take longer time to prepare their precaution plans. They prepare the progress reports for better conformance and control; they face more challenges when dealing with larger sized projects or longer periods ones; they prefer starting the mitigation process as early as possible and giving more priority to financial risks as well as to the interaction with the environmental complexity and quality conformance; they also believe in the need to have technical training for better control over project performance risks; they reinforce all possible methods to avoid rework, waste, and delays especially during periods of low demand and high supply capabilities; and t They also believe that the clarity of the scope of the project saves time. On the other side, quantitatively they moderate and mediate the relationship between the project interdependency and the project conformance to the quality and are apt to have a mediation impact on the relationship between interdependency and the cost conformance of the project. It is clear qualitatively and quantitatively that the RAKCS impacts the quality and the cost control of the project performance.

7.12 Preferences and Sequences of Using KCSs for Controlling Project Performance – Triangulation of Qualitative and Quantitative Findings

During the qualitative study, the investigations related to the relationships between knowledge creation styles and whether there is preference in using one over other style in certain situations reveal that there are classifications of project managers in this regard. Some sampled project managers preferred EKCS to the SKCS because they have more experience about the market and how to cope with technical development. They think that more project management creates better project managers not more certification or more studying, and one of the indicators they have is the quality of plans based on EKCS compared to plans based on SKCS. They highly value learning from others' experience and others' mistakes in strengthening the credibility and the reliability of the implementation processes. They are more precise than SKCS in setting realistic due dates as they said, better also in building teams and solving communication problems. They are faster in implementation and have better control over budget and scope and in being aware of and avoiding previous mistakes than the SKCS managers. This is supported by the quantitative significant moderation impact of the EKCS on the relationship project complexity and project performance. Whereas the SKCS does not have the same importance as a moderator as the EKCS, especially regarding the dependency on the experience of other people in the team as a source of creating knowledge for better performance control.

On the other hand, there is an opposing point of view in the qualitative study that believes that SKS is more important than the EKCS, but they are relatively very few.

Another debate about the preferences and priorities of using the KCSs is between the IKCS and the RAKCS. This debate is important because it correlates with the findings of the literature about the inability to stick to one style because it is affected by the situation and the context in which the knowledge and for which this knowledge is created. One of the points of views believes that risk averse is more important than the innovative knowledge creation. The advocates of this point of view justify their position by maintaining that they will consume longer leading time, but lowering the levels of risks in the project eliminates obstacles and avails resources on time and hence minimizes the gap between the planned performance and the actual one. This control increases efficiency and profits as well as customer trust. They think that it is more important to use RAKCS in larger sized projects that have higher levels of complexity in their contexts than the use of the IKCS. This correlates with the findings of the quantitative study about the impact of RAKCS on the quality of the project and its moderation and mediation impacts between interdependency and both time and cost of the project performance. This is giving higher importance to start with the building of risks averse knowledge, then move to the use of other styles or add them the management team in the future. The other styles in the qualitative study talked about their preference to get the support from the RAKC before they start creating new knowledge using their styles. In the quantitative study, there is evidence that risk-averse knowledge creation has a significant impact on the innovative knowledge creation and, in turn, on the quality conformance of the project. There is similarity between the findings of the quantitative and the qualitative studies about the needs for higher levels of risk averse knowledge creation when having higher levels of project complexity. To avoid subjectivity, this part discusses the opposing point of view of another part of sampled managers who believed that the innovative knowledge creation is more important than the risk averse e for their project performance success. They think that avoiding risks limits the growth and the searching for better solutions to minimize risks in the long run. The IKCS has a wider view of the meaning of controlling project performance by enabling the project to control the prices against the competition and increasing customer loyalty. Time and safety standards are their main challenges of conformance. They seek the right performance that leads to better results and exceeds customers' expectations so that they can increase profits in the long run. When this is compared to the literature, it is concluded that the RAKCS is more explicit and relatively

operational than the IKCS. The IKCS is strategically impactful and more implicitly built. In the short run, start with the RAKCS and then gradually move to the IKCS in longer periods of time. Building knowledge is a continuous cumulative process that can consume a sequence of styles of building knowledge in this research. The performance is not a fixed target; rather, it is a dynamic one including rapid changes that may cause delays, errors, failure, and deviations. This affects re-planning and corrective actions for more valuable improvements in the project performance in the future.

This part of the findings of the qualitative study is somehow related to the research work of (Biedenbach, 2011). They divided the environmental context into order context and unorder context, and they figured out four classifications of how project managers react to these two types of complexity. If there is high level of chaos, then the manager tries new knowledge for the first time and depends on novelty and uses sense to respond to the lack of order in the project, and this is close to the description of IKCS. If this lack of order is not chaotic but complex, then the project manager depends on propositions before sensing chaos, and creating knowledge about the propositions is relatively close to the description of the RAKCS.

Both, the third classification and the fourth classification, are in the area of the order complexity. If there is a complicated situation in which the good practice is the best solution to be created by cooperating with the team and, all together, they sense and then analyse the available information to build the contextual actionable knowledge, then this is relatively close to the EKCS description in the qualitative study, especially the part that is related to the dependence on the experience of others in the team. In the same area of order complexity, if there is simple situation that after sensing it, a kind of categorization and coordination will create the right actionable knowledge to respond to the simple or low-level complexity, then this is relatively closer to the description of the SKCS that exists in low level complexities and may raise it up

if lacks the homogeneity of specializations instead of overlapped ones. A good match to note in this regard is that in the qualitative study results. The qualitative study started with asking the interviewees about their definition of unexpected problems. They reported problems of delay, cancellation or termination of the whole project, failure in the project or dissatisfied customers. They also reported a sequence of knowledge creation used styles starting with the EKCS to the RAKCS to the IKCS and finally using the SKCS. However, this contradicts to some extent the quantitative results, especially in the position of using the SKCS. This may be caused by the smaller number of interviewees who are relatively using the SKCS relative to the other styles in the sample. This may be related to the demographics of the project manager and his or her experience in project management. The important part to notice is that interviewees reported that the EKCS and RAKCS are closely and interchangeably used and that the IKCS and SKCS are closely and interchangeably used to create new knowledge. This is happening when there is a need to use more than one style as when there is a sudden change in the price or a change in the customer needs either because of dissatisfaction or because of having new needs. The interviewees also reported the use of IKCS and the EKCS when there are changes in market prices and the use of RAKCS and IKCS when there is change in time because of increasing the level of dependency on other projects in the organisation. In the work of (Zhao, 2016) the IKCS description is grouped with the RAKCS description as mentioned earlier and both work better within relatively an environment where there is lack of order and higher levels of complexity. Then, the EKCS and SKCS work better in order situations or low complexity situations. In the quantitative study, it was evidenced statistically that this sequence of close use of certain KCSs together or after each other is valid. It was found that when complexity gets higher, the need for the RAKCS increases, and increasing the RAKCS increases the use of EKCS which depends on the creation of new knowledge depending on other members' experience in the team. This,

in turn, increases the use of the IKCS so that the project manager can reach the targeted conformance between the plan and the implementation. The quantitative study reveals that the SKCS impacts the complexity itself and is out of this sequence of KCSs impacts. This may reflect the gradual improvement in the behaviour of the project manager where he or she starts to learn about the PM even before managing a project and then starts the managing by taking all possible precautions and having the highest level of risk management to avoid mistakes at the beginning of performing PM functions. With time, he or she builds a kind of experiential knowledge to be able to speed up solving problems by having ready-made and well tested solutions and to plan better than before so that he or she can reach the conformance between the plan and the implementation easier and with less costs. Finally, there is the last and highest level of knowledge creation. This is related to thinking out of the box and to strategically creating knowledge to compete and to achieve better distinguished results based on solutions that are tried for the first time to achieve the conformance faster, smarter, and more efficiently. This sequence also tells top management about the sequence of work among a team of project managers, and this is another channel to explore further research in the future where the same questions are answered by a team of project managers not individual project managers.

7.13 Discussion of Reasons and Directions of Deviations in Project Performance from the Point of View of Every KCS– Triangulation of Qualitative and Quantitative Findings

Deviations happen when the project manager compares between the planned performance and the actual implemented performance. Then, after analysis, the reasons of this deviation are attributed to the plan or to the implementation or to out-of-control factors. The qualitative study analysed these reasons based on two stages in the project life cycle. The first one is deviations during the planning phase and the second one is deviations during the implementation phase. Next, the qualitative study considered these deviations as somehow relatively controlled ones and then moved to a third area that is uncontrollable and call it deviations due to external factors.

Deviations in the cost due to planning reasons happens when there are unclear factors in the scope of the project or when there is a high level of dependency in the plan. Deviations in the profit exists when there is a negative impact of the image of the company on the customer trust before implementation. Deviations in time exist when the experience in planning is not enough, which may create no expectations of delays in receiving resources of the project. Even when workers have unexpected vacations that have not been planned (e.g. Covid-19like CORONA nowadays), the analysis of the reasons of theses missing expectations are attributed to the lack of experience or to the disorder and complexity in the environment changes. The specifications of resources may not be clear in the plan or even the schedule of implementation may not consider all possible changes and challenges.

Deviations that occur during the implementation phase of the PLC may exist because of lack of capital or changes in team members during implementation or a pressure on the project manager to complete and submit the project earlier than planned. These reasons create deviations in cost. Taking immediate corrective actions is preferable but it may be time-consuming and may cause time non-conformance. On the other hand, a positive deviation exists when the delivery of the project happens earlier than planned and savings in time leads to savings in costs and, hence, increases the profit margins of the project. Bearing in the project manager's mind that early delivery must not be at the expense of the conformance to the safety standards, means that there is a need for precautions and thus the creation of RA knowledge for this purpose. Changing the

scope of the project based on the customer demand during implementation after having the legal approval on this change may cause non-conformance during the implementation phase as well. Again, RAKCS plays the role of a significant mediator to deal with these sudden nonconformance cases during the implementation process. This is proved by both qualitative and quantitative results of the current study about the role of EKCS in minimizing this nonconformance gap, the ready-tested and well-experienced solutions of such similar or semisimilar deviation problems. Sometimes the SKCS finds these solutions in books, libraries, and courses as reported by sampled project managers in the qualitative study. The faster tracking of the project implementation by suggesting changes in implementation schedules of all projects (Gant chart) is also related to the use of experiential knowledge or specialized one as well. As for the IKCS, project managers try new solutions for the first time. This may cause implementation errors, and here comes the need for more precautions and reserves for these trials and these precautions. Therefore, a risk averse actionable knowledge to be created by the project manager to enable the creation of innovative actionable knowledge. The IKCS also works hand in hand with the EKCS because both of them were found to have a significant moderation impact on the relationship between the project complexity and the time conformance of the project and they both significantly and directly affect the time conformance of the project. This is another point of consistency between the findings of the qualitative and the quantitative findings in the current study.

A third group of deviation reasons belong to the uncontrollable factors such as changes in the currency, changes in market prices due to changes in supply and demand, and changes in levels of customers' satisfaction and/or expectations. That is why the calculation of profits of the project is found to be relatively difficult because of these uncontrollable reasons and is for many managers replaced by the calculation of the return on investment. The higher interdependency

decisions are beyond the control of the project manager and comes from upper management which sometimes does not facilitate the work and, thus, represents another uncontrollable reason for deviations itself. The outdoor working conditions such as the weather and like weather or airborne viruses may affect the workers' ability to complete the work on time or even affect the due dates of delivery of raw material and resources to the project. That is why project managers feel that the conformance is easier to achieve when there is less interdependency or when managing local project rather than managing global ones. When customers ask for changes in their requirements and need violations of standardization and going for customization, this may increase the possibility of uncontrollable deviations. Even the high dependability on vendors to avail scarce resources for the project is another uncontrollable reason for deviations and nonconformance. All these reasons represent cases of disorder in the context and then deviations between the planned and the implemented project processes and requires creation of contextual actionable knowledge to manage it.

Each style has interpretations of the conformance and non-conformance reasons of project performance. EKCS perceives that conformance means stability and that it mainly depends on the cooperation and positivity of the team and the support of suppliers to be able to meet the planned milestones on time. High commitment to the planned schedule along with acceptance of slight deviations are justifiable techniques performed by the EKC managers. They generate new knowledge using the regular progress reports as well as periodical meetings because they believe that the conformance is not something static and needs tracking Because of its dynamic nature and the clarity of project, contracts are important to achieve partial stability in this regard. EKCS think that nonconformance in the project performance is caused by the lack of experience of the workers, especially the ones under training. The lack of experience includes experience about what data to collect and what planning skills to use. Less experienced managers have less

stored knowledge about similar or semi-similar projects in the past, and this affects their capability to achieve the targeted conformance. They know how and when to use which knowledge and they use communication to build new knowledge from the other members' experience about what factors to consider to achieve stability and conformance. Their experience enables them to avoid putting tight schedules that may cause deviation in the implementation phase. Finally, they believe that larger sizes and larger scopes and unclear ones are more challenging to achieve conformance.

With respect to the SKCS, conformance is achieved by inspection and checking the normal ranges of control and tracking indicators. In addition to the team collaboration, specialization adds to the ability to achieve this conformance. Lack of specialized knowledge, overlapped specializations, interference from other specializations from other departments in the organisations, collecting the improper data, and lack of specialized knowledge about the project in question are reported reasons of non-conformance from the perspective of SKCS. Lack of communication, lack of clarity of the project scope, and tight schedules are common areas of justification of non-conformance reported by both the SKCS and ECKS, which means that the project manager has partial behaviours that can belong to more than one style or even to all styles based on the policy of the organisation. Same reasons apply for the RAKCS which is the main mediator in this study. The RAKCS managers spend more time on continuous knowledge building for better risk management as a controller of the performance success. They target keeping risks under control to keep the whole performance under control. The removing of obstacles, collaboration, getting suppliers support, and disciplinary commitment are the kind of contributors of this style to the conformance of the project performance. With regard to IKCS managers, they spend a lot of time on creating knowledge related to planning, readiness for change, fitting planning with customers' expectations, getting knowledge from external assets,

and using instability as a source for knowledge that creates stability and conformance. They also believe that starting up the project has some chaos at the beginning until they figure out how to stabilize it. The inaccurate surveys during the preparation for the project are reasons of instability and non-conformance for this IKCS. Lack of knowledge and clarity about the internal cycle of the customer's business may lead to non-conformance in performance from the point of view of this style. Project managers build on the previous reasons and justifications of the previous styles which support the gradual use of theses styles and that there is somehow a sequence of using them in the management of the knowledge for performance success purposes. To triangulate this reasoning with the results of the quantitative study, the researcher found direct impact of both the SKCS and the IKCS on the quality conformance of the project. RAKCS is not always able to have a direct impact on the quality conformance of the project because it is not guaranteed that the dynamics and changes in the context of the project have been experienced before or have ready assets of knowledge to create actions to deal with it.

7.14 Relevance of Results to Research in General

In his research, (Floricel, 2016) stated that various types of knowledge production strategies can be developed for the purpose of dealing with complexity in projects. In his study, (Daniel & Daniel, 2018) said that any kind of uncertainty arises in a project setting is due to the probability of the events or occurrences which are unknown in nature. These can give rise to complexities in project management.

The research study by (Neely, 1997) highlights that the knowledge creation style that is implemented by the project managers has a key implication on the stability of the project performance. It mainly impacts elements such as time, cost, level of productivity, and quality of the outcome. The research studies that have been presented in the literature section indicate that the shorter the scope of a project the more preferable it is. This is because it can help the project team and the project manager to achieve better results in terms of performance. The shorter scope of projects also implies that the level of stability of a project is higher as compared to projects with a larger scope.

The major factors that come into play and influence the performance of the project are the available time, available resources and the scope of the project work. In fact, these factors have been considered as the fundamental dimensions which can be used to get a detailed insight into the project performance. Time, resources and scope of the project have been referred to as the Quality Triangle for a project. In his research, (Burke, 2013) stated that when any kind of change takes place in one of these three elements, the other two also get affected. For example, if the scope of a project is expanded, the requirement relating to time and resources will increase. Similarly, when the deadline of a project is limited, the available resources and time will have to be adjusted so that it can be completed within the provided timeframe. This paves the way to extend the findings of the current study to include the interrelationships among performance subconstructs in the model for uncovering more relationships that could help in reaching higher levels of conformance and control of project performance.

The research work by noted researchers such as Frahm have found that the knowledge creation style plays a key role in a project setting and ultimately contributes to the performance of the project. But at the same time, he also highlighted in his study that the decision-making strategies that are implemented by project managers to deal with complexities in projects influence the project performance to a substantial degree.

7.15 Contextual and Actionable Nature of Created Knowledge

Changes in the context of the project are reported in this study and include human disputes, miscommunication, lack of collaboration, delays in equipment and resources, lack of capital, overlap of specializations, high levels of interdependency among organisational projects, fluctuations in currencies and market prices due to changes in supply, relationship between project manager and senior management, unclear requirements of implementation of new projects or changed customers' requirements and/or expectations, unclear inputs for newly launched projects for the first time, and trying new corrective actions during implementation phase.

Project managers take actions to deal with these changes and other reported changes in this study. In general, the use of the self-experience and/or others' experiences are sources of actions and new knowledge to take action toward unexpected changes and problems that may affect achieving the performance success. Changing plans or even management style is an option to deal with the expected project failure. Considerations of the flexibility to change the plan in the face of risks is another action to take by managers. Another possible contextual challenge is the inability to conform to the time which may lead to negative or positive impacts on the profits of the project. Actions like creating knowledge about the common environmental culture and facilitating communication may decrease the time needed for planning and for the implementation of the project. This is another area about the team dynamics that needs further research in the future in relation to building of knowledge about it. More planning may uncover cultural complexity and environmental complexity, but the point here is which piece of information and assets of knowledge to use during the planning phase, and this differs from one manager to another.

Contextual changes related to the outdoor working conditions, for example, need knowledge about changes in the implementation schedules and only accepting attractive projects that has this kind of changes as well as the creation of awareness and motivation among team members to facilitate communication and build one common understanding of how to conform to the plan during the implementation phase. This is again highlighting the importance of the team dynamics in relation to the knowledge creation as a relatively important area of further research. Contextual changes include delays caused by interdependency, and this can be repetitively experienced and managed by project managers using experiential sources of knowledge.

External uncontrollable changes include contextual factors and changes that require innovative assets of knowledge to be used to take the right action to achieve conformance. Examples include lack of demand and of clients or conflicts with clients about the final touch of the completed project, or how to react to changes in prices and currencies and suppliers' commitment or changes in availing scarce resources for the project or changes in the scope of the project because of depending on a third party. All these changes require improvement in the results of the project by taking innovative actions especially at the beginnings of planning or implementation phases.

Internal contextual changes include delays in financial resourcing, lack of workers' experience, time spent in inspections, and all these internal changes may affect the conformance to the time, cost, productivity, and quality performance of the project as reported by sampled project managers. Some of them think that if the total of the deviations in the project performance indicators exceeds 30%, then there is a need to revisit the project objectives and scope. There is a group of project managers who said that there is no relationship between the complexity and the project performance and that they can take the previously mentioned actions to deal with it to avoid the impacts of this complexity on the project performance. Others said that there are

significant impacts caused by the project contextual complexity and that these impacts negatively change the ability to achieve the targeted conformance between the planned performance and the implemented one.

The following table summarizes the relationships between the project complexity and the impact on the project performance from the point of view of the project managers who see that there is a significant association between the project performance and the project complexity

Complexity factor	Impact on project performance
System size	Planning for larger sized project, more customer needs for larger sized projects,
	increased standards and challenges of achieving conformance to quality in larger
	sized projects, may cause radical changes in planning and schedules of
	implementation.
System variety	Dealing with many stakeholders, variety of customers' needs, then this requires
	dealing with larger number of suppliers, and/or investors, and this affects changing
	the plan, schedule, conformance to time and cost, and sometimes delays
	implementation phase.
Interdependency	Nonconformance to Gant charts of implementation, shared plans and overlapped
	uses of resources or dependence on the same vendors, or depending on customers
	inputs during the planning phase my cause changes in the performance of the
	project.
System context	Changes in cultural aspects, legislations, and complicated communications due to
	cultural diversity may cause nonconformance in the project performance

Table 7.4 The impact of complexity on performance from qualitative study results

Source: Created by the research depending on the results of the qualitative research of the current study.

Triangulation of these findings to the quantitative results reveals that there is no significant direct relationship between the main variables in this study and between the project complexity and the project performance. However, some of the sub-constructs of complexity such as size and variety are directly related to the project performance or to its sub-constructs.

Also, in the literature and after checking the relationship between project complexity and project performance studies uncovered significant negative relationship but not relatively strong one. In the current study, the same negative relationship exists but not enough to become statistically accepted at a level of confidence of 95%. This may be interpreted by the nature of the sample of the current study compared to the samples of the previous ones. In previous studies, there is focus on one sector to sample and research mainly like the constructions sector or the IT sector. In the present study, there are many industries like constructions, business, IT and others, and the focal criteria of picking the sample was not the sector but was the focus on the MENA region as a context for the small and medium sized projects to uncover how knowledge is built in this region and how it mediates and/or moderates the impact of complexity on the project performance. There are suggestions of further research in the coming chapter about the focus on one sector and the choice of more than one cross-sectional sample during the planning phase and the implementation phase of the project for better understanding of the graduality of building new knowledge.

7.15 Chapter summary

The discussion chapter relates the results of the current study to the previous research in the body of knowledge of project management, complexity, and knowledge management. It also triangulates the results of the qualitative study to the results of the quantitative one. The justifications for the choice of certain constructs to measure qualitatively and quantitatively are introduced and discussed. The contribution of the current study over the previous research is discussed based on the gaps in the previous studies and the solutions introduced by the current study to close this gap. All research questions, hypotheses, and propositions are discussed in

this chapter in light of the literature review, and the evidence from the field of application and the justifications behind the generalization and validation of results are introduced. The following chapter illustrates the journey of the current research with the evidence on the achievement of the research aim and the originality of the contribution of the current study to the body of knowledge.

Chapter Eight: Conclusions, Limitations, and Recommendations 8.1 Focus on Knowledge Creation

(Hussain, 2004) highlighted the role of knowledge creation in dealing with uncertainty and staying competitive in the marketplace. Their work also emphasised how redundancy work is not desirable and that creating knowledge assets and using it is replacing the downsizing resulting from avoiding redundancy of manual work in a way that boosts productivity using shorter production cycles. Between heads and documents, there exists knowledge creation. Knowledge is the processed data that are transformed to information which then becomes relevant and contextually actionable because it has experiential and reflective elements to be created in a certain context and it has historical relevance and evolves over time. As Hussain and others illustrated in their work, there are six different types of knowledge: descriptive, procedural, reasoning, linguistic, presentation, and assimilative e. Descriptive is about knowing what; procedural is about knowing how; reasoning is about knowing why; presentation knowledge facilitates communication, and to interpret the received communication linguistic knowledge is needed; and finally, assimilative knowledge improves on the existing one. The first three types are basic ones and last three are the learning ones. The knowledge of the project manager represents an intellectual capital for the organisation which consists of interaction between the commitment of the project manager to contribute to the organisation and his or her competency (Ulrich, 1998). Codification of knowledge splits it into tacit and explicit. The focal point of the present study is not about the types of knowledge but about how it contributes to better project performance, and this is a kind of knowledge management (Marr et al., 2003). Knowledge objects like experience, evaluations, insights, and wisdom, etc. lack the classification into titles nominal behavioural patterns of usage. That is to say, the dependence

on different objects of knowledge is not the same for all project managers and, hence, does not lead to the same performance success in the face of continuous increasing environmental change. How does the innovation capacity lead to knowledge creation? Or why does research consider innovation as an outcome of knowledge creation instead of an input to it? Is it a human capability to create knowledge differently and use it differently for better conformance between planned objectives and actual ones? Predictable environments facilitate and clear the link between the creation of knowledge and the performance success, but in reality, the environment is not perfectly predictable. Pre-defined best practices can play a role but is no longer enough for continuous success, for new knowledge is always in need of survival. The capabilities needed to close the gap between the pre-defined goals and the uncertain future are related to the continuous and dynamic knowledge creation.

The knowledge management is a tool to increase the project manager's ability to implement the project processes more efficiently. To be able to do so, the project manager improves and uses knowledge repository and assets and manages them (Davenport, 2015). The purpose of the project manager is to add value by transforming the created knowledge into tangible improvements during and after implementation of the project. Creating the right knowledge from the right source at the right time may or may not lead to the success of the project performance, and this is a continuous process based on its needs. Managers exercise externalization, internalization, intermediation, and cognition; however, it is not enough to manage knowledge but also to consider its context (Frantzeskaki, 2016). Sources of knowledge from its assets is built by the company (Zhao, 2016). Mapping the needed knowledge with its assets and usages is subjected to behavioural patterns of performing this mapping by project managers and leads to different levels of performance success in their projects. Where to build

the knowledge from as well as its achievement of the conformance purpose is the scope of classification of project managers in the current study.

The research study primarily focuses on core project variables, namely the project complexity, the knowledge creation styles of project managers, and project performance. The conceptual model of the conducted research study has been presented below.



Figure 8.1 The theoretical framework of the current study – created by the researcher

The research study on the project management topic delves deeper into the relationship that exists between project complexity, knowledge creation styles, and the ultimate project performance. The research study that has been conducted does not focus on the surface of these variables only but also sheds light on the sub-constructs that exist under each variable of the research study. The major sub-constructs under project complexity that have been considered in the research work are system complexity, interdependency complexity, size complexity, and environmental complexity. Similarly, the sub-constructs identified under the knowledge creation style of project managers are experiential, specialized, risk averse, and innovative. Ultimately, the sub-constructs under project performance are cost stability, productivity stability, time stability, and quality stability. In addition to the literature review that helps in obtaining a detailed insight into the conceptual framework of the research study, a mixed method approach has been employed. One of the main reasons for employing this research technique is that there are is a limited number of research studies which have adopted this approach to analyse the association between project complexity and project performance. The findings of the conducted pilot study indicate that the knowledge creation style of project managers primarily influences how they handle and manage a project work. Most of the project managers stated that irregular variation is a key indicator which shows the chances of errors or mistakes. But it was also evident from the study that each and every project manager approaches a project from his/her individual perspective. Thus, the project managers might also differ in making use of different sources of knowledge while working on a given project. The findings of the qualitative research study indicate that the knowledge creation of project managers has a key implication on the ultimate project performance.

Some of the main areas where the knowledge creation style of project managers is reflected include the planning process, the accuracy of making estimations, the quality and standard of the technical work, the reduction in the level of effort, cost, and time, and productivity. Project managers can gather knowledge from various sources. For example, the project managers with experiential style gather knowledge through their hands-on experience itself. Complexity basically gives rise to unexpected problems, thus disrupting the stability of the project performance. Project managers basically use their knowledge creation style so that they can effectively deal with project complexities and positively impact the ultimate project performance.

8.2 Limitations of the Research

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Even though a comprehensive research study has been carried out which revolves around project management, there exist several limitations which had an adverse impact on the project work. One of the main limitations of the research study relates to sampling limitation. The authenticity and reliability of the research study could have been further strengthened if the total number of participants that took part in the research study had been high. Another key limitation that arose in the research study was the instrument limitation. Several studies, that were considered in the literature review section have a limited level of validity relating to the research instruments that have been used by these studies. The vast scope of the research on the project management topic also made it quite challenging to cover all the key factors that come into play and have an implication on the overall project performance.

Another limitation on the study is the inability to conduct plenty of cross-sectional studies over time to track the fluctuations at the level of complexity accompanied with changes in the levels of conformance in the project performance. This was due to time constraints, and the researcher expects better results by adding the different time periods as a controller in the conceptual framework of the study.

The political, psychological, economic, cultural, legal, and technological aspects of the project context are excluded from the study for better understanding of the change in the researched variables of the study

The sampling unit is limited to the characteristics of sampling that was introduced in details in chapter six of this thesis. Any unit that does not have all the previously mentioned characteristics was excluded.

This analysis of the quantitative data is limited to the fully answered questionnaires only and any missing or inability or unwillingness to answer any of the survey questions meant excluding

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the respondent's results. Thus, 60 respondents were excluded to increase the level of accuracy of the research results.

The limitations in a research study can have a major implication on the entire research process including the research outcome that has been arrived at by the research team. These elements, too, impact the interpretation of the research findings to a significant degree. The limitations that have been reported in this section acted as a key challenge while carrying out the research process.

8.3 The Journey of Finding the Research Gap

The aim of the study is to test the moderation and/or mediation impacts of the knowledge creation styles on the relationship between the project complexity and the project performance. To achieve the aim of the study, the researcher put several objectives to achieve and translated these objectives to many main and sub-research questions.

The researcher found a gap in the body of knowledge and many unanswered questions that needed further research to answer them. For instance, are we able to classify project managers into styles based on their choices of different sources and assets to build new knowledge for the purpose of keeping the conformance between the planned performance and the actual one or not? The starting point was to investigate the literature about the answer to this question. In fact, it was found that knowledge is a situational process, a dynamic one, and an actionable one, and these characteristics prohibit the ability to classify project managers into styles. However, there is evidence in the literature that there are different learning styles, and the learning process in a way or another includes knowledge creation. One of the noticeable findings in the literature about the success of the project performance is the attribution of this success to the team

effective communication which the researcher thinks that it is a direct application on the idea of knowledge creation using self- and other experiences. The use of the project manager's experience is another process of knowledge creation, and even innovation was found to be an input in some research and an output in others for the knowledge creation process. These discrepancies in the contributions lead to the re-thinking of the determination of the project performance and the need of a new classification of project managers on the bases of how they create new knowledge differently. This does not mean that they cannot change from one style to another based on the situation they are in in the same way as changing from transactional to transformational management styles when needed. But one manager is better than the other in controlling the project performance by innovative knowledge creation and another one is better controller of the project performance using the risk-averse knowledge creation style.

8.4 Managerial Implications and Recommendations

This is a mixed-method study and aims at the investigation of classifications of project managers into knowledge creation styles and the impacts of these different styles and their interactions with the project complexity and their significance in predicting the change or absence of change in the project performance. The results of the study are generalized to all population units and offer managerial implications to the project managers in the MENA region. Project managers who benefit from the results of the current study will be able to understand the relative importance of each one of the knowledge creation style against the others. They can figure out when the IKCS is more preferred than the RAKCS and vice-versa. It seems that the mediation of the RAKCS gives higher safety to start using the IKCS and that IKCS managers become more successful in achieving better performance results when they are backed by the RAKCS managers in their teams. There is closeness in results between these two styles of knowledge creation; in fact, it is recommended that they work together for better performance. They have the advantage of the creation of precautional actions while trying new solutions for the first time, and this keeps the long-term survival in the market and increases the ability of the project manager to attain customer satisfaction and customer loyalty to the organisation. The preferences of using experiential sources of knowledge against using specialized sources of knowledge are based on what the project manager lacks. If he/she thinks that he has enough experience of similar or semi-similar projects, then it is more expected that he/she will depend on these assets to create appropriate action to manage the planning and the implementation of the project. If not, then he or she will have a second option which is the dependency on the experiences of other members in the team, and this proved effective in impacting the relationship between complexity and project performance in the current study. If no experience is available because the project is new, in this case it is recommended that the project manager starts to build thorough understanding and more coordination and organisation of efforts to be able to manage the new project by depending on scientific specialized knowledge assets. For this purpose, he or she may depend on specialists or certified people or consultants in the new field of the project. Therefore, it looks like there is a sequence of thinking steps of which knowledge assets to use based on the demographics of both the project manager and the project itself. It is recommended to extend the results of the current study by adding the influence of these demographics on the prediction of the knowledge creation style the manager will prefer to use for his planning and implementation for a certain project. It is obvious from discussing the qualitative results of the present study that project managers always experience variances between their planned performance and their actual one for different but repetitive reasons. The qualitative study contributes to the thinking of the deviations in the project performance by

giving a classification of reasons behind these deviations. The classification puts reasons into three categories: one category is due to the plan; one is due to implementation; and the last one is due to uncontrollable external factors beyond the project manager. This gives higher value to the controllable manageable phases of planning and implementation of the project and how critical is to use the right style of dependency on which assets during these two important phases of the project life cycle. The types of main critical examples of deviations in the MENA region are discussed in details in the qualitative research to provide a guide to the project manager on how to deal with similar deviations in the future, and their repetitiveness increases their importance and probability of occurrence in different projects, situations, and with different styles of managers. However, each manager manages them differently, and this depends highly on using the results of the current study to decide on the best knowledge creation style to use for better conformance between the planned performance and the actual one. The performance stability or instability discussed in the qualitative study of this research requires further research to consider the value of time and using longitudinal or at least multi-cross-sectional samples to study the value of time and its effects on the change in project complexity and project performance stability. This will shed more light on the needed change in using each style of knowledge creation through project life cycle by project managers. Also, the linkage between the knowledge creation style and the full study of the project life cycle is recommended for better contribution to the body of knowledge. The instability in the project performance is characterized by being related to time and to external uncontrollable factors, and project managers differ in perceiving periods of instability as suitable or not suitable to create new knowledge. It is advisable for project managers to accept short-term instability and deviations in their project performance for the purpose of achieving higher ability to control better results in the future. As found in the literature from Harvard Business Review, that exaggeration of using the risk-averse knowledge may lower the potential profits rather than protect them; as a result, there should be a kind of a balance between the use of the IKCS and the RAKCS which are considered to be the main KCSs in this study. The SKCS is found to be the least available used one by project managers in the sample, and this trend was clear in the descriptive statistics. Project managers need to know that the KCSs are not equally used in the management of their projects, and maybe this is the key to re-thinking about a better way to manage the project performance in the MENA region. Each project manager believes that the style used for creating actionable and customized knowledge will definitely impact the project performance, and no project manager thinks the opposite way. The main difference among project managers is how each KCS is thought of in terms of its contribution to the conformance and control of the project performance and to the achievement of the project success. With respect to the relationship between the project complexity and the project performance, there is evidence in the qualitative study, in quantitative study, and in the literature on the contradicting views of whether this relationship exists or not and if it exists, whether it is strong or weak. This is the main reason why the researcher went to the level of analysis of sub-constructs to have better understanding of the most influential complexity sub-constructs on which project performance sub-constructs with regard to the managers' ability to create knowledge for better control over these significant influences.

The full mediation of the RAKCS in the main relationship between project complexity and project performance gives the project manager a hint about what piece of knowledge he or she has to start building even before starting the planning phase of the project. When the project manager has a target of interaction with the current level of project complexity to change its impact on the project performance, then it is better to use the IKCS according to the results of the quantitative study that informs of a significant moderation impact of the IKCS on the main
relationship between the project complexity and the project performance. When the project manager wants to minimize this effect, he or she must think out of the box and use the information coming from the market and about competitors and his own skills and feelings to create new innovative knowledge and to try it for the first time for the purpose of achieving longer term stability and success in the project performance. This is really important to consider when talking about the increasing complexity of today's projects in light of rapidly changing environments, the increase of uncontrollable factors, and the continuous changes in customers' needs. The examples on uncontrollable changes and how they increase complexity are understood from the qualitative study and have triangulation in the results of the qualitative study, and this adds to the value of this contribution to the practicalities of managing projects nowadays.

At the level of sub-constructs, this research investigates significant contribution to the body of knowledge. Project managers can decrease the negative impact of interdependency on other projects in the organisation at the level of control over productivity by creating innovative knowledge and finding new solutions to keep the conformance to the planned productivity even if the interdependency on other projects or shared vendors increases. Innovative knowledge creation enables the project manager to minimize the negative impacts of the higher levels of environmental complexity of the project on deviations in cost. Innovative new solutions will keep the conformance to the planned costs and will keep implementation costs under control. Another key to the performance success in this study is the ability of the innovative knowledge creation to minimize the negative impact of environmental complexity and this adds value to the project management by working smarter and, thus, achieving better results at the expected time or even before. Using information sources about customers' companies and competitors solutions adds to the potential of

achieving better conformance and keeping customers loyal even if the manager is working in a high-level complexity environment. The project manager will benefit from the results of the current study by merging between the SKCS and the IKCS when trying to minimize the negative impact of environmental complexity on the cost conformance. Specialization and innovation sources of knowledge can effectively work together on better achievement of this purpose. When the project manager is faced with system variety that may lead to changes in the quality performance of the project, the key is to generate experiential knowledge to adapt this high level of system variety. Project managers will especially focus on the experience that the project manager can get from others in the team because it is found to add significantly to the minimization of changes in the quality performance due to the change in the system variety of the project. The experience that source the knowledge creation can significantly affect many aspects in the project such as the increase of the negative impact of environmental complexity on cost conformance and the increase in the project size in a way that negatively affects its conformance to quality. Also, the increase in the level of interdependency on other projects and resources may hinder the conformance to the planned productivity, and this adds special value to the conduction of further studies on the role of the team experience as a source of creating new knowledge to have better control over the project performance in different contexts and situations. Communication and its effectiveness among the team members appeared in the literature as a significant influencer on the project success. In fact, in this study communication process is dealt with as a use of the experience of other people in creating new knowledge, and this proves to significantly affect the performance control and success. Managers may depend more on experienced people when they want to increase their productivity in light of having dependent project implementation schedules. RAKCS has a common significant impact with the EKCS in minimizing the negative effect of project interdependency on the quality

performance of the project. This means that more precautional based knowledge and actions related, for instance, to keeping reservations will significantly keep the conformance to the planned quality under control even if the project has a higher level of interdependency on other projects in vendors or use of resources. Specialization knowledge creation plays a significant role in controlling the time performance of the project as found in this research. The interaction between the SKC and the system variety on one hand and with the environmental complexity on the other minimizes their significant impacts on changing the conformance to the planned time of implementation. This is guidance to project managers on how and when and why to use each KCS based on the results that are generalized to the MENA region context. Project managers must value seeking and understanding the support of other members' experience in the team as a significant contributor to the creation of new knowledge that adds to the capability of having better control over the project performance. Other members' experience can generate a kind of knowledge that gives better control over the quality performance as well as the time performance of the project. The project manager can implement the project in shorter time and with better quality if he or she decides to depend on experienced people during the planning and the implementation process. What is exactly their contribution? It is the interaction with the system variety, the larger sized projects, and the higher levels of interdependency of the project to minimize their significant impacts on the deviations in time performance and quality performance. The project manager can also create new knowledge and take contextual actions based on his own experience to have better control on the quality performance especially in the type of projects that have higher levels of interdependency, and where the manager needs to have previous experience in managing interdependency and communication with others to avoid the negative impacts of inter-dependency. There are many examples of this in the qualitative study. There are some full mediation impacts of knowledge creation styles on the

level of sub-constructs relationships in this study. The RAKCS has a full mediation impact not only on the main level of relationships but also on the sub-constructs level. It mediates the relationship between interdependency and both quality performance and cost performance and this is only logical. If the project manager has potential negative impact of interdependency on quality and cost, he or she will start to build actionable and contextual knowledge based on riskaverse sources and information assets. The SKCS has a common impact with the RAKCS on the control of the quality performance when there are higher levels of interdependency on the project. The project managers can use these two styles of knowledge creation to control the impact of interdependency of the project on the conformance to the planned quality. These are all key of better project management and are based on evidenced, tested, triangulated, and generalized results in the present study.

This research contributes to the prediction power of the project performance for the purpose of controlling it in a better way. The size of the project and its system variety directly predict the conformance to the planned quality in the project performance. If the project managers want to increase the prediction power of the size and the system variety of the quality performance, he or she can use the RAKCS as well as the EKCS. The risk-averse and the experiential knowledge creation increase the predictability of the quality conformance for the project. At the level of the direct prediction of the project performance using the knowledge creation styles, there is direct significant impact of the change in the SKCS and the IKCS on the change in the quality performance of the project. The project managers can increase the use of SKCS and the IKCS to direct the change in the quality performance and to control this change

Another significant contribution to the managerial implications is the prediction of a sequence of the usage of knowledge creation styles for better control over the project performance. Project managers can add the IKCS to the SKCS for better control over the quality performance and can add RAKCS to the IKCS to have better prediction power over the quality performance of the project. Project managers must know that the change in the project complexity leads to change in the RAKCS which, in turn, leads to change in EKCS which, in turn, leads to change in IKCS which, in turn leads to change in project performance, and this is a contribution to the formulation of the project management team and how to create a purposeful knowledge that can show its benefits and direct and indirect positive impacts on the project performance control and success.

8.5 Value and Originality of the Conclusion of the Research

The aim of the current study is to measure the knowledge creation styles and to describe and measure the moderation and/or mediation impacts on the relationship between project complexity and project performance. This aim leads to unanswered research questions that have to be answered to fill a gap in the body of knowledge in the literature in the field of project management and knowledge management.

The objectives of the current study are to describe the project performance in the MENA region and its success, analysing the relationship between the level of project complexity, knowledge creation styles, and the level of success in the project performance, and interpreting the difference in the relationship between project complexity and project performance in light of the impact of knowledge creation style. The researcher derived several research questions to be able to achieve the research objectives.

These questions are as follows: Which knowledge creation styles mediate the relationship between the project complexity and the project performance? Which knowledge creation styles moderate the relationship between the project complexity and the project performance? Which knowledge creation styles moderate the relationships between the complexity sub-constructs

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and the performance sub-constructs? Which knowledge creation styles mediate the relationships between the complexity sub-constructs and the performance sub-constructs? What independent factors predict what dependent factors of the study? Does the prediction power significantly change after adding the knowledge creation style variables to the prediction model? What knowledge creation styles predict the project performance? What hierarchical relationships between KCSs significantly exist to determine the change in the project performance? How do KCSs impact the relationship between complexity and performance? What is the comparative importance and preferences of using knowledge creation assets for achieving performance success? What are the reasons behind deviations in project performance? How does knowledge creation associate with project performance? How does project complexity associate with project performance?

The first nine questions were answered quantitatively, and the last five ones were answered qualitatively to achieve the research objectives. This adds to the answering of non-answered research questions in the fields of project management and knowledge management. The originality of creating these questions and the analysis of primary qualitative and quantitative data collected from the MENA region and the creation of the theoretical framework and the hypothetical model of thinking about how to solve the problem of controlling the deviations in the project performance in the world of changing levels of complexity, all these contributions represent added value to previous research. The use of a generalizable qualitative approach of critical case study analysis of a sample of 101 interviewees adds to the value of the findings of the current study. The use of more than one statistical analysis tools for better accuracy of measurement of the moderation and mediation impacts of knowledge creation styles also adds to the value of the current study. The addition of practical implications that can positively impact

the rationale of the decision-making processes of the project managers during the project planning phase and the project implementation phase also contribute to the added value of the current study.

The research contributes to the body of knowledge by creating a customized measurement of the project performance, project complexity, and then classifies the project managers into styles based on the behaviours of creating new knowledge they have. Finally, the research adds a new measurement of theses classifications.

The current research answers the main questions of the study. It was found that the risk averse is the main mediator of the relationship between the project complexity and the project performance, and that the innovative knowledge creation style is the main moderator of the relationship between the project complexity and the project performance. According to the present research, there are qualitative associations among the project complexity and the project performance as well as the knowledge creation styles. The research also o found that there are many reasons behind the deviation in the project performance in the Middle East region and that project managers deal and manage these deviations differently and accordingly at the level of conformance in their performance. The level of the consequent success accordingly differs from one manager to another. The research contributes to the sub-construct levels of the relationship between the project complexity and the project performance and adds the value of original new contributions in the area of predicting the project performance and increasing the prediction power of this performance by adding the behavioural styles of the project manager when creating the new knowledge for the purpose of performance control.

The study has original contribution to the uncovering and investigations of moderation impacts of knowledge creation styles on the relationships between size, variety, interdependency, and environmental complexity on one hand and the time, cost, quality, and productivity on the other.

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It is concluded that interdependency and performance quality are the main sub-constructs that are key controllers of the interaction between the project complexity and the project performance.

Another valuable original contribution to the body of knowledge is the finding of a sequenced significant impacts of the knowledge creation styles among the relationship between the project complexity and the project performance at the general level of research and between the project interdependency and the conformance to the quality performance at the sub-construct level of research.

8.6 Suggestions for Further Research

According to (Iacono et al., 2012), the level of knowledge of the entire project comes into play and has a major influence on the ultimate project performance. This information can encourage project teams and project managers to focus on strengthening the knowledge level of all the team members so that each one of them can play an active role and contribute to the performance and overall success of the project. The current study is one step on the long road of the research in the area of the contribution of the knowledge creation to the relationship between the project complexity and the project performance. Further research is needed on the consideration of the demographics of the project managers and the demographics of the project and their impacts on the styles of knowledge creation in the field of project management in MENA region. Another study about the same theoretical framework needs to be implemented after considering the value of time as a significant influencer on the change in the project complexity and the consequences of this change on the interaction between project complexity and both the knowledge creation styles and the project performance success. Another research can be conducted on the phases of the project performance that follow the stage of the implementation and that have direct interaction and impact on the project customer. Also, another research may include more dimensions and sub-constructs of both project complexity and project performance. Moreover, the measurement of the knowledge creation styles is subject for further research on the improvement of this measurement to include more items. Further research is needed to be focused on each industrial sector separately for better contextual and situational actionable contributions to the project managers. Further research is needed on different instability problems and for each classification of these problems like a separate study on the planning problems, another one on implementation problems, and a third one on the external uncontrollable problems affecting the project performance. Another further research is needed to consider the measurement of complexity and project success on the level of several projects belonging to one organisation and to measure this on a constant sum like what (Vidal, 2011) did in his measurement of complexity. A classification of types of complexities and their independent impacts on the project performance and the knowledge creation will add to the body of knowledge. Conducting the same research using longitudinal study or multiple crosssectional ones as well as using the stratified sample rather than the simple random one will add more accurate contributions to the body of knowledge. Considering the stages of managing project performance, starting from the conformance between the planned one and the actual one and then moving to the success with customers and the stability of this success, will illustrate more valuable conclusions related to the determination of theses stages of performance management by the level of project complexity. Another further research is needed to include the effect of the culture in details on the suggested and tested framework and model of the current study.

8.7 Personal Implications

On the personal level, the researcher has few published works in the fields of project management and knowledge management and aims at increasing the published work in the same area of knowledge as well as to contribute to the academic work and the societal work in this area. The experience and working in the MENA region enabled the researcher to understand the non-verbal clues of the interviewees during interviews, and this adds to the interpretation of the results in the light of the eagerness of achieving success and the culture of avoiding blame. This gives the researcher the ability to employ this experience collected through and during the data collection period to continue this effort to the contribution to consultation services in this field for project-based organisations and sectors, especially in the MENA region.

8.8 Chapter summary

This chapter describes the journey to reach significant contributions to the body of knowledge and it also speaks about a human being effort that has its strengths and weaknesses s. The chapter describes the step of research that is taken by conducting this study and the further steps that are to come to continue the journey of research in the area of project management in relation to the science of knowledge management. Despite the challenges of self-funding and having no sponsor, time constraints, inability to collect confidential documents about the measurements of performance indicators, and the repeated attempts of arranging appointments with more than 100 interviewees as well as the collection of surveys, along with the unavoidable researcher's bias. The researcher expended many efforts to minimize and surmount these obstacles to succeed in completing this research. In fact, the success of conducting this research depended on following the rules of conducting a scientific research and the ability to find the gap in the body of knowledge and to search for valid reliable and generalizable answers to a number of non-answered research questions qualitatively and quantitatively.

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Appendices

Appendix 1 – Research Questionnaire and Interview Points

Project Manager's Knowledge Creation Styles and Both Complexity and Stability of Project Performance Introduction:

The Aim of this questionnaire is to identify styles of knowledge creation used by project managers in projects with different degrees of complexity and levels of project performance. If you are a manager of any project that has an implementation period of at least 2 years and has a due date to finish, please fill this questionnaire. Thank you for your cooperation.

Consent:

I Hereby agree to answer this questionnaire, and I am aware that I can withdraw from this study at any time during the data collection. The individual data collected by this questionnaire will remain confidential and will be used for research purposes only. I am aware that the researcher is responsible for the security of storing the data. Accordingly, I confirm that the data I give is a genuine data.

Signature:----- Date:-----

Mrs. Rasha Abou Samra

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Email address *

Demographic Information

Nationality

UAE













Gender

Mark only one oval.



Education

For how long have you been continuously studying PM?





Current education Level "Minor"

Are you certified in project management?

Mark only one oval.



Did you study project management as part of your academic or professional education?

Mark only one oval.



Current level of education

Mark only one oval.



Project manager experience

How long have you been working as a project manager?





How many projects you are currently managing?

Mark only one oval.



Study subject project

How long have you been working on the current project?





More than 3 years

The customer of this project is

Mark only one oval.

© Public sector business customer
© Private sector business customer
© Mixed sector business customer
© Individual customer
Other:

How long have you been managing the current project?



О More than 6

Which part\s of the project are you managing?



Are you the only manager of the current project?

Mark only one oval.



What is the category of number of workers in this project?



What kind of project is the current one?



0		
\sim	Other:	

What is the final product of this project?

. 1			

This project belongs to

Mark only one oval.

© Public sector
© Private sector
© Mixed sector
Other:

Determinants of successful project manager

Which factor is more effective for successful project management?

0	My Experience
0	My Education





Which factor is more important to you as a successful project manager?

Mark only one oval.



The Effect of Project Operational Size on Complexity

Rate each of the following factors according to its importance in contributing to the level of complexity of the current project.

In general, the importance of the effect of the project operational SIZE on complexity

Mark only one oval.

1 2 3 4 5

High importance	0	0	0	0	0	Low importance			

NUMBER OF INVESTORS in the current project

	1	2	3	4	5			
High importance	0	0	0	0	0	Low importance		
NUMBER	OF SU	JPPLIE	RS in	the curr	rent pro	ject		
Mark only	one ov	al.						
	1	2	3	4	5			
High Importance	0	0	0	0	0	Low importance		
NUMBER	OF W	ORKEI	RS in t	he curr	ent proj	ect		
Mark only	one ov	al.						
	1	2	3	4	5			
	1	2	3	4	5			
High importance	0	0	0	0	0	Low importance		
DURATIC)N of th	ne curre	ent proj	ect				
Mark only	one ov	al.						
	1	2	3	4	5			
High Importance	0	0	0	0	0	Low importance		
The Effect of Pr	oject V	Variety	on Co	mplexi	ty			
In general,	the im	portanc	e of the	e effect	of VA	RIETY in the project of	perational s	system
complexity	/							
Mark only	one ov	al.						
	1	2	2	4	F			
	1	2	3	4	3			

High importance	0	0	0	0	0	Low importance	
VARIETY	OF IN	FORM	ATION	I SYST	'EMS u	sed in the current	project

	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
VARIETY	OF GE	EOGRA	PHICA	AL LOO	CATIO	NS in the current	project					
Mark only	one ove	al.										
	1	2	3	4	5							
High importnace	0	0	0	0	0	Low importance						
VARIETY	AND	CONFI	LICTS	AMON	G PRO	JECT's GOALS						
Mark only	one ove	al.										
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
The Effect of Level of Project Interdependency on Complexity												
INTER-DEPENDENCIES BETWEEN SITES, DEPARTMENTS, AND COMPANIES FOR												
IMPLEME	INTING	G THE	CURR	ENT PI	ROJEC	Т						
Mark only	one ova	al.										
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
INTER-DE	EPEND	ENCIE	S BET	WEEN	INFO	RMATION SYST	EMS IN THE CURRENT					
PROJECT												
Mark only	one ova	al.										
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						

INTER-CONNECTIVITY & FEEDBACK LOOPS IN THE TASKS & NETWORKS IN THE

CURRENT PROJECT

Mark only one oval.

	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
In general, the importance of the effect of the Level of interdependency with other projects and												
systems on complexity												
Mark only one oval.												
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
AVAILAE	AVAILABILITY OF PEOPLE, MATERIALS, & ANY RESOURCES DUE TO SHARING											
WITH OTHER PROJECTS												
Mark only one oval												
mark only one oval.												
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
DEPENDE	ENCIES	S BETV	VEEN	SCHEI	DULES	OF IMPLEMEN	TATION OF THE CURRENT					
PROJECT	WITH	OTHE	R PRO	JECTS								
Mark only	one ov	al.										
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
INTER-DI	EPEND	ENCIE	ES BET	WEEN	OBJE	CTIVES OF THE	CURRENT PROJECT					
Mark only	one ov	al.										

1 2 3 4 5

High importance	0	0	0	0	0	Low importance						
PROCESSES INTER-DEPENDENCIES OF THE CURRENT PROJECT												
Mark only	Mark only one oval.											
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
TEAM COMMUNICATION AND COOPERATION PROBLEMS												
Mark only one oval.												
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
LEVEL O	F INTE	RREL	ATION	BETW	/EEN F	PROJECT PHASES						
Mark only	Mark only one oval.											
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						

The Effect of Environmental and Cultural Context complexity on Complexity

DEPENDENCIES BETWEEN THE CURRENT PROJECT AND EXTERNAL

ENVIRONMENT

Mark only one oval.

1 2 3 4 5

High importance	0	0	0	0	0	Low importance
-----------------	---	---	---	---	---	----------------

In general, the importance of the effect of the complexity of Environmental and cultural contexts

of the project on complexity

Mark only one oval.

	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
Networked	Networked environment (environmental complexity)											
Mark only	Mark only one oval.											
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						
Cultural co	onfigura	ation an	d varie	ty in th	is proje	ect						
Mark only	one ov	al.										
	1	2	3	4	5							
High importance	0	0	0	0	0	Low importance						

Do you think that the level of project complexity affects your project's planned performance? If yes, how?

Do you think that the level of project complexity may lead to performance deviations? If yes, give an example.

Sources of Knowledge Creation during Performance Stability and Instability

Rate the following sources of new knowledge creation to you during stability and instability of

the project performance "stability is when the project is functioning properly as or better than estimated"

First - During Stability

Source 4 "During stability": Using your previous years' experience											
Mark only	one ov	al.									
	1	2	3	4	5						
High importance	0	0	0	0	0	Low importance					
Source 1"During Stability": Stored data, databases, information systems, files, and documents											
Mark only	one ov	al.									
	1	2	3	4	5						
High importance	0	0	0	0	0	Low importance					
Source 2 "	During	stabilit	y": Tea	ım men	nbers' k	nowledge and cor	isultation				
Mark only	one ov	al.									
	1	2	3	4	5						
High importance	0	0	0	0	0	Low importance					
Source 3 "	During	stabilit	y": Opj	posing	the nor	mal routine and us	ing your creativity				
Mark only	one ov	al.									
	1	2	3	4	5						
High importance	0	0	0	0	0	Low importance					
Second - During	g Instal	bility									

Source 4 - "During Instability": Using your previous years' experience

	1	2	3	4	5		
High importance	0	0	0	0	0	Low importance	
Source 1 "	During	Instabi	lity" St	ored da	ita, data	bases, information	systems, files, and documents.
Mark only	one ov	al.					
	1	2	3	4	5		
	1	2	5	-	5		
High importance	0	0	0	0	0	Low importance	
Source 2 -	"Durin	g Instal	oility" :	Team	membe	rs' knowledge and	l consultation
Mark only	one ov	al.					
	1	2	3	4	5		
	1	2	5	+	5		
High importance	0	0	0	0	0	Low importance	
Source 3 -	"Durin	g Instał	oility":	Opposi	ng the	normal routine and	l using your creativity
Mark only	one ove	al.					
	1	2	3	4	5		
High importance	0	0	0	0	0	Low importance	
Why do you cre	ate nev	v know	ledge?	Rate t	he foll	owing reasons	
Other reaso	ons nle	ase sne	cify			8	
		use spe	,en y				
To innovat	e some	thing n	ew and	disting	uished	in my project	
Mark only	one ove	al.					
	1	2	3	4	5		
High importance	0	0	0	0	0	Low importance	

To make best use of different specializations in my project team

Mark only one oval.

 1
 2
 3
 4
 5

 Hgih importance
 O
 O
 O
 O
 Low importance

To make best use of my personal experience

Mark only one oval.

1 2 3 4 5

To avoid potential risks or to minimize current ones for higher safety levels

Mark only one oval.

1 2 3 4 5

High importance	0	0	0	0	0	Low importance
-----------------	---	---	---	---	---	----------------

To what extent do you think that your project is implemented as planned?



0	
\sim	96% to 100%

Styles of Knowledge Creation - to what extent do you agree with each of the following

statements?

Safety precautions enables me to stabilize my project performance.

Mark only one oval.

	1	2	3	4	5						
Strongly agree	0	0	0	0	0	Strongly disagree					
I try to innovate something new to cope with chaotic changes in my project performance.											
Mark only one oval.											
	1	2	3	4	5						
Strongly agree	0	0	0	0	0	Strongly disagree					
I depend	I depend on others' experience to learn new things.										
Mark on	ly one	oval.									
	1	2	3	4	5						
Strongly agree	0	0	0	0	0	Strongly disagree					
Risk avo	oidance	is my f	ïrst pri	ority in	manag	ing chaotic changes	in my project performanc				
Mark on	ly one	oval.									
	1	2	3	4	5						
Strongly agree	0	0	0	0	0	Strongly disagree					

I push the decision-making process to lower levels if I don't have enough information to make it.

	1	2	3	4	5						
Strongly agree	0	0	0	0	0	Strongly disagree					
I used my educational background when managing this project.											
Mark only one oval.											
	1	2	3	4	5						
Strongly agree	0	0	0	0	0	Strongly disagree					
Innovati	ons is r	ny best	course	of acti	on to so	olve chaotic problen	ns during project implementation.				
Mark on	ly one	oval.									
	1	2	3	4	5						
Strongly agree	0	0	0	0	0	Strongly disagree					
Dependi	ng on c	liversif	ied spe	cializat	ions is	ineffective in manag	ging chaotic situations.				
Mark on	ly one	oval.									
	1	2	3	4	5						
Strongly agree	0	0	0	0	0	Strongly disagree					
I depend	on col	lecting	inform	ation a	bout co	mpetitors to create 1	new knowledge.				
Mark on	ly one	oval.									
		_			_						
	1	2	3	4	5						
Strongly agree	0	0	0	0	0	Strongly disagree					
When I t	ake cri	tical de	cisions	, I depe	end on t	he available databas	ses more than my feelings and				
personal	skills.										

	1	2	3	4	5					
Strongly agree	0	0	0	0	0	Strongly disagree				
I disrega	rd thin	king of	what I	have st	udied v	when dealing with chaotic changes in my project.				
Mark only one oval.										
	1	2	3	4	5					
Strongly agree	0	0	0	0	0	Strongly disagree				
I use my	experi	ence fo	r dealir	ng with	chaotic	situations in project management.				
Mark on	ly one o	oval.								
	1	2	3	4	5					
Strongly agree	0	0	0	0	0	Strongly disagree				
My stud	y helpe	d me to	achiev	ve my p	roject g	goals				
Mark on	ly one o	oval.								
	1	2	3	4	5					
Strongly agree	0	0	0	0	0	Strongly disagree				
Others' of	experie	nce ena	ıbles m	e to cor	nnect pi	eces of knowledge.				
Mark on	ly one o	oval.								
	1	2	3	4	5					
Strongly agree	0	0	0	0	0	Strongly disagree				
Feelings	and sk	ills are	more in	nportai	nt to me	e than databases and documents when creating new				
knowled	ge.									

	1	2	3	4	5					
Strongly agree	0	0	0	0	0	Strongly disagree				
I don't fe	eel con	nfortabl	e with	changir	ng the v	vay I manage the pro	oject			
Mark only one oval.										
	2									
	1	2	3	4	5					
Strongly agree	0	0	0	0	0	Strongly disagree				
My expe	rience	enables	s me to	familia	rize wi	th a new change in t	he environment.			
Mark on	ly one	oval.								
	1	2	3	1	5					
	1	2	5	-	5					
Strongly agree	0	0	0	0	0	Strongly disagree				
Controll	ing risk	s is not	t the fir	st prior	ity goal	of this project.				
Mark on	ly one	oval.								
	1	2	3	1	5					
	1	2	5	-	5					
Strongly agree	0	0	0	0	0	Strongly disagree				
I practic	ally ign	ore kee	ping co	ontinge	ncy res	erve for dealing wit	h expected risks to increase my			
profits.			_	_		-				
Mark on	ly one	oval.								
	1	2	3	4	5					
						1				
Strongly agree	0	0	0	0	0	Strongly disagree				
I keep co	ontinge	ncy res	erve on	ly for c	lealing	with expected risks	that I am sure it will affect my			

project performance.

	1	2	3	4	5							
Strongly agree	0	0	0	0	0	Strongly disagree						
My Social networks help me in creating new knowledge.												
Mark only one oval.												
	1	2	3	4	5							
Strongly agree	0	0	0	0	0	Strongly disagree						
Changin	g the p	lan is n	ot my f	avourit	e copin	g solution for unexpected changes.						
Mark on	ly one	oval.										
					_							
	I	2	3	4	5							
Strongly agree	0	0	0	0	0	Strongly disagree						
I focus o	on one s	pecialt	y to dea	al with	new ch	anges.						
Mark on	ly one	oval.										
	1	2	3	4	5							
Strongly agree	0	0	0	0	0	Strongly disagree						
My perfe	ormanc	e in the	past is	an inp	ut for c	reating new knowledge.						
Mark on	ly one	oval.										
	1	2	2	4	F							
	1	L	3	4	3							
Strongly agree	0	0	0	0	0	Strongly disagree						
Measurement	s of Pr	oject C	Cost									

Kindly fill the following indicators for your current project

The percentage of the out of budget cost relative to the planned cost is



What is the percentage of resource utilization variance to plan? (Percentage of deviation between actual utilization of resources and planned one for the whole project) (XX%)

The percentage of the raw material's cost relative to the total cost in the current project is



The percentage of returns on investment of the current project is

Mark only one oval.



What is the percentage of cost variance to plan? (Percentage of deviation between the planned cost and the actual cost of the project in total) (XX%)

What is the percentage of out-of-budget costs relative to planned costs? (Percentage of deviation between the planned cost and the out of budget cost of the project in total) (XX%)

What is the percentage of variance between planned raw materials costs and actual raw materials costs? (XX%)

The percentage of resource utilization variance to plan in the current project is

Mark only one oval.



The percentage of cost savings in the current project is



The percentage of variance between planned raw material costs and actual raw material costs is

Mark only one oval.



The average cost / hour for the current project is



What is the percentage of cost savings? (Percentage of total project costs savings relative to the planned costs) (XX%)



Current Project Cost is

Mark only one oval.



What is the percentage of returns on investment? (Return on an investment relative to the

investment's cost) (XX%)

The percentage of cost variance to plan in the current project is


What is the percentage of raw material's costs relative to total project costs? (XX%)

What is the average cost/hour in the current project? (The cost of each working hour on average

during the implementation of this project) (XX/Hour)

Measurements of Project Productivity

What is the average percentage of working hours per month? (total working hours per each

month divided by number of months) (XX%)

What is the percentage of number of milestones missed relative to number of milestones

planned? (XX%)

The percentage of number of milestones missed relative to number of milestones planned in the

current project is





What is the percentage of successful phase exit against milestones planned? (number of phases

implemented on time to total number of phases) (XX%)

The percentage of profit per employee costs in the current project is



The average percentage of working hours per month in the current project is

Mark only one oval.



What is the percentage of profit per employee costs? (percentage of project's net profits divided by employee total cost) (XX%)

The average percentage of downtime to the total working time per day in the current project is *Mark only one oval.*





The Percentage of successful phase exit against milestones planned in the current project is





What is the average percentage of downtime to the total working time per day? (percentage of time consumed in maintenance, warming up, breaks, lunch time and so on to the total working time) (XX%)



Measurements of product quality

What is the percentage of rework time? (number of rework working hours divided by total

working hours per project) (XX%)

What is the percentage of errors detected during design and process reviews? (total number of errors detected before delivery divided by the total number of errors per project) (XX%)

The percentage of errors detected during design and process reviews in the current project is *Mark only one oval.*

C Higher than estimated
C Slightly higher than estimated
© As estimated
© Slightly lower than estimated
C Lower than estimated

What is the defect rate? (percentage of nonconformance to the project required standards)

(XX%)

The percentage of customer satisfaction up to the current stage of the current project is





The percentage of rework time in the current project is





What is the percentage of customer satisfaction? (percentage of customer satisfaction with project performance and quality after project delivery or up to the current stage) (XX%)

The number of training courses provided for the project manager of the current project is *Mark only one oval.*



The defect rate in the current project is

Mark only one oval.



What is the number of training courses of project manager per year? (total number of training courses related to the project performance and taken by the project manager) (XX)

Measurement of project timing

What is the percentage of overtime? (Percentage of total amount of overtime paid to the workers divided by their total basic salaries) (XX%)

The project actual cycle time against the planned cycle time is

Mark only one oval.



What is the percentage of cost savings due to early delivery? (Percentage of cost savings due to early delivery divided by the total planned costs of the project) (XX%)

The planning time needed for the current project is



What is the project actual cycle time against planned cycle time? (Total cycle time of the project since start to the end "or until now" against the planned cycle time) (XX)

The number of days needed to supply the main resource in the current project is



Lower than estimated

What is the average time required to process a request for corrective action? (XX)

What is the number of days needed to supply main resource? (How many days do you need to

supply the needed inventory of your main resource?) (XX)

The main resource waiting time in the current project is

Mark only one oval.



The percentage of overtime in the current project is





What is the main resource waiting time? (Number of days or hours of waiting time for the

project's main resource in stores) (XX)

What is the dollar value of time variance- plus or minus (Percentage of variance between actual project costs and planned project costs IN DOLLARS- plus or minus) (XX%)

What was the project planning time (Number of days or hours needed to plan for this project)

(XX)?

The dollar value of time variance in the current project is

Mark only one oval.

Higher than estimated





The percentage of cost savings due to early delivery in the current project is





The average time required to process a request for corrective action in the current project is





Appendix 2: Questionnaire Survey of KCSs with the 24 Items Sent to All Respondents with Coding

No.	Questions or items of Styles of Knowledge Creation	Variable names	Coding
1	Safety precautions enables me to stabilize my project performance. (RA)	RAKCS1	SA=5,A=4,M=3,DisA=2,SDisA=1
2	Risk avoidance is my first priority in managing chaotic changes in my project performance. (RA)	RAKCS2	SA=5,A=4,M=3,DisA=2,SDisA=1
3	Controlling risks is not the first priority goal of this project. (RA-)	RAKCS3	SA=1,A=2,M=3,DisA=4,c SDisA=5
4	I practically ignore keeping contingency reserve for dealing with expected risks to increase my profits (RA-)	RAKCS4	SA=1,A=2,M=3,DisA=4,c SDisA=5
5	I keep contingency reserve only for dealing with expected risks that I am sure it will affect my project performance. (RA)	RAKCS5	SA=5,A=4,M=3,DisA=2,SDisA=1
6	Changing the plan is not my favourite coping solution for unexpected changes. (RA)	RAKCS6	SA=5,A=4,M=3,DisA=2,SDisA=1
7	I don't feel comfortable with changing the way I manage the project (INN-)	IKCS1	SA=1,A=2,M=3,DisA=4,c SDisA=5
8	I try to innovate something new to cope with chaotic changes in my project performance. (INN)	IKCS2	SA=5,A=4,M=3,DisA=2,SDisA=1
9	Innovations is my best course of action to solve chaotic problems during project implementation. (INN)	IKCS3	SA=5,A=4,M=3,DisA=2,SDisA=1
10	I depend on collecting information about competitors to create new knowledge. (INN)	IKCS4	SA=5,A=4,M=3,DisA=2,SDisA=1
11	My Social networks help me in creating new knowledge. (INN)	IKCS5	SA=5,A=4,M=3,DisA=2,SDisA=1
12	Feelings and skills are more important to me than databases and documents when creating new knowledge. (INN)	IKCS6	SA=5,A=4,M=3,DisA=2,SDisA=1
13	I depend on others' experience to learn new things. (EXP)	EKCS1	SA=5,A=4,M=3,DisA=2,SDisA=1
14	When I take critical decisions, I depend on the available databases more than my feelings and personal skills. (EXP)	EKCS2	SA=5,A=4,M=3,DisA=2,SDisA=1
15	Others' experience enables me to connect pieces of knowledge. (EXP)	EKCS3	SA=5,A=4,M=3,DisA=2,SDisA=1
16	I use my experience for dealing with chaotic situations in project management. (EXP)	EKCS4	SA=5,A=4,M=3,DisA=2,SDisA=1
17	My experience enables me to familiarize with a new change in the environment. (EXP)	EKCS5	SA=5,A=4,M=3,DisA=2,SDisA=1
18	My performance in the past is an input for creating new knowledge. (EXP)	EKCS6	SA=5,A=4,M=3,DisA=2,SDisA=1
19	I push the decision-making process to lower levels if I don't have enough information (SPEC)	SKCS1	SA=5,A=4,M=3,DisA=2,SDisA=1
20	I used my educational background when managing this project. (SPEC)	SKCS2	SA=5,A=4,M=3,DisA=2,SDisA=1
21	Depending on diversified specializations is ineffective in managing chaotic situations. (SPEC-)	SKCS3	SA=1,A=2,M=3,DisA=4,c SDisA=5
22	I disregard thinking of what I have studied when dealing with chaotic changes in my project. (SPEC-)	SKCS4	SA=5,A=4,M=3,DisA=2,SDisA=1
23	My study helped me to achieve my project goals (SPEC)	SKCS5	SA=5,A=4,M=3,DisA=2,SDisA=1
24	I focus on one specialty to deal with new changes. (SPEC)	SKCS6	SA=5,A=4,M=3,DisA=2,SDisA=1

Appendix 3 - Items Dropped to Improve the Goodness of Fit of SEM Analysis

No.	Questions or items of Styles of Knowledge Creation	Variable names	Coding
1	Safety precautions enables me to stabilize my project performance. (RA)	RAKCS1	SA=5,A=4,M=3,DisA=2,SDisA=1
2	Risk avoidance is my first priority in managing chaotic changes in my project performance. (RA)	RAKCS2	SA=5,A=4,M=3,DisA=2,SDisA=1
3	Controlling risks is not the first priority goal of this project. (RA-)	RAKCS3	SA=1,A=2,M=3,DisA=4,c SDisA=5
4	I practically ignore keeping contingency reserve for dealing with expected risks to increase my profits (RA-)	RAKCS4	SA=1,A=2,M=3,DisA=4,c SDisA=5
5	I keep contingency reserve only for dealing with expected risks that I am sure it will affect my project performance. (RA)	RAKCS5	SA=5,A=4,M=3,DisA=2,SDisA=1
6	Changing the plan is not my favourite coping solution for unexpected changes. (RA)	RAKCS6	SA=5,A=4,M=3,DisA=2,SDisA=1
7	I don't feel comfortable with changing the way I manage the project (INN-)	IKCS1	SA=1,A=2,M=3,DisA=4,c SDisA=5
8	I try to innovate something new to cope with chaotic changes in my project performance. (INN)	IKCS2	SA=5,A=4,M=3,DisA=2,SDisA=1
9	Innovations is my best course of action to solve chaotic problems during project implementation. (INN)	IKCS3	SA=5,A=4,M=3,DisA=2,SDisA=1
10	I depend on collecting information about competitors to create new knowledge. (INN)	IKCS4	SA=5,A=4,M=3,DisA=2,SDisA=1
11	My Social networks help me in creating new knowledge. (INN)	IKCS5	SA=5,A=4,M=3,DisA=2,SDisA=1
12	Feelings and skills are more important to me than databases and documents when creating new knowledge. (INN)	IKCS6	SA=5,A=4,M=3,DisA=2,SDisA=1
13	I depend on others' experience to learn new things. (EXP)	EKCS1	SA=5,A=4,M=3,DisA=2,SDisA=1
14	When I take critical decisions, I depend on the available databases more than my feelings and personal skills. (EXP)	EKCS2	SA=5,A=4,M=3,DisA=2,SDisA=1
15	Others' experience enables me to connect pieces of knowledge. (EXP)	EKCS3	SA=5,A=4,M=3,DisA=2,SDisA=1
16	I use my experience for dealing with chaotic situations in project management. (EXP)	EKCS4	SA=5,A=4,M=3,DisA=2,SDisA=1
17	My experience enables me to familiarize with a new change in the environment. (EXP)	EKCS5	SA=5,A=4,M=3,DisA=2,SDisA=1
18	My performance in the past is an input for creating new knowledge. (EXP)	EKCS6	SA=5,A=4,M=3,DisA=2,SDisA=1
19	I push the decision-making process to lower levels if I don't have enough information (SPEC)	SKCS1	SA=5,A=4,M=3,DisA=2,SDisA=1
20	I used my educational background when managing this project. (SPEC)	SKCS2	SA=5,A=4,M=3,DisA=2,SDisA=1
21	Depending on diversified specializations is ineffective in managing chaotic situations. (SPEC-)	SKCS3	SA=1,A=2,M=3,DisA=4,c SDisA=5
22	I disregard thinking of what I have studied when dealing with chaotic changes in my project. (SPEC-)	SKCS4	SA=5,A=4,M=3,DisA=2,SDisA=1
23	My study helped me to achieve my project goals (SPEC)	SKCS5	SA=5,A=4,M=3,DisA=2,SDisA=1
24	I focus on one specialty to deal with new changes. (SPEC)	SKCS6	SA=5,A=4,M=3,DisA=2,SDisA=1

Appendix 4 – Interview Points of Discussion and Questions

Do you expect that costs of the current project will be higher or lower than planned? And why? Give a brief idea about your project (goals, resources, technology used, context and structure of work)

Give examples of unexpected problems as a project manager and how you dealt with them? How does innovating new ideas affect your project performance? Give examples

Do you prefer creating new knowledge during stability periods of your project or during instability periods? And why?

How does your personal experience affect your project performance? Give examples Do you expect the real time needed to implement the current project will be longer or shorter than planned? and why?

How does risk management and taking possible precautions affect your project performance? Give examples.

What are the areas in your project performance in which you can accept instability and what is the maximum percentage of instability do you expect or accept? accept?

Do you expect that profits of the current project will be higher or lower than planned? And why?

In your opinion, what are the main reasons behind the instability of project performance?

How does new knowledge creation affect your project performance? Give examples

How do specialization and certification in project management affect your project performance? Give

Do you consider the performance of the current project as stable? And Why?

This is a required question Thank you for your time and cooperation!

Appendix 5 – Sample Transcript of the Interview with Project Managers

Interview one: file name "ID 22.m4a"

A general Idea about the project:

This project is producing cosmetics and perfumes that are customized and tailored to each company. It is a business to business project. This is an individual private sector project. The life of the project is 3 years. This is a project that is based on the demand of the customer in the market. In this project we are using herbals and natural raw materials as an input to our product. This mainly comes from Gulf area and Egypt. We are trying to add to it a mix of raw materials that comes from Asian countries to increase the quality of the product the hence the number of customers in the marketplace.

How does the knowledge creation affect your project?

There are many kinds of the knowledge and the main type of knowledge that we need is the knowledge created about the customer needs and the second important type of knowledge is the knowledge about the supply of my raw materials according to the first type of knowledge about the customers' needs.

What are the aspects in this project that you feel that are unstable and what is maximum level of instability that you accept in this project?

We measure the level of stability by the ability to achieve our objectives. If we are not achieving the objective then we are in an instability situation. Especially when our achievement is less than the targeted objective. If there are uncontrollable factors like the increase in the dollar price or the unavailability of some raw materials especially the imported ones, this can greatly affect the stability of our performance. How does your personal experience affect your project performance?

This is a very important part of the project because this is an individual private project. I benefit from the experience of others by collecting the needed data and information from them to be able to have a successful project and I collect the experience of other in the field of project management to be able to communicate with traders and suppliers. It is very important to have enough amount of data to be able to deal with variables in the market.

Do you think that your study affects the project performance?

My Study is important but not that much because you may study in a field and have your project in another field. In my opinion the most important kind of study is the study of the market.

How does the risk management affect the performance of your project? What kind of precautions do you take to avoid any kind of risks?

Risk management must be limited because if it exceeds the needed percentage it will represent an obstacle for better project performance. I must take the risk management into consideration but I can't start by the risk management at the beginning of the project because this is minimizing the target profit that I want to achieve especially at the beginning of the project. For me it is a second step. When I feel that there is risk or that I am close to have risks I start to change the plan to prepare my project to face this risk. I put into consideration what type of risks am I facing.

How does the specialization and certification in the project management on the project performance? The certificate of project management is important in the field of project management and it enables us to manage in theoretical and also practical ways. I join the two parts to each other and I can reach good results in the process of project planning. I can achieve better results because of the certificate of the project management.

How does the innovation of new ideas affect your project?

To make any project succeed there has to be not less than 10% innovation in the project to be able to attract customers and to compete well in the market. This has to focus on the end user which is an indirect customer for us but this makes the project succeed.

Which do you prefer more; creating new knowledge during the stability period or during the instability period of the project performance?

During the stability period we can create new knowledge for innovation purposes. During instability period we are forced to create new knowledge to get back to the stability of the project performance. Knowledge creation is very important because we need to create new knowledge all the time.

Give examples about unexpected problems and how did you deal with it in this project?

Some of the unexpected problems are related to the country in which I am working. For example, new laws or legislations. Mainly legislations related to products and importing and exporting. Sometimes there are legislations related to financial issues. These are the main obstacles that are uncontrollable and at the

same time it is unexpected to a great extent. There are other types of problems there are more expected like seasonal demand or inflation and we are able to cope with it effectively.

Do you expect that the costs of the current project are higher or lower than the planned ones?

Usually we expect that the cost will be higher in real life so when we plan, we put higher than what we expect. Sometimes the rapid increase in prices and wages of workers are higher than expected and this is our main problem.

Do you expect that the profit of the current project is higher or lower than what is expected?

Profitability is strongly related to cost, so if the cost increases the profitability will become less.

Do you expect that the actual time needed to implement the current project will be higher or lower than what was planned?

Currently due to the market conditions and the investment abilities we expect than the implementation will be slower than planned.

Do you think that the performance of the current project is stable?

In general, we live in unstable trading environment. Other types of projects like consultation projects may be more stable than production projects.

What are the main reasons behind the instability of the project performance?

- 1- The project planning
- 2- Project environment
- 3- The starting up phase of the project
- 4- Challenging and risks of dealing with those challenges
- 5- The most important stage that will affect the project stability is the planning stage of the project.

Appendix 6: Emerging Constructs from the Qualitative Research

In the following part of this chapter, the study explains the emerging constructs that were investigated by interviewing project managers. These emerging constructs are considered as contributions to the body of science; however, they are not directly related to the objective and purpose of the current study.

How does the new knowledge creation affect your project's performance?

The following table shows new constructs representing the relationship between the creation of new knowledge and the project performance. These constructs represent suggestions for further research.

#	Emerging	Project managers' responses
	constructs	
1	New market	• When you create new knowledge, you create new projects in the future
	opportunities	• It helps in better estimation for future variables
		• Leading to further knowledge creation and contribution to the success of the
		project.
2	Increasing trust	• It enables you to trust the right people
		 When we use the test automation this enables us to test and estimate efforts by 50% accuracy
		• It helps in better estimation for future variables
		• Anything I don't understand is a new knowledge for me

Figure 11.1Emerging constructs of the impact of KC on project performance

		0	Leading to further knowledge creation and contribution to the success of the project.
3	Easiness of	o	1- New knowledge helped me in the selection of resources
	processing	o	It eases the next phases of the current project
		o	It makes future projects easier
		o	For example, dealing with a new tool, or new team member in any project
			phase is considered as a creation of a new knowledge.

Source: Adapted from the interviews feedback

In the above table, there are three new constructs that show the relationship between the knowledge creation and the project performance. The first construct is that the creation of new knowledge leads to the creation of new market opportunities. The creation of new knowledge means better estimation of future opportunities, and this leads to more marketing and, hence, to better opportunities for future success for the project. The second emerging construct is increasing trust with the right people. This happens through increasing the accuracy of estimation by creating new knowledge and building on it. Increasing samples leads to increasing accuracy of estimation, and this increases trust in results. Future variables in chaotic environments are critical for the success of the project performance. The estimation itself represents a new knowledge for project managers. The continuous creation of new knowledge is increasing the accuracy of estimating the trends and future variance and possible changes. This keeps the project manager's decision more accurate through time. Moreover, there is another new construct that emerged from the interviews. It is the easiness of processing. Based on the creation of new knowledge, the processing will be easier for implementers and performers. New knowledge helped project managers to choose better resources and to raise the quality of choosing appropriate economic resources for their projects. This decreases the

rework and increases the quality of the processing in shorter period of time and with higher levels of quality. The easiness of processing includes the smoothness of moving from one phase to another. This easiness of processing is a reason for future smoothness of performance in other future projects, so the managers reported that new knowledge makes future projects easier. For example, dealing with a new tool, or new team member in any project phase is considered as a creation of a new knowledge.

How does	personal ex	perience	affect your	project	performance?
		F		F . J	

Figure 11.2 Emerging constructs from asking about the relationship between personal experience and project performance

#	New	Project managers' responses
	constructs	
1	Managerial	 do proper planning in future projects
	process functioning	• Delegation of authority to team members especially in planning
		• Knowledge about the business and the experience about the project management
		help in putting a successful plan.
		• Experience and knowledge are the main keys for successful project management.
		• Making intermediate managerial checkpoints helps the project manager to
		discover any performance deviation early and fix it.
		• Experience enables the project manager to have better control over the emerging
		risks and conflicts
		• As I managed many projects and know how to deal with the unexpected issues
		and how to build continuity plan, I believe that I won't be able to do that without
		my experience.
2	Effectiveness	• Delegation of authority to team members especially in planning
	of leadership	• How to create commitment need a lot of experience

	o	Experience is needed for the high level of communication with all parties
	o	Experience is needed to minimize the resistance to change
	o	Keeping strong network connections will provide alternative solutions to issues
		and deviations that may occur.
	o	Experience has a positive effect on suggesting workarounds
	o	Experience helps in managing communication smoothly with stakeholders
	o	As a project manager my role is strongly related to my personal experience and it
		becomes part of my profession especially in the area of communication
		management.
	o	Experience helps in resolving issues that are of the same nature and that the
		project manager came across in the previous implementations.

Source: Adapted from the interviews feedback

The table above shows the emerging constructs from asking interviewees about the relationship between personal experience and the project performance. There are two emerging constructs. The first construct is the managerial processes functioning. The name of the construct is judgmental to reflect the planning process, the delegation of authority, setting the checkpoints of the project and early discovering of possible deviations and fixing them. It also includes controlling and managing project risks and conflicts. As a conclusion, better management based on the knowledge creation leads to longer period of continuity of project successful life.

The second construct is the effectiveness of leadership. Project managers believe that they can use new knowledge in delegating authorities to their team members, especially planning functions. New knowledge is related to better commitment of project leaders, and this represents a new link between project leadership and knowledge creation processes. Experience increases the level and effectiveness of communication with all parties inside and outside the project boundaries. Better project performance is accompanied with the higher levels of experience, and this is explained in terms of the link between the accumulated experience and the ability to lower the possible levels of resistance to change in the project performance. This means that the change in the project performance will become easier and more flexible and leads to smoother implementation in the light of experiential knowledge creation. Experiential knowledge creation keeps strong network connections, which increases the flexibility of collecting different points of view and alternative solutions to performance issues and deviations. Experiential knowledge creation feeds the project performance with new suggestions, better and smoother

How does risk averse and taking possible precautions affect the performance of your project?

Figure 11.3 Emerging constructs related to the association between risk-averse knowledge creation and the project performance

#	New	Project managers' responses
	constructs	
1	Pre-start	Risk management supports planning ahead
	Decisions	 Quick decisions are the highest risks in project management but if it was supported by risk management this will help the project manager a lot.
		• Possible risks should be identified at the beginning of the project because this
		will enable the manager to start the mitigation process earlier. There are many
		examples on this. One example was that the environment was not ready to start
		the process and we decided to work on our virtual machines to pass the first
		milestone of the project.
		 Risk management affects the project performance by helping the project manager to plan ahead.
		• Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on

			the peak hour so the crashing cost can be identified at early stage and causes no
			problem in the project performance.
		0	Incomplete and unclear scope of work lead to more focus on gap analysis phase.
		o	This is important at the start up process of the project especially regarding the
			delivery time of the hardware versus the installation time frame. If there is delay
			in the delivery time due to customized procedures the installation team must be
			fully utilized to compensate this delay. This may happen in this project and in
			other projects as well.
		o	Mostly affects the performance by considering all the risks that may occur in
			the planning phase.
		o	Risk management positively affects the project performance. Incomplete and
			unclear scope of work lead to more focus on gap analysis phase.
2	Problem	0	The more effort paid on risk management, the less problems you face in the
2	Problem Avoidance	0	The more effort paid on risk management, the less problems you face in the project.
2	Problem Avoidance	0	The more effort paid on risk management, the less problems you face in the project. Risk management due to peak usage of the resources or crashing hours requires
2	Problem Avoidance	0	The more effort paid on risk management, the less problems you face in the project. Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on
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2	Problem Avoidance	0	The more effort paid on risk management, the less problems you face in the project. Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on the peak hour so the crashing cost can be identified at early stage and causes no problem in the project performance.
2	Problem Avoidance	0	The more effort paid on risk management, the less problems you face in the project. Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on the peak hour so the crashing cost can be identified at early stage and causes no problem in the project performance. Managing risk is very important to avoid any rework and finish project as
2	Problem Avoidance	0	The more effort paid on risk management, the less problems you face in the project. Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on the peak hour so the crashing cost can be identified at early stage and causes no problem in the project performance. Managing risk is very important to avoid any rework and finish project as planned.
2	Problem Avoidance	0	The more effort paid on risk management, the less problems you face in the project. Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on the peak hour so the crashing cost can be identified at early stage and causes no problem in the project performance. Managing risk is very important to avoid any rework and finish project as planned. It will help in avoiding any possible reason for delaying the project
2	Problem Avoidance	0 0 0 0 0	The more effort paid on risk management, the less problems you face in the project. Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on the peak hour so the crashing cost can be identified at early stage and causes no problem in the project performance. Managing risk is very important to avoid any rework and finish project as planned. It will help in avoiding any possible reason for delaying the project We need risk management and taking possible precaution when there is
2	Problem Avoidance	0 0 0 0 0	The more effort paid on risk management, the less problems you face in the project. Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on the peak hour so the crashing cost can be identified at early stage and causes no problem in the project performance. Managing risk is very important to avoid any rework and finish project as planned. It will help in avoiding any possible reason for delaying the project We need risk management and taking possible precaution when there is decrease in demand, increase in supply, and lack of development.

	0	Risk management highly affects my project performance, safety precautions for
		workers during implementations as well as safety level of the final project
		before submission to the customer are my main concerns.
	o	Risk management in the field of project management includes progress report
		with the customer, and internal regular meeting to review project issues help to
		have a full view about the project and minimize un-expected issues.
	1	

Source: Adapted from the interviews feedback

In the table above, new constructs emerge from asking interviewees about the relationship between the risk-averse knowledge creation and the project performance. The first emerging construct is pre-start decisions of the project. The project manager cares about the planning and the pre-planning process before implementation. The implementation depends highly on the pre-start decisions. This includes the risk management support and planning. Pre-start decisions give more time to take better decisions. The pre-determination of possible implementation risks enables project managers to start the mitigation processes earlier and, hence, become ready to meet the planned milestones with less deviations. The risk-averse knowledge creation is related to the plan-ahead process. The risk-averse knowledge creation is associated with the early stages of the project management. The project manager can avoid the crashing costs of using extra resources by preparing lists of subcontractors. This enables project managers to have better calculated risks and cost control. This minimizes the ambiguity and increases the clarity of the project scope and the specific workload needed for implementing the project and reaching its goals. The customization process to rapid changes is relatively easier when there is knowledge creation for risk-averse purposes. The time frame needed to introduce flexible agile changes is less when there is control over costs and calculated risks. The importance of the risk-averse knowledge creation is relatively high during the planning phase of the project. As a conclusion, the knowledge creation for risk-averse is related to clarity of project scope. Another new

emerging construct is the problem avoidance. The effort exerted in creating risk-averse knowledge is positively related to facing less problems during the project implementation process. Managing risk is very important to avoid any rework and finish project as planned. It will help in avoiding any possible reason for delaying the project. Taking all possible precautions to deal with the fluctuation in the size of customers in the market or market changes will highly affect the project performance and success. Safety levels are controlled by the risk-averse knowledge creation process and leads to smooth implementation and the submission of the final project as expected by management and customers. Risk management in the field of project management includes progress report with the customer, and internal regular meeting to review project issues help to have a full view about the project and minimize un-expected issues. In conclusion, risk-averse knowledge creation leads to higher levels of project performance.

How does specialization and certification in project management affect the performance of your project?

#	New	Project managers' responses
	constructs	
1	Strategic	• PMP certification is needed for working with big enterprises to know the
	thinking	standards of project management and how to apply it during the project life
		cycle.
		• Because of my specialization a learned how to use KPIs to monitor an improve
		the project performance
		• Specialization gives suitable amount of knowledge about the project; it enables
		the manager to have a thorough view of the whole project
		• This affects the reputation of the project in the eyes of the customer
		 Because of my specialization a learned how to use KPIs to monitor an im the project performance Specialization gives suitable amount of knowledge about the project; it en the manager to have a thorough view of the whole project This affects the reputation of the project in the eyes of the customer

Figure 11.4 Emerging constructs related to the relationship between the specialization and certification in project management and its relationship with project performance

		0	The specialized knowledge helps in assessing the project's performance and its lasting impact.
2	Mixing with real life	0	Most of the time there is no effect of the specialization and certification on the project performance.
	experience	o	The specialization and certification may be a supporting factor but doesn't have the same effect that the practical experience has.
		o	Specialization helps in better execution of project plan.

Source: Adapted from the interviews feedback

In the table above, new constructs emerge from interviews with project managers. When project managers were asked about the role of their certification and specialization in project management and how this plays a role in their project performance, their responses single out two basic new constructs. The first construct is the contribution to the strategic thinking. Strategic thinking related to the project is reinforced by the managers who hold the PMP certificate. This was noticed with bigger organisations which have global standards to follow and international scope of their projects. The PMP holders were relatively more apt to deal with the project life cycle, KPIs of the project, monitoring the improvement of the project performance, and having a thorough view of the whole project. When customers know that the project managers are specialized and certified, this gives better credibility and improves the reputation of the organisation in the eyes of its customers. This has a long-lasting impact on customers' relationships from the project managers' point of view.

The second construct revealed by the interviews with project managers is the mixing with life experience. This construct is related to the point of view of a significant number of project managers who believe that the specialization is strongly related to the life experience and that practical experience in collaboration with the certification together can have a significant effect on the project performance. In general, project managers believed that specialization helps in better execution of project plans.

How does innovating ideas affect your project performance?

Figure 11.5 Emerging constructs in the relationship between innovative knowledge creation and the project
performance

#	New constructs	Project managers' responses	
1	Market opportunities	 Innovating something new increases customer demand and expands the business in the market. If the project implementer is innovative this can be enough to satisfy 	
		the customer.	
		 Innovation enables the project manager to gain the customer confidence that we are always able to find solutions 	
		 Sometimes we face problems in the deployment duration or any other problems that may affect our customers. We work by batches of sites and we need to make the site and then work on air on the project so. 	
		we may face many problems. Innovation helps us to solve these problems and meet customers' expectations.	
2	Feeding managerial processes	 Innovating something new gives unexpected results which is good for the project and will add new engineering ideas and modern innovative standards to the project. 	
		 Innovating ideas increases organisation Innovation facilitates the implementation of the project 	
		 Innovation leads to expected results like better work performance reports 	

		0	Innovation leads to better competition among workers to innovate
			sometning new
		o	Innovation is reinforcing more competitions among workers and
			creating a rewarding system for innovators.
		o	Innovative ideas help a lot in solving some issues.
		о	Sometimes there is no need to go to a developer because we have
			innovation.
		o	Innovation helps in achieving goals faster than working without
			innovation
		0	Innovation is important basically in the vertical experience of the
			project manager not the horizontal one. Vertical experience is the one
			that enables the project manager to grow vertically though out upper
			levels in the career path.
3	Sources of innovative	o	Communication in all directions increases the ability to get great and
	knowledge		innovative ideas, like for example having suggestions box.
		o	We must listen carefully and focus on all new ideas.
	Time for creating	0	Innovation is not preferred during implementation.
	innovative knowledge	O	It may be managed while planning the project.
		o	Innovation helps in changing the method of implementation to save
			time.
	Effects of innovative	0	Innovation helps in the process of test automation
	knowledge creation	o	The development of routine procedures heavily relies on innovation
			and new ideas. Before any routine there was innovation

	0	Innovation helps in thinking out of the box, finding alternative
		solutions, and conducting deep analysis.
	o	Innovation may affect the project performance positively by affecting
		the functioning of the project, time, and cost of the project.
	0	Innovation enabled us to propose a new structure for the technical
		guide and this made it easier and faster to be understood and this
		caused a decrease in the number of technical mistakes in project
		performance.
	0	The effect of innovation on the project performance is positive
		because innovation increases the technical value of the project.
	o	Innovation saves time and cost for the project manager
	0	Innovation helps in achieving goals faster than working without
		innovation
	0	Sometimes we face problems in the deployment duration or any other
		problems that may affect our customers. We work by batches of sites
		and we need to make the site and then work on air on the project so
		we may face many problems. Innovation helps us to solve these
		problems and meet customers' expectations.
	o	Innovation helps in changing the method of implementation to save
		time.
	o	It does not affect project performance!!!!!

Source: Adapted from the interviews feedback

The above table indicates the emerging constructs of the relationship between the innovation knowledge creation and the project performance. There are many new constructs revealed by interviews with project managers in this regard. One of the main constructs in that the

innovative knowledge creation is related to the creation of new market opportunities. Customers have higher levels of demand on new innovative projects. This expands the current market and can also I open new markets for the organisation. The new market opportunities open the door for a short-term monopolistic profit for the project manager because of acquiring new innovative knowledge that may represent a comparative advantage and an opportunity for higher level of specialization among competitors in the market. Before competitors can reach the know-how of the new innovations, the project manager can lead the market shares and increase the number of customers and the retention rates of the current customers. Project managers believe that innovative knowledge creation is related to higher levels of customers' satisfaction for their projects. Innovative knowledge creation is related to getting out of the planned procedures to face sudden emerging problems during implementation. This is somehow risky; however, interviewed managers reported that this behaviour enabled them many times to meet their customers' expectations on time. Waiting for the plan to say what must be done is not always helpful, especially in the light of the rapid environmental chaotic changes. This is the area where the innovative knowledge creation plays relatively better role than planned controlling procedures. Another emerging construct is that innovative knowledge creation processes feed the managerial processes. Adding new innovative knowledge means probably adding engineering ideas, or better implementation standards to the project, which facilitates the implementation along with the management of the project by project managers. Project managers reported that innovative knowledge leads to better project organisation and facilitates its implementation. They believe that the innovation leads to better results and better work performance, because one of the resources of innovation could be the problem solving or opposing the routine of implementing processes for the purpose of reaching higher levels of performance, productivity, quality, time and cost control in the project performance. Innovative

knowledge creation leads to better constructive competition among workers to innovate new ideas and, hence, creates a system of innovation that is related to a rewarding system. This leads to smoother problem solving. Workers become braver and not afraid to get out of the plan, try new practices, and to take tolerated levels of risk at work. Innovative knowledge creation is related to saving costs of outsourcing some processes or speeding up the achievement of goals. Innovation is important basically in the vertical experience of the project manager not the horizontal one. Vertical experience is the one that enables the project manager to grow vertically throughout upper levels in the career path. Another new construct to be measured and added to the relationship between the innovative knowledge creation and the project performance is the sources of innovative knowledge. Project managers reported that communication in all directions increases the ability to get greater innovative ideas. Listening carefully to new ideas is one of the major sources of innovative knowledge creation according to project managers. It was investigated that project managers prefer to allocate special time for the innovative knowledge creation and that innovative knowledge creation is not preferred during the implementation of the project because it is accompanied with higher levels of uncalculated risks. They prefer to allocate more time for innovative ideas and innovative knowledge creation during the planning process of the project life. At this stage, the managers are ready to calculate estimated risks rather than during the implementation processes. They give higher importance to the innovative knowledge creation when it is related to the minimization of project costs and time of implementation. This may happen by innovating new methods of implementation or by innovations related to simplification without compromising safety standards. Innovation is the starting point before any routine or any automation. The understanding of how variables change leads to the creation of innovative links, then to the standardization afterwards. Innovation helps in thinking out of the box, finding alternative solutions, and conducting deep analysis. As a conclusion, innovation may affect the project performance positively by affecting the functioning of the project, time, and cost of the project. It is not just that but also the decrease of number of errors, reworks, and mistakes during implementation. This guarantees the increase in the level of performance quality without compromising productivity. Accordingly, the innovative knowledge creation is positively related to increasing the technical value of the project. Saving time and cost of the project helps in achieving project goals more efficiently. On the other hand, a minority of project managers did not think that there is significant association between the innovative knowledge creation and the project performance.

Appendix 7sss – the detailed quotes, classification of quotes, and interpretation in light of research objectives

FIRST – THE GROUP OF QUESTIONS THAT ARE RELATED TO THE KNOWLEDGE CREATION STYLES

How does the new knowledge creation affect your project's performance?

The first question in the interview was about the effect of the new knowledge creation on the project performance and based on the table of research main variables and sub-variables of the study we are able to classify responses of the project managers as shown below in the following table:

Independent variables	Moderating variables	Dependent variables	
Knowledge creation	Level of project complexity:	Level of stability of project	
styles:		performance:	
 Innovative style Knowledge about the market helps in developing and innovating new mechanisms of performance New knowledge creation always has a positive effect because it is a source of creative ideas about how to implement the project. 	 Size of the project "big – small" 	 Stability of the level of quality as planned 1- Planning and goal setting, achieving satisfactory results by the end of the project. 2- When we use the test automation this enables us to test and estimate efforts by 50% accuracy 3- New knowledge for me increases the quality of technical work 	
 Risk averse style Creation of new knowledge helps project managers and also other team members to avoid mistakes made by others 	 Project system variety "High-Low" For example, dealing with a new tool, or new team member in any project phase is considered as a creation of a new knowledge. 	 Stability of time as planned Planning and goal setting, achieving satisfactory results by the end of the project. New knowledge creation reduces the project effort and time. 	

 When we face any new situation in current project we simply avoid it and postpone handling it to our new projects It help in better estimation for 		
future variables		
 Expert style It enables you to find ways for best practices. Work experience is a source of new knowledge When we use the test automation this enables us to test and estimate efforts by 50% accuracy Knowledge about how problems are solved can be captured so that knowledge management can promote organizational learning. 	• Project interdependency "high-low"	 Stability of cost as planned 1- Planning and goal setting, achieving satisfactory results by the end of the project.
 Specialist style New knowledge creation is related to the latest learning techniques and how to place things in the right place. 	 Complexity of environmental and cultural contexts "high – low" 	 Stability of productivity as planned Planning and goal setting, achieving satisfactory results by the end of the project. New knowledge creation reduces the project effort and time. By time the project manager uses this knowledge to enhance the productivity of projects.
As shown in the table above there is an evidence that we can find the four proposed styles of knowledge managers in the sample of the study. Some of the project managers think that the knowledge creation process enables them to find new mechanisms and new ideas to implement their projects. This shows that their response is related to the innovative style of knowledge creation in which the project manager focuses on getting out of his or her comfort zone. On the other hand those project managers who are focused on working in their comfort zones and highly valuing the avoidance of new things or mistakes as well as the dependency on high levels of future risk estimation are responding to this interview question in a way that shows their risk averse style clearly. Expert styles of knowledge creation managers think that knowledge creation is important because it increases experience, best practices, testing, and learning. The specialist knowledge creation style who is concerned with the educational background were able to consider the new knowledge creation as a source of updating their educational backgrounds.

Another dimension in this study is the complexity of the project. The variety of the components in the system is found to be related to dealing with new team members and new tools and that this is another source of new knowledge creation for the project manager.

Responses that explain the direct effect of the knowledge creation on the project performance are related to the four dimensions of the project performance stability in this study. The new knowledge creation is related to the better and more accurate planning of the project performance, as well as achieving higher percentages of estimated performance ratios, and consequently achieving better project performance results. It also affects accuracy levels and better quality of the technical work according to the project managers. This can be classified under the dimension of the project performance quality. Also the new knowledge that relates between the better planning and better results is found to be related to less effort and less time which is another dimension in the stability of the project performance in this study and is called the time dimension. Satisfactory results are in general including financial results that can be classified under the cost dimension of the study; however, the cost dimension is more of quantitative rather than qualitative so the responses on the knowledge creation's effect on the stability of project cost will appear in a clearer way in other parts of this research. Regarding the dimension of productivity the project manager says that it is related to new knowledge. By time the new knowledge decreases the needed inputs of time and effort as a result of learning curve benefits and at the same time increases the outputs and achieves better results in project performance. As long as we have a relationship between the decrease of inputs and increase of outputs in the project performance, then this will lead to higher levels of productivity.

How does your personal experience affect your project performance?

The second question in the interview was about the effect of the personal experience on the project performance from the project manager's point of view. In the following table the researcher is trying to classify the responses of project managers under the main variables in the proposed model of the study and even under the sub-variables if possible. The researcher will also try to find new constructs other than the ones that were proposed based on the literature review of the study.

Independent variables		Moderating variables	Dependent variables			
Knowledge creation		Level of project complexity:	Level of stability of project performance:			
styles:						

Innovative style	 Size of the project "big – small" Personal experience of the project manager plays a great role in how to deal with stakeholders of the project. Experience helps in expecting other stakeholders' actions and any sudden requirements. Experience helps in managing communication smoothly with stakeholders 	 Stability of the level of quality as planned Knowledge about the business and the experience about the project management help in putting a successful plan. Using the experience in the project planning and making intermediate technical and managerial checkpoints helps the project manager to discover any performance deviation early and fix it. Provides alternative solutions to issues and deviations that may occur. Experience helps in expecting other stakeholders' actions and any sudden requirements.
 Risk averse style Personal experience is related to better risk management, emergency control, effective cautions, and keeping financial preservatives for unexpected risks. Usually project manager has to use his experience in similar projects to avoid risks Experience enables the project manager to have better control over the emerging risks and conflicts know how to deal with the unexpected issues 	 Project system variety "High- Low" Experience is the main reason of working with the minimum amount of resources and the best allocation of it 	 Stability of time as planned Personal experience assures meeting the delivery due dates and being on time and implementation as scheduled even if there are some obstacles or special circumstances during implementation like for example if we have bad weather the project manager can decide having extra shift in the next day. Using the experience in the project planning and making intermediate technical and managerial checkpoints helps the project manager to discover any performance deviation early and fix it. I use all my previous experience and lessons learned to apply it on the current project. For example, I make sure that the environment is ok before starting the project implementation to avoid any waste of time. Experience saves time

		 Provides alternative solutions to issues and deviations that may occur. Experience not teams are able to reduce the number and amount of required resources and increase the percentage of its utilization without impacting the planned time. Experience leads to higher utilization of resources without the need to have extra time for this.
 Expert style leads to better learning from the previous mistakes Provides alternative solutions to issues and deviations that may occur. Experience has a positive effect on suggesting workarounds As a project manager my role is strongly related to my personal experience and it becomes part of my profession especially in the area of communication management. Experience helps in resolving issues that are of the same nature and that the project manager came across in the previous implementations. 	 Project interdependency "high-low" Experience enables the project manager to have better control over conflicts 	 Stability of cost as planned Using the experience in the project planning and making intermediate technical and managerial checkpoints helps the project manager to discover any performance deviation early and fix it. Experience saves cost Provides alternative solutions to issues and deviations that may occur.
• Specialist style	• Complexity of environmental and	• Stability of productivity as planned

	cultural contexts	• Using the experience in the project
	"high – low"	nlanning and making intermediate
	I use all my previous	technical and managerial
	avperience and	checkpoints helps the project
	lassons last to	manager to discover any
	apply it on the current	norformance deviation early and fix
	apply it on the current	
	project. For example,	
	I make sure that the	• Provides alternative solutions to
	environment is ok	issues and deviations that may
	before starting the	occur.
	project	• Experience is the main reason of
	implementation to	working with the minimum amount
	avoid any waste of	of resources and the best allocation
	time.	of it
•	Experience helps in	• Experience leads to higher
	expecting other	utilization of resources without the
	stakeholders' actions	need to have extra time for this.
	and any sudden	
	requirements.	
•	Experience helps in	
	managing	
	communication	
	smoothly with	
	stakeholders	

In general there is a clear trend among project managers to consider the personal experience of the project manager as of a positive effect on improving the project performance. Also is it a source of minimizing the deviation between the planned and the actual performance according to sampled project managers. The project managers' responses enabled the researcher to get insights about the expert style and its characteristics as well. Not only that but also it was found that personal experience of the project manager is positively related to the risk averse knowledge creation style by enabling project managers who belong to this style to have better risk management in their projects. Project managers said that the personal experience is positively affecting the stability of implementation time by meeting delivery dates as scheduled even if there were kinds of obstacles during implementation. Again in general project managers believe that better planned performance can be achieved by having higher levels of personal experience. Accordingly they believe that the excellence in project experience is highly needed for successful project performance in most of the projects if not all.

The researcher literally found that the personal experience is related to the clarification of the characteristics of the expert knowledge creation style as well as the strong relationship that appears between the personal experience and the better risk management for risk averse styles of project managers. Regarding the characteristics of the experiential knowledge creation style the study qualitative analysis reveals that experiential knowledge creation styles are more capable to use their previous mistakes to create a new knowledge by learning from those mistakes. By this they become more capable to find and provide alternative solutions and to have better control over different kinds of deviations compared to others who are not depending highly on the personal experience. They become more capable on suggesting the workarounds.

It is obvious after analyzing the responses of the project managers that this style of knowledge creation is characterized by better communication skills, better problem solving skills that are related to problems similar to previously experienced ones. When we move to another knowledge creation style which is the risk averse one we will find that the personal experience is highly affecting this style of project managers. They are capable to have better risk management skills depending on their personal experience. They tend to have higher levels of emergency controls, more effective cautions. They even tend because of their personal experience to keep financial preservatives for unexpected risks. Some of the sampled project managers believed that the personal experience is always used in similar project for the purpose of risk avoidance. As a conclusion the risk averse knowledge creation styles depend on personal experience in having higher levels of control over the unexpected issues in their projects' performance.

The qualitative study did not lead to explanation of any kind of relationship between the personal experience and both the specialization knowledge creation styles and the innovative knowledge creation styles.

Talking about complexity of projects, we can find that in general the personal experience of the project manager minimizes the level of complexity of the project or at least enables the project manager to deal with this complexity in a better way. Talking about dealing with stakeholders and expecting their actions and any sudden requirements they may have, it is found that the project manager uses his or her personal experience in this matter and the result is better and smoother communication with stakeholders. The project manager is using his or her personal experience for better resource utilization and allocation. This means that it may indirectly lead to savings in the cost of these resources as well as increasing its productivity. This will lead to better management of higher number of resources during project implementation. In another word this will positively affect managing projects with high complexity levels compared to managing the same kind of projects by less experienced project managers. The experienced project manager have better control over conflicts so he or she can better deal with interdependency as a dimension of project complexity. One of the important dimensions of complexity in this study is the complexity of the environmental and the cultural contexts of the project. Project managers feel that they have learned through the personal experience how to prepare the environment or at least how to study it before the implementation of the project to avoid any waste of time. Even the sudden changes in the environmental or cultural contexts of the project are better responded to by project managers who have higher levels of using their personal experience. They are more effective in communicating with the environmental change and in a smoother way compared to the less experienced project managers.

To explain the direct effect of personal experience on the stability of project performance the project managers elaborated how the personal experience enhances the success of the project plan. They believed that the flexibility of planning and the ability of making intermediate technical and managerial checkpoints as well as having higher ability to discover deviations early and fix it are fruits of personal experience. They believed that stability of project performance increases by providing quick alternative solutions for instability issues and that this comes again through the personal experience of the project manager. Even if there are sudden or unexpected deviations that may lead to instability, the project manager who has the personal experience is more capable to control its effect than the less experienced one. Hence the level of quality of the project performance is expected to become more stable when the project manager has more personal experience. Another aspect of performance stability is related to the time of project implementation. The personal experience is positively related to

the delivery on time and the implementation as scheduled and as planned. Project managers think that some obstacles during implementation may hinder conformance between actual implementation and planned schedule. They also believe that the personal experience is the key to overcome the effect of these obstacles and keeps implementation as scheduled. One of the examples on time control and its relationship with the personal experience is that the experienced manager may decide having extra shifts to overcome the delay that may result from any type of obstacles during implementation. Early detection of and discovering the performance deviation is saving time and is positively related to higher levels of personal experience. Personal experience of the project manager is positively related to the avoidance of any waste of time. The project manager increases productivity without impacting the planned time because of having higher levels of personal experience. No extra time is needed to have better utilization of resources, maybe less time will be consumed to reach this goal by the experienced project manager. The experienced manager tends to have many technical and managerial checkpoints which gives preventive rather than detective control over performance stability of the project. Sampled project managers think that experience saves cost and time and easily provides alternative solutions for different kinds of deviations. Experience even minimizes the time needed to finish the planning phase of the project. Planning takes less time and becomes more effective and efficient with the experienced project manager. In general the personal experience increase productivity, decreases time and cost and keeps high and stable levels of project performance quality.

How does risk management and taking possible precautions affect your project performance?

In the following table the researcher is classifying the responses of the project managers into the research model that was built based on the literature review and the systematic analysis of the research findings.

Independent variables	Moderating variables	Dependent variables					
Knowledge creation styles:	Level of project complexity:	Level of stability of project					
		performance:					
• Innovative style	 Size of the project "big – small" Risk management in the field of project management includes progress report with the customer, and internal regular meeting to review project issues help to have a full view about the project and minimize un- expected issues. 	 Stability of the level of quality as planned Risk management highly affects my project performance, safety precautions for workers during implementations as well as safety level of the final project before submission to the customer are my main concerns. There is a positive relationship between the risk management and the performance of the project. The performance of the project becomes more stable if there is good risk management and vice versa. 					

			\mathbf{D}^{\prime}
		•	Risks of delays or risks of lacking technical training will directly affect the performance of the project. Risk management positively affects the project performance. Incomplete and unclear scope of work lead to more focus on gap analysis phase.
• Risk averse style	• Project system variety	•	Stability of time as planned
• We need risk	"High- Low"	•	There is a positive relationship
management and	6		between the risk management
taking possible			and the performance of the
precaution when there			project. The performance of the
is decrease in			project becomes more stable if
demand, increase in			there is good risk management
supply, and lack of			and vice versa.
development.		•	Managing risk is very
• Risk management			important to avoid any rework
highly affects my			and finish project as planned.
project performance,		•	It will help in avoiding any
safety precautions for			possible reason for delaying the
workers during			project
implementations as		•	Risks of delays or risks of
well as safety level of			lacking technical training will
the final project			directly affect the performance
before submission to			of the project.
the customer are my		•	The main concern to manage
main concerns.			the risks of the project is to save
• I always put a lose			money and time.
percentage of 20%		•	Risk management needs extra
and consider that this			time to manage risks.
percentage will not be		•	This is important at the start up
compensated at any			process of the project especially
point of the project			regarding the delivery time of
avample of the risk			the hardware versus the
management actions I			installation time frame. If there
take			is delay in the delivery time due
• Sure you need risk			to customized procedures the
management at least			utilized to compare this
for random irresistible			delay This may happen in this
crisis that happens			project and in other projects as
accidently like earth			well
quick.		•	Risk management positively
• 50% of our		-	affects the project performance
management is about			Incomplete and unclear scope
risk management.			respe

• Proper risk		of work lead to more focus on
management will		gap analysis phase.
reduce not only the		
likelihood of an event		
occurring, but also the		
magnitude of its		
impact		
 Quick decisions are 		
the highest risks in		
project management		
but if it was supported		
by risk management		
this will help the		
project manager a lot		
The main concorr to		
• The main concern to		
the project is to save		
money and time		
Risk management		
needs extra time to		
manage risks		
• The more effort naid		
on risk management		
the less problems you		
face in the project.		
 Risk management 		
positively affects the		
project performance		
Incomplete and		
unclear scope of work		
lead to more focus on		
gap analysis phase.		
• Risk management in		
the field of project		
management includes		
progress report with		
the customer, and		
internal regular		
meeting to review		
project issues help to		
have a full view about		
the project and		
minimize un-		
expected issues.		
• Expert style	• Project	• Stability of cost as planned
	interdependency	• We need risk management and
	"high-low"	taking possible precaution
		when there is decrease in

		demand, increase in supply, and lack of development.There is a positive relationship between the risk management and the performance of the
		 project. The performance of the project becomes more stable if there is good risk management and vice versa. Managing risk is very
		important to avoid any rework and finish project as planned.
		• It will help in avoiding any possible reason for increasing the cost
		• The main concern to manage the risks of the project is to save money and time.
		• Risk management positively affects the project performance. Incomplete and unclear scope of work lead to more focus on
Specialist style	 Complexity of environmental and cultural contexts "high – low" Possible risks should be identified at the basinging of the 	 gap analysis phase. Stability of productivity as planned Risk management highly affects my project performance, safety precautions for workers during implementations as well as acfety level of the final
	project because this will enable the	project before submission to the customer are my main
	mitigation process earlier. There are many examples on this. One example was that the environment was not	• There is a positive relationship between the risk management and the performance of the project. The performance of the project becomes more stable if there is good risk management
	process and we decided to work on	 Managing risk is very important to avoid any rework
	to pass the first milestone of the project.	 Risk management positively affects the project performance. Incomplete and unclear scope

	Our mainat and mat	of work lead to more focus on
•	Our project are not	con analysis phase
	very risky so it is not	gap analysis phase.
	of great importance.	
•	Risk management	
	does not work in the	
	public sector.	
•	Possible risks should	
	be identified at the	
	beginning of the	
	project because this	
	will enable the	
	manager to start the	
	mitigation process	
	earlier. There are	
	many examples on	
	this. One example	
	was that the	
	environment was not	
	ready to start the	
	process and we	
	decided to work on	
	our virtual machines	
	to page the first	
	to pass the first	
	milestone of the	
	project.	

The answer to this question was used to get insights about the risk averse style at the beginning. The interviews with project managers revealed that risk averse managers are keen most of the time about taking the possible precautions especially during instability periods of the project performance. For example, during instability of supply and demand. Continuous development and improvements are good reasons to care about risk management especially that it is unavoidable. Risk averse project managers are convinced that risk avoidance affects their project performance positively. They take all the possible precautions during implementation and they care a lot about testing the safety level of their final product before submitting it to the final customer. This affects their reputation and ability to keep their customers loyal in the future. Cautions are kept aside for any emergency matters. Cautions may cost the risk averse manager 20% up to 50% of the total production cost based on the resistibility ratio against crisis that may happen accidently. Risk averse managers believe that risk management plays preventive and even detective roles during project implementation. Risk managers think they are able to reduce the magnitude of the impact of any sudden risk. They do not like quick decisions unless it is backed by calculated risks. They believe that risk management leads to savings in time and costs; however the processes needed to manage risk are time consuming. This extra time consumed in risk management is highly valued by risk averse managers because they minimize number of problems by performing risk management processes. They care a lot about the clarity of the scope of the work load and analyzing the gap between the plan and the implementation phases of project life. They periodically check the progress of the implementation process and regularly review emerging issues with customers of stakeholders.

#	New constructs	Project managers' responses
#	New constructs Pre-start Decisions	 Project managers' responses Risk management supports planning ahead Quick decisions are the highest risks in project management but if it was supported by risk management this will help the project manager a lot. Possible risks should be identified at the beginning of the project because this will enable the manager to start the mitigation process earlier. There are many examples on this. One example was that the environment was not ready to start the project manager to pass the first milestone of the project. Risk management affects the project performance by helping the project manager to plan ahead. Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on the peak hour so the crashing cost can be identified at early stage and causes no problem in the project performance. Incomplete and unclear scope of work lead to more focus on gap analysis phase. This is important at the start up process of the project especially regarding the delivery time of the hardware versus the installation time frame. If there is delay in the delivery time due to customized procedures the installation team must be fully utilized to compensate this delay. This may happen in this project and in other projects as well. Mostly affects the performance by considering all the risks that may occur in the planning phase.
		• Risk management positively affects the project performance. Incomplete and unclear scope of work lead to more focus on gap analysis phase.
	Problem Avoidance	 The more effort paid on risk management, the less problems you face in the project. Risk management due to peak usage of the resources or crashing hours requires to be handled in the early stage of the project by contracting subcontractor on the peak hour so the crashing cost can be identified at early stage and causes no problem in the project performance. Managing risk is very important to avoid any rework and finish project as planned. It will help in avoiding any possible reason for delaying the project We need risk management and taking possible precaution when there is decrease in demand, increase in supply, and lack of development.

• Risk management highly affects my project performance, safety precautions for workers during implementations as well as safety level of the final project before submission to the customer are my main concerns.
• Risk management in the field of project management includes progress report with the customer, and internal regular meeting to review project issues help to have a full view about the project and minimize un-expected issues.

In the above table the research reveals two constructs that are obviously repeated in respondents' comments, thoughts, and feelings. The actions taken to manage risks start at the beginning of the project life. The pre-start decisions are mainly affecting the project performance during and even after implementation. The second construct is the tendency to avoid problems. The risk averse style is related to the responses that talk about the problem averse actions. Prevention and early detection of project problems is enhancing the performance stability according to risk averse project managers.

How does specialization and certification in project management affect the performance of your project?

Independent vari	ables	Moderating variables		Dependent variables					
Knowledge	creation	Level of	f project comple	exity:	Level	of stability of proj		project	
styles:					perfor	mance:			
• Innovativ	re style		Size of the proje small" Specialization helps by enab project manage with the stakeh the same langua	ect "big – mainly bling the r to talk olders in age.	•	Stabil plann The s capab and h succes Specia create enviro better projec There specia and contro Specia and contro Specia	ity of the level ed specialized p le than other as of the pro- alized pers a collabor on the impre- t performance alization of rmance and alization m its i ollable and e alization ct manager to n and unkn dingly it a	vel of o bersom ers in to sup ject. on is cative is able overmine. ve effen the this is akes mplen asy to enable o reac own talso	quality as a is more his field oport the able to working e to work ent of the ect of the project s because the plan nentation monitor. es the ct to both risks and helps in

The following table classifies the responses of the project managers with the variables of the conceptual model of this study

 Risk averse style Specialization enables the project manager to react to both known and unknown risks and accordingly it also helps in reorganizing the project again to fulfill the customer requirements. 	 Project system variety "High- Low" Most of the phases of the project are related to specialization 	 reorganizing the project again to fulfill the customer requirements. This affects the reputation of the project in the eyes of the customer The specialized knowledge helps in assessing the project's performance and its lasting impact. Specialization helps in better execution of project plan. Stability of time as planned Specialization gives suitable amount of knowledge about the project, it enables the manager to have a thorough view of the whole project, and it enables the manager to balance between time and cost of the project. The specialized person is more capable than others in his field and he is able to support the success of the project. Specialized person is able to create a collaborative working environment and is able to work better on the improvement of the project performance. There is a positive effect of the specialization makes the plan and its is because specialization makes the plan and its is because specialization makes the plan
	D	controllable and easy to monitor.
 Expert style This gives experience, knowledge, better planning skills Experience is much more important than certification Specialization affects positively the project 	• Project interdependency "high-low"	 Stability of cost as planned Specialization gives suitable amount of knowledge about the project, it enables the manager to have a thorough view of the whole project, and it enables the manager to balance between time and cost of the project. The specialized person is more capable than others in his field and he is able to support the success of the project.

performance however; the certification in project management has no effect itself. It is affected by the real life experience and interacts with it.		 Specialized person is able to create a collaborative working environment and is able to work better on the improvement of the project performance. There is a positive effect of the specialization on the project performance and this is because specialization makes the plan and its implementation controllable and easy to monitor.
 Specialist style The person who learns something and works in the same field has the basic knowledge needed to start a project. Specialization gives suitable amount of knowledge about the project, it enables the manager to have a thorough view of the whole project, and it enables the manager to balance between time and cost of the project. There is a positive effect of the specialization on the project performance and this is because specialization makes the plan and its implementation controllable and easy to monitor. Specialization will affect much if not used properly 	 Complexity of environmental and cultural contexts "high – low" Specialized person is able to create a collaborative working environment and is able to work better on the improvement of the project performance. 	 Stability of productivity as planned The specialized person is more capable than others in his field and he is able to support the success of the project. Specialized person is able to create a collaborative working environment and is able to work better on the improvement of the project performance. There is a positive effect of the specialization on the project performance and this is because specialization makes the plan and its implementation controllable and easy to monitor.

in the project	
management	
• Because of my	
specialization a	
learned how to use	
KPIs to monitor	
an improve the	
project	
performance	
• Project teams not	
only the project	
manager have to	
be certified.	

As shown in the table above the study revealed that the specialized knowledge creation style may be related to the experiential style or the risk averse style. After analyzing the data coming from respondents there was no indicator that this knowledge creation style is directly related to the innovative knowledge creation style in the research sample. The responses leads to describing the characteristics of the specialized knowledge creation style. It is characterized by being ready more than others to start up their project because of their specialized knowledge. They believe that they are better than other non-specialized managers when it comes to the thorough view of the whole project. They can consider more variables when it comes to the effectiveness of planning at the early stage of the project life. They think that they are more capable to balance between time and costs of the project implementation compared to less specialized project managers. They feel that they have better control over the implementation process and that this is due to the specialized knowledge creation style they have. Accordingly, it becomes easier for them to monitor the implementation process than project managers who are not belonging to this style of knowledge creation. They are convinced that the project performance will be affected a lot by not using specialized knowledge to manage it. Also, they have a strategic way of thinking on the long run about the KPI's and how to improve it using the specialized knowledge creation and that this in return is reflected on better project performance. Accordingly, some of those project managers would want to hire specialized and certified team members to assure the quality of implementation and results of their projects.

Regarding the relationship between the specialized knowledge creation style and the other knowledge creation styles proposed by this study we found that the specialized knowledge creation style believes that because of specialization project managers are more capable to react to both known and unknown risks and hence respond in a better way to customers' requirements. Regarding the relationship with the expert style of knowledge creation it was found that specialized managers have better capabilities to create new experience and better quality one as well. The knowledge that is created by a specialized manager who has experience is leading to better planning skills. The interaction between the specialization and the experience is important in the eye of project managers. Some of them gives more priority and weight to the experience in this interaction. Others believe that the specialized knowledge remains inactive until it is mixed with the real-life experience.

About the relationship between the contextual variables and the specialized knowledge creation style the study revealed that specialization mainly helps in enabling the project manager to talk

with the stakeholders in the same language of each. The project managers who belong to this style believe that it is important to use specialized knowledge in each and every phase of the project life. Moreover, that they think that a specialized manager is able to create a collaborative working environment and is able to work better on the improvements needed for better project performance.

When talking about the effect of the specialized knowledge creation style on the project performance dimensions we can say that the better planning leads to better performance and that the better planning according to specialized managers is affected positively by the specialized knowledge and certification of project managers. Specialized project managers are more capable to lead to the project success, create collaborative improvements in the project performance, have better control and monitoring processes, have more effective and efficient reactions to the known and unknown fluctuations in the project performance indicators and in a scientific way, more capable to fulfill the customer requirements, more capable to have efficient implementation for the project, and strategically can create sound reputation, better market impact, and higher levels of customer satisfaction by the end of the project life.

When we talk about time performance, we can find that the thorough view of the project by the specialized manager enables him or her to save time and cost compared to less specialized project managers or those project managers who did not study project management. Better communication and creation of collaborative environment minimizes the effect of complexity on the project performance and the needed time, control, and monitoring during project implementation. Suitable amount of specialized knowledge leads to more stable and successful performance indicators according to project managers' responses. In general, there is a trend among respondents to consider the effect of the specialized knowledge creation style as a positive one on the stability of project performance.

Independent variables	Moderating variables	Dependent variables
Knowledge creation	Level of project complexity:	Level of stability of project
styles:		performance:
 Innovative style Innovative project managers consider the instability in the project performance as something positive that leads to better opportunities in the market. Their view of instability in project performance is not as the same as 	 Size of the project "big – small" 	 Stability of the level of quality as planned Innovating something new gives unexpected results which is good for the project and will add new engineering ideas and modern innovative standards to the project. Innovation enabled us to propose a new structure for the technical guide and this made it easier and faster to be understood and this caused a decrease in the number of technical mistakes in project performance.

How does innovating ideas affect your project performance?

 other styles of knowledge creation. Innovative knowledge creation is used in problem solving and creating new solutions. Many problems can't be resolved unless you think out of the box 		 The effect of innovation on the project performance is positive because innovation increases the technical value of the project. Sometimes we face problems in the deployment duration or any other problems that may affect our customers. We work by batches of sites and we need to make the site and then work on air on the project so we may face many problems. Innovation helps us to solve these problems and meet customers' expectations.
		• Innovating new ideas has positive effects on the project performance
Risk averse style	• Project system variety "High- Low"	 Stability of time as planned Innovation may affect the project performance positively by affecting the functioning of the project, time, and cost of the project. Innovation enabled us to propose a new structure for the technical guide and this made it easier and faster to be understood and this caused a decrease in the number of technical mistakes in project performance. Innovation saves time and cost for the project manager Innovation helps in achieving goals faster than working without innovation Innovation helps in changing the method of implementation to save time. Innovating new ideas has positive effects on the project performance
 Expert style Innovation is important basically in the 	• Project interdependency "high-low"	 Stability of cost as planned Innovation may affect the project performance positively by affecting the functioning of

vertical experience of the project manager not the horizontal one. Vertical experience is the one that enables the project manager to grow vertically though out upper levels in the career path.		 the project, time, and cost of the project. Innovation saves time and cost for the project manager Innovating new ideas has positive effects on the project performance
• Specialist style	 Complexity of environmental and cultural contexts "high – low" Many problems can't be resolved unless you think out of the box 	 Stability of productivity as planned Innovation may affect the project performance positively by affecting the functioning of the project, time, and cost of the project. Innovation enabled us to propose a new structure for the technical guide and this made it easier and faster to be understood and this caused a decrease in the number of technical mistakes in project performance. Innovating new ideas has positive effects on the project performance

In the above table we can notice that the innovative style has some characteristics that were found in the responses of the project managers of the research sample. This style of knowledge creation is against the other styles of knowledge creations in this study. This is because this is the only style that has positive attitude toward instability of performance. The other styles consider that the instability of project performance is something negative and that the project manager should always have the capability to keep the project performance as stable as possible. On the contrary the innovative knowledge creation style believe that the instability of project performance is something positive because it will lead to better opportunities in the marketplace. Innovative knowledge creation style of project managers uses knowledge creation in problem solving and creation of new solutions not the routine and usual ones. They are different from different managers in their ability to think out of the box. They can think about the environmental variables and how to employ these variables in finding new weird solutions for their problems. This style of project managers uses innovative knowledge in creating what they call the vertical experience not the horizontal one. The vertical experience is the one that enables the project manager to grow vertically throughout upper levels in the career path. This is the only link that was found between the innovative knowledge creation style and the experiential

knowledge creation style. Moreover, that this style of knowledge creation does not show any evidence to have any relationship with other proposed knowledge creation styles in the study like the specialization knowledge creation style and the risk averse one. Also, the complexity of the project seems to be unrelated to the innovative knowledge creation style unless we relate this style to the complexity of the environmental and cultural contexts where the project managers can find changes and variables that help him or her to think out of the box.

Regarding the effect of this style of knowledge creation on the project performance, this knowledge creation style affects all dimensions of the stability of project performance in this study. This knowledge creation style affects the dimension of quality. Because interviewees believed that the continuous improvement and ability to innovate something new gives unexpected results. This in turn is good for the project as they said and will add new engineering ideas and modern innovative standards to the project. The meaning is that the innovative knowledge creation style is related to the quality of the project, the product, and the quality of survival in the marketplace as well. Not only this, but also affecting the technical performance of the project. According to the responses collected by the project managers about this style of knowledge creation they said that innovation enables us to propose a new structure for the technical guide and this made it easier and faster to be understood and this caused a decrease in the number of technical mistakes in the project performance. This shows that innovative knowledge creation styles are trying to frame new structures to explain, to guide, to minimize mistakes and consequently cost, and to speed up the technical processes of project performance. This is confirmed by another group of respondents who claimed that the effect of innovation on the project performance is positive because it increases the technical value of the project from their perspective. As a practical example on the importance of innovative knowledge creation and its effect on the project performance, one of the projects' managers explained how this innovative knowledge creation helps in narrowing down the gap between the deployment performance and the work on air performance. Sometimes when project managers try implementation using simulators and then they come to the real-life implementation they face many problems. Innovation helps to solve these problems in a way that meets customers' expectations. In general, there is a strong trend in the sample that the effect of innovation on the project performance is positive.

Speaking about the dimension of time in the project performance and how does innovative style of knowledge creation affect it, we found direct responses that explained how innovation affects the functioning time of the project. Project managers assured that innovation takes them to technical guidance of easier and faster and more cost-effective project performance. They explained how innovation leads to more understandable processes and consequently less ratios of performance errors. Minimization of ratio of errors will save time and cost for the project manager. It will also support the achievement of the project goals faster than working without innovation enables the manager to change the methods implementation to consume less time. This convinced the project manager by experimentation that innovation saves time of implementation in the future.

This is related to the stability of project cost too. Less time, lower ratios of errors, better functioning structures and easier ones, higher capabilities to meet customer's expectations are all cost savers for project managers. We did not find any of the sampled project managers who relate the innovative knowledge creation styles to the higher levels of project costs. They may

want to choose when to innovate but they believe that innovation leads to survival and better market positioning and that one aspect of achieving this is by having less costs in the future.

This is also related to the productivity of the project, which means the relationship between the inputs and the outputs of the project. As explained earlier the cost will be less, the time is expected to be less, the processes become easier to implement, and the errors become less. All these are representing minimization of inputs. Also, when we analyse the respondents opinion about reaching better ideas and higher ability to meet customer expectations. This shows the efficiency of project performance and that it may increase by innovative knowledge creation. The innovative knowledge creation may lead to maximization of outputs and its quality and ability to meet customers' expectations. As long as we are able to minimize the input and / or maximize the output, then we are talking about higher levels of productivity in projects that uses innovative knowledge creation styles.

Comparative importance of each style of knowledge creation

After talking about each style of the four proposed knowledge creation styles in this study and describing its characteristics from the field of the data collection, the researcher conducted relative comparisons between each two styles of knowledge creation. Then the responses of the project managers were reported and analyzed in depth.

The following table shows the four proposed relative comparisons that were discussed with the sampled project managers and the reasons behind the preference of each comparative relationship:

Experiential	ential Specialization knowledge Risk		Innovative
knowledge	creation is more important	knowledge creation	knowledge creation
creation is more	than experiential	is more important	is more important
important than		than innovative	than risk averse
specialization			
-Not able to	• Certain types	 Knowing 	• Lots of
enter the market	of courses are	about the	minimization
as a	important and	risks before	and
manufacturer	are related to	starting the	avoidance of
until having	application in	project will	risks limits
experience.	the real life.	increase the	the achieved
-Market updates	• Education is percentage of		results and
matters.	highly	its success	limits
-Experience is	important for	• We need to	growth.
related to	implementatio	take care	• Because the
creative	n and	about any	innovative
solutions and at	recognition of	factors of	project will
the same time	the possible	circumstance	find better
coping with the	risks and how	s that may	solutions to
latest changes in	to avoid it.	lead to any	minimize
the market.	• Education is	kind of delay	risks in the
-To be able to	the most	in the due	future
make the right	important	date of	• Innovation is
plan since the	factor then		more

beginning of the	comes the	project	important but
project you	experience,	submission.	we need to
need	knowledge,	• Lowering	take care of
experience.	and	down the	basics and
-To cope with	management of	level of risk	plans for the
the	implementatio	enables	whole
technological	n	project	project since
development	Education	manager to	its start to the
you need	helps one to	create clear	end of the
experience.	invest all that	vision in the	project.
-The more you	they learned	light of what	• Innovation is
manage the	into the project	abilities and	more
better you		skills he has.	important to
manage		More over	increase
projects.		this he has to	customer
-Supports the		be on time	satisfaction
ability to deal		with both	but this
with		managers and	depends on
unexpected		customers.	the strength
problems		• This assures	of the
especially when		that the	infrastructur
the kind of		project will	e of the
projects is the		not face any	project day
same for a long		kind of	after day.
period of time.		obstacles that	• Innovation in
-The experience		may affect its	more
helps you to		success	important but
recognize all		negatively.	we must
needed		• Many aspects	submit the
objectives to be		in the project	project on its
accomplished		are risky like	due date and
by the end of the		changes in	conforming
project and		Dollar price,	to the latest
accordingly		changes in	standards
make a better		number of	followed in
plan to achieve		workers, and	such
those goals.		scarcity of	projects.
-Practical		resources or	• The more
experience in		unavailability	innovation
the field is much		of resources.	you apply in
more important		Taking care	your project
than theoretical		of these	the faster you
education		factors must	can finish it
because it is		take the first	before its due
related to		priority.	date.
reality.		• Putting this as	• Innovation is
-Gain others'		priority	a must
experience and		increases the	because the

learn from the	ability to	project
mistakes of	minimize	manager
other people in	risks of the	must not be
the field.	project	afraid and
-Experience	• A good	must not
plays a great	project	surrender to
role with project	manager	the natural
management.	should plan	fright related
-Experience	for expected	to capital
provides	risks and do	management.
successful	the needful to	• The right
management,	minimize	performance
ability to avail	them	and the
the needed	Minimization	perfect
resources of the	of risks and	management
project,	submission	play a great
experience of	on time is our	role in the
workers as well	first priority	project
not only the	• By	success and
manager, and	minimizing	in avoiding
speed up	risks vou are	many risks.
achievement.	able to	• To come up
-Experience is a	achieve	with the rest
source of	planned	results
strength of	results	• To satisfy the
management	without	customer by
and better	serious	the end of the
organization.	problems	project
-Experience	• Because if we	• It is more
gives higher	minimize	important
level of	risks profits	than
credibility and	will increase	minimizing
reliability in	Minimization	risks
implementation	of risks	• Because if
and better	increases	we want to
determination	efficiency of	promote our
of due dates and	work	work we
the manager can	• Low risk	need
use his	because it is	innovative
experience in	important to	and new
the project	build a	designs for
itself.	project in a	our projects.
-It is a source of	smooth way,	• Because
enthusiasm,	to boost the	innovation
motivating	trust of the	creates an
otners,	client	imagination
delegation of	• Low risk	about how
autnority,	performance	the end of the

building	will avoid	project will
successful		look like
toomwork and	dolov	More focus
ability to solve		• More locus
ability to solve	• Because the	on
problems.	geographic	minimization
-Experience is	location of	of risks will
more reliable	the project as	limit the
than	well as the	project
knowledge.	cultural	results and
-Experience	norms and	ability to
plays a great	traditions of	have new
role in speeding	the hosting	customers.
up the	country of the	• More
implementation	project are	important for
	strongly	customer
-Experience	affecting it	satisfaction
enables you to	complexity	• This better
better avoid of	comprenity.	
risks		meets
-Experience		customers
-Experience		expectations
finish the		and increases
milisii uie		our sales in
project faster		the future.
because of the		 Any project
direct		needs
relationship		innovative
with the		and new
implementation		ideas to
of the plan.		facilitate the
-Experience is		system
better when you		operations.
have a certain		• To make the
goal to reach		project easier
and aspiration		to implement
to reach it.		and more
-You gain		and more
experience		successiui.
simply when		
you manage lots		
of projects		
-Over time you		
use vour		
experience in		
new projects to		
and up as		
enu up as		
successiul ones.		
-The experience		
will balance the		

project timeframe, budget and scope. -Long		
helps with avoiding the previous mistakes.		

A general overview of this table shows an important indicator. Most of the reasons were given to the importance of the experiential knowledge creation over the educational one. Then comes the reasoning of the importance of the innovative knowledge creation over the risk averse one, then comes the reasoning of the importance of the risk averse knowledge creation over the innovative one, and finally the weak reasoning for the importance of the educational or specialization knowledge creation over the experiential one. This can be considered as an initial qualitative ranking of how important is each style in the real life from the project manager's perspective. The project manager is of course using different sources to create new knowledge. The experience, the educational background, the policies of risk averse, and the innovative challenging are all different sources of creating knowledge to be able to solve problems or improve standards. Experience seem to be the most important source in this sample of creating new knowledge and that the experienced project managers are highly valued when it comes to the effect on the stability of project performance as we will discuss later in the stability section of the qualitative study. Innovation and risk averse are competing with each other; however the innovative knowledge creation style seems to be more important than the risk averse one in achieving more stable project performance from the project managers' perspective. Using the educational background and specialization are the least important effective reasons for the stability of project performance and project managers tend to depend less on this source when they create new knowledge according to the analysis of the respondents' feedback.

Why do you think that experience is more important than the education for the success of the project?

In the first column the respondents gave reasons why would they give higher importance to their experience more than their educational background to achieve the success of their projects. Those group of project managers believe that they are not able to enter the market until and unless they have a respectable amount of experience. Without this experience they are not able to compete especially if the project is a manufacturing one. Manufacturing projects are technical ones and the technical experience is practical, deep, and detailed so it takes time to be built and it makes difference between the managers' capabilities to achieve project success. Day after day project managers' experience changes in their markets and they believe that market updates matters and it devalue the educational background effect on the project success compared to the experience. They correlate these updates with experience because this enables them to find creative solutions and at the same time cope with the environmental changes. Experienced project managers are relatively more capable to find solutions and to cope with change than less

experienced educated ones. When it comes to the planning process again there is a difference from the project managers' point of view. They think that making the right plan since the beginning of the project accurately and concretely is based on the experience of the project manager and its quality and depth. Experienced managers are able to understand the technological developments when they compare it with their experiences knowledge. Accordingly they are more capable relatively to cope with new technological developments that exist in the project environment. Project managers feel that the more they manage, the better they manage their projects. Over time their decisions become solid and practically tested in previous similar situations. The experienced managers are more capable to consider higher number of situational variables when they manage their projects. They may be related to the better control of project risks because of previous experience. One type of these risks is the management of unexpected problems especially if the type of projects managed by this manager is the same one for a long period of time so that the manager has enough experience about this type of projects. Experienced project managers are better planners and better in goal setting than those who depend on their educational background when planning or setting goals for their projects. When the project managers were asked about the reason behind this they said that experienced managers recognize all needed objectives to be accomplished by the end of the project and accordingly they can make a better plan to achieve those objectives. It is not the first them to set objectives or to plan but more importantly is that it is not the first time for them to be sure about the results of their plans and how the objectives are achieved in reality. This factor is not existing in the case of depending on the educational background only unless the type of education is relatively practical, but still this is not as effective as the practical built experience over years of planning and managing projects. Reality plays a great role and is a distinguishing factor between the experiential knowledge creation and the specialized knowledge creation. Reality is more related to the experience than to the education of the project manager. Project managers who experience reality of managing projects learn from the mistakes they had or others had in the past. They learn from their own experience and from the experience of others in the same field of their projects. They sense the best practice rather than read about it. This group of project managers think that well-experienced project managers are more capable to achieve the project success than the well-educated ones. The experience also affects the speed of availing the needed resources for the project so this again affects the smooth implementation of the project. The experiential style manager prefers to have experienced team to work with as well. Experiential managers believe that the work with experienced team will speed up the achievement and facilitate successful management of the project. Accordingly the experience of them is a source of strength and of having better organization. The credibility of the experienced manager and the reliability on his work is high because the experienced project manager is relatively more capable to estimate and determine the due dates based on his or her previous experience with the same kinds of projects. Project managers feel that their experience gives them confidence, enthusiasm, ability to motivate others, ability to delegate authority in the right way, right time, and to the right persons. It also increases the ability to build successful teamwork and the ability and the quality of problem solving. Experienced project managers have a stock of knowledge that enables them to deal with semi-similar daily situations; however project managers said that they respect work experience more than knowledge they get from theoretical sources as the work experience highly affects their success as they think. This is a characteristic of this style. They rely heavily on the practical experience as a source of creating new knowledge to use for managing their projects. They can feel this when they use this experiential knowledge and the result is speeding up the implementation of the project and in a successful way. The experiential project managers are convinced that they are more effective in

reaching the goal and are more efficient than less experienced project managers. When we asked the experienced project managers about the reasons behind their ability to avoid or manage risks they referred this to their experience. They also assure that year after year they are more capable to finish their projects faster than what they did when they started project management without enough experience. The reason behind this according to their point of view is the direct relationship with the implementation of the plan where they can feel the gaps and learn how to manage it. Regarding the relationship between the experience and the goal setting and achievement, there is a mutual relationship. The experience is better when the project manager has a certain goal to reach and aspiration to reach it, and by time the experience enables the project manager to set goals in more effective and efficient ways and reach it smoothly. Simply experience requires managing higher number of projects then using the experience gained from these projects in managing new projects and make sure that these projects end up as a successful ones. Also one important indicator that shows that the project manager has experiential knowledge is that he is capable by using this experiential knowledge to avoid mistakes. Regarding the effect of the experiential knowledge creation style on the project performance the project managers think that the experience is better than education in balancing the project timeframe, budget, and scope. Practically the educational background is less effective in achieving these effects on the project performance from the project manager's perspective. The reason is that the educational background does provide detailed scenarios for different cases of project management and if this happens the experience still provide more in depth details to use for creating new knowledge and this leads to better control and at the same time better flexibility.

Why do you think that education is more important than the experience for the success of the project?

There are few reasons that explain the point of view of the project managers who think that the educational background is more important than the experience for the project success. They explained that the education has to become continuous course of action and that certain types of educational courses are important and are related to the application in the real life and not only theoretical education. This is like a mix between the education and the experience to make sure that the project manager gains the fruits of both approaches to project success. This is one approach of reasoning the importance of the educational background and why it is more important than experience. This approach relies on the type of education that I tightly related to the practical real life experience. Another point of view shows that the education is highly important for the implementation and the recognition of the possible risks and how to avoid it. They think that the experience is not enough to know about all types of risks and that the education covers this part effectively. Their point of view is that the experience that the project manager gain from the project is limited to what he or she interacts with in the project or in few number of projects and it is not necessarily that the way this manager solves problems is the best practice. The success in the project performance may not represent the peak that the project manager can achieve. The educational background from their point of view is a better source to reach this peak of success in project performance then comes the experiential knowledge that come from managing the implementation process. The project managers who believe that educational knowledge is more important than experiential one are convinced that the education helps them to invest all they have learned into their projects. This shows that they are more satisfied because they work with their full capacity and use all their capabilities. This is not the case when we talk about the experiential style managers who think that they did not get much out of their study and their educational background and that they forgot it and replaced it with the practical experience because according to them it matters more when it comes to the project success.

In general, project managers who believe that experience is more important than education in achieving and affecting project success have more reasons to rationalize their point of view against those project managers who think the opposite way.

It is more important to have low risk project performance than to have innovative project performance.

In the third column of the table above the reasons of the project managers who believe that the risk averse is more important to the project success than the innovation are listed. The purpose in this part is to know the answer to two questions. The first question is why would project managers prefer to avoid risk than to innovate something new in their projects? The second question is why would project managers think that risk averse is better than innovation for successful project performance?

The risk averse project managers feel comfortable when they are able to know about risks before starting the project and they think that this increases its percentage of success. The reason behind that is that they think that they need to take care about any factors or circumstances that may lead to any kind of delay in the due date of project submission. This is one reason. Another reason is related to the clear vision. Project managers believe that the risk averse style is relatively more focused on minimizing the level of risks and hence can create clearer vision in the light of what abilities and skills he or she has in their projects. Referring back to the same point that talks about the due date of the project and project completion on time this clearer vision enhances the completion of the project on time. Project managers rationalize this by assuring that the project will not face any kind of obstacles that may negatively affect the successful completion of the project. They tend to believe that innovation requires extra time and may become an obstacle for project completion on time. They believe that risk averse is more important than innovation for the project success because any project has many risks related to aspects like changes in the dollar price, changes in the number of workers, and scarcity or unavailability of resources. The dollar is needed to buy the raw material and any change in its price will affect the cost and expected profits of the project. The overlap between projects' schedules and interdependency of resources and workers may cause lack of any of them at any stage of the project implementation and this may cause some delays that should be avoided. Risk averse managers think that these issues must become a first priority for project managers to be able to have successful project performance rather than thinking of something new and innovative like a new method of implementation for example. This is less important for them. Putting issues like currency, workers, and resources in the first priority from their point of view will increase their ability to minimize risks of their projects. These are expected risks so they focus their attention on how to plan to manage and avoid such risks and to do the needful actions to minimize these risks. This is the definition of the good project management from their perspective. Many of risk averse project managers define the good project manager as the one who can minimize the risks and submit on time. The project manager who puts these two factors in the first priority is a successful one from their point of view and this is what should be focused on in the first place. This is because they think that by minimization of risks they are able to achieve planned results without serious problems and by minimization of risks they can increase efficiency of work and project profits. They build their projects in a smooth way to boost the trust of the client about their work. If the client knows that they are trying innovative things for the first time this may affect his or her trust and this is risky according to the risk averse style

managers. Sometimes when project managers innovate something new they need some extra time and the performance of the project becomes risky. This is unnecessary delay according to the risk averse managers and it's more preferred to have low risk performance. They relate the level of project risk to the contextual complexity of their projects and they said that geographic location and the cultural norms and traditions of the hosting country will differ and accordingly the levels of risks will differ because it is strongly related to complexity of the project context. The environment in which the project lives differs from country to country and that is why the risk averse from country to country is more important than the innovation for those risk averse managers. In general we can conclude that the main reasons behind giving higher priority to the risk averse knowledge creation over the innovative knowledge creation is the readiness for expected risks and the desire to deliver on time and gain the client trust easily. Also the risk averse knowledge creation is more capable according to the point of view of risk averse style managers to focus on expected changes in dollar price, interdependency delays, and scarcity of resources better than innovative style managers can do.

It is more important to have innovative project performance than having low risk project performance.

In the last column we listed the reasons of the opposite point of view that thinks that the innovative knowledge creation is more important than the risk averse knowledge creation and that the innovation is affecting the success of the project performance more than the risk averse knowledge creation does. The innovative knowledge creation style managers think that lots of minimization and avoidance of risks will limit the achieved results and will limit the growth. They believe that the innovation itself is indirectly a reason for minimizing the project risks in the future and that without innovation the risks might be increased and growth will be threatened. Better innovative solutions that are found by innovative project managers will assure the survival and growth, however; it is also important to take care of the basics and plans for the whole project since its start to its end. This is the infrastructure that must be ready day by day to enable the project manager to think about innovative knowledge creation. This means that innovation does not succeed unless there is a base for it and that this base is made up of the regular and standardized plans and procedures of the project. Otherwise the innovation without this base becomes a mess. Innovative project managers think that they are more capable than the risk averse managers to achieve the customer satisfaction as long as they have strong infrastructure to work with. When innovative managers put into consideration that they need to keep in mind that the project must be delivered on its due date and that it has to be conforming to the latest standards followed in similar projects, then innovation becomes more important than risk averse. This indirectly tells us that if the project manager thinks that innovation will cause delays or will lead to nonconformity and lower quality standards, then the risk averse will surely become in the first priority and more important than the innovation. This contradicts with the opinion of some innovative project managers who tell that the more innovation we apply in out projects, the faster we can finish it before its due date. This point of view is linked to the personality of the project manager. Those project managers who think this way believe that the project manager must not be afraid and must not surrender to the natural fright related to capital management. Trying new things is risky and costing extra money on the short run but on the long run the returns on investments are higher than running the project without innovative knowledge creation processes. The innovative project managers think that the risk averse is naturally achieved by the right performance and the perfect management. There is no need to focus on risk avoidance. It is consequently achieved through perfect management as they said. Innovation leads to better capabilities to satisfy the end user and to achieve better results.

Sometimes there are delays in the due date, however; the customer is satisfied with the results because it is unique and innovative. This adds to the belief that it is more important to innovate than to minimize risks. The innovative managers think that if they want to promote their work the only way to do this is by innovating new designs for their projects. They feel that innovation created an imagination about how the end of the project will look like. Moreover that the innovative managers think that the key to have new customers is innovation and that the focus on the minimization of risks will hinder the ability to have new customers in the future. The reason behind that is that they experienced that the quality of results that is achieved in their projects becomes higher with innovative knowledge creation compared to other projects where the focus is only on the risk averse knowledge creation. The quality of results of the projects that are managed by risk averse styles is less compared to the projects that are managed by innovative styles from the customers' point of view as the project managers claimed. They feel that innovative results are more important to the customers than ordinary ones and even more important sometimes than delivering the project on time. This innovation better meets customers' expectations and some cases exceeds customers' expectations in a way that increases the sales in the future. The simplification of the project operations needs innovation, so innovative managers believe that the project implementation will become easier and more successful by having innovation knowledge creation rather than having the risk averse knowledge creation. In general, we can say that the innovative project managers give the innovative knowledge creation higher priority than the risk averse knowledge creation as long as the infrastructure and bases are strong and ready. The innovative style managers also try their best to deliver their projects on time and to conform to the standards of similar projects in the industry and these are the main conditions under which they choose to give the innovative knowledge creation more priority than the risk averse knowledge creation. The effect of the innovative knowledge creation is focused on better results, higher levels of customer satisfaction and retention in the future, better chances of growth and making higher profits compared to the risk averse styles.

This is an overview of the four styles in this study and a qualitative analysis of the project managers' points of view and the reason behind it. In the following lines we will discuss another aspect of the study which is focused on the performance of the project and its stability versus instability. This explanation and qualitative analysis will help in understanding the quantitative relationships that are analyzed and explained between the four styles of knowledge creation and the stability and instability of project performance in the next chapter.

5.15.2 SECOND – THE GROUP OF QUESTIONS THAT ARE RELATED TO STABILITY AND INSTABILITY OF PROJECT PERFORMANCE

When do you prefer to create new knowledge; during stability or during instability of your project performance?

Stability in this study is defined as the relative conformity between the planned performance of the project and the actual one. If the project manager is faced with changes and nonconformity between the plan and the actual implementation for reasons that are uncontrollable then this is a type of projects that is characterized by having instability issues. In fact all projects were found to have instability in it beside stability. Even large governmental projects has instability. When we asked project managers about the percentage of goals achievement none of them was confident that the goals are achieved by 100%, however they want to achieve it by 100% but in

reality instability plays a role in having actual deviation and nonconformity. As a conclusion the project manager is faced with stability and instability periods during managing any project. We were able to group three different ways of thinking of the stability and instability by project managers. The following table shows these three groups of thinking:

	-			-
Reasons of	choosing the	best time to cre	ate new	knowledge?

Reasons of choosing the best time to create new knowledge:				
During	instability	To bring back stability, to fix errors in the plan, to manage		
periods		failure in implementation, to react to the challenges of		
		competitiveness during instability periods, to assure successful		
		plan execution, and to have clearer reflection, and quicker		
		corrective action. Knowledge obtained during instability is more valuable		
During	stability	Innovation needs to be done without stress, better organization		
periods		of ideas, better planned knowledge transfer, plenty of time for		
		knowledge sharing and deep thinking, creation of new		
		knowledge during stability may lead to lower risks, clearer		
		thinking without risks, avoidance of impacts on performance,		
		plenty of time for the team to learn from each other, less		
		workload during stability periods gives better chance to create		
		new knowledge than instability periods.		
During	both	New knowledge creation must be continuous in all periods		
periods		because it will lead to innovation and this leads to better		
		results, however; it is more important during instability periods		
		to help in future projects. Project managers think that		
		knowledge is cumulative and that even repeated activities need		
		to be logged and traced to create new knowledge.		

As shown in the table above there are three groups of opinion about the best time to create new knowledge. The first group thinks that the best time is during the instability periods. The second group thinks that it is better to create new knowledge during the stability periods. The third and the last group thinks that the knowledge creation process is a continuous process and that it should not stop and must be done during both stability and instability periods however it is more important during instability periods. The following lines shed more light on each of the three points of view.

Those who chose creating new knowledge during the instability periods of their project life were doing this because they thought that new knowledge is a tool to bring back stability to their project performance. They believed that they need to change the plan sometimes especially if there was an error in the plan or a failure in its implementation. During the instability there is difficulty of competitiveness in the field. The knowledge creation needs accurate manager. During instability challenges increase and this leads to new knowledge. Knowledge creation ensures the successful plan execution. During instability reflection on some issues is clear and the corrective actions are implemented accordingly.

Another group of project managers believed they have to create new knowledge during stability periods because they believed that creating new knowledge especially the innovative ones needs to be done without stress of thinking during instability periods. This group of managers feel that they are able to organize their ideas and innovate during stability periods in a way that leads to

exceeding the expected performance levels which may not be the case if they tried to do this during instability periods. Planned knowledge transfer is better during the stability periods because we have more time to share knowledge among team members and think deeply, however; the knowledge obtained during the instability periods is more valuable. During the stability periods the creation of new knowledge may lead to lower risks. However; another opinion is focusing on creating new knowledge during stability since the project is not facing any risks at these phases. Stability enables the project manager to think clearly. During stability the project manager can avoid impacts on the project. Project managers use knowledge sharing with team members to create new knowledge and this is better done during stability period where the team has plenty of time to share knowledge and learn from each other. Other project managers think that during stability periods they have less workload and thus they are more able to create new knowledge.

The third group of project managers believed that they need to create new knowledge continuously and during both stability periods and instability periods because the more you create new knowledge, the more you can innovate, and the more you innovate, the better and wonderful results you can get. It is good to create new knowledge during both stability periods and instability periods; however it is more important during the instability periods to help in future projects. Project managers who think that it is important to create new knowledge during both periods, think that knowledge is cumulative and that even repeated activities need to be logged and traced to create new knowledge. That is why they think is important to create knowledge in both periods.

How did you deal with unexpected problems in your project?

The aim of this part is to prove that the project manager face unexpected problems and that this causes instability in their project performance. Many of these unexpected problems were solved using innovative solutions. The following table lists the different reasons found in the sample for unexpected problems and classification of its solution to show which style was more dominant when facing unexpected problems in reality:

#	Problems	Solutions	Style behind
			solution
1	Unexpected increase in the price of	Depending on more than	Risk averse and
	raw material	one supplier	experiential
		Keeping aside an amount	knowledge
		of money	
2	Changes in dollar price	Keeping a side an amount	Risk averse
		of money	knowledge
3	Workers quit during implementation	Depending on more than	Risk averse
		one supplier	knowledge
4	Unexpected changes in the weather	Take this period off and	Experiential
	condition	work for extra shifts	knowledge
		during pleasant weather	
		days	

5	Delays of machines and tools	Delete the deal with the	Undecided
		customer and find another	knowledge (-)
		one.	
6	Actual losses percentage exceeds the	Project is a failure	Undecided
	expected one		knowledge (-)
7	Delay of finance	Delay in project time	Undecided
		frame accordingly	knowledge (-)
8	Lack of commitment of suppliers	Start contacting	Risk averse
		alternative supplier	knowledge
		quickly	
9	Changing the project manager during	Use the team skills until	Experiential
	implementation	the new project manager	knowledge
		starts working	
10	Unexpected changes related to	Coping with customer	Innovative
	customers	related changes	knowledge,
		Changing parts of the	experiential
		project	knowledge
11	Inability to find enough	Delays or failure to satisfy	Undecided
	subcontractors	the customer	knowledge (-)
12	No unexpected issues	Repeated solutions	Experiential
			knowledge
13	Interference of a third party based on	Discipline contract	Experiential
	the customer demand	conditions at the	knowledge
		beginning of the project	
14	Customer disagreement on updates	Refer to the contract	Risk averse
		Changing updates to get	knowledge and
		customer agreement	innovative
			knowledge
15	Regulatory changes by government	Just change what the	Risk averse
		government want no other	knowledge
		choice	
16	Changes in the time frame of the	Minimization of	Risk averse
	project due to conflicts with other	dependency and hence	knowledge and
	projects	minimization of	innovative
		complexity and	knowledge
		unexpected instability	a
17	Resignation of an important human	Resignation forced the	Specialized
	resource	project manager to split	knowledge
		his tasks among self and	
		some other members until	
		they were able to hire and	
10		train nim.	T
18	Installing the system on French	The solution for this	Innovative
	windows.	problem was to mock the	knowledge
		system on English	
		the lor manage	
		the language after	
1		installation to display the	

		application on French windows and it worked well.	
19	Increasing quantities compared to the official contract	The project manager must make re-survey with a consultant to decide on what to do.	Specialized knowledge
20	One challenge that may not be expected is the change of the management of the client company. This may cause that the approval cycle is debatable or changes in the seriousness of work.	May lead to changes in the time frame May lead to termination of the project	
21	Resources are not available on time due to urgent cases.	When these resources return back to the same project, the project manager may need to force these resources to work for extra time when they come back to the project.	Experiential knowledge
22	The unavailability of transit space for materials since no store is dedicated for such a task.	The project managers was forced to use containers to keep project materials in it	Innovative knowledge
23	During the implementation process the project manager found that the measurements in one of the implementation processes are not conforming to the standards	He solved this problem by depending heavily on the safety and the measurement of safety was conforming to the standard so he accepted deviation of the process as long as it is not harming safety.	Specialized knowledge
24	Some changes were needed in the IT part of the project by the customer	The manager went back to the contract and made some agreements with the customer and accordingly the customer retention rate was increased	Experiential knowledge
25	Problems may happen in the level of quality of the site.	One of the project managers used the contingency budget to allocate a consultant to be able to verify that the design will not have a negative impact or any critical problems in the future and he took	Specialized knowledge

		recommendations from the consultant on how to increase certain limits of quality for the final product of the project.	
26	Working against the decisions of the holding company. The holding company in a project assigned a supplier. By time the project manager discovered that the supplier has a technical incompetency problem in his resources.	The project manager had to replace him with a better one quickly.	Experiential knowledge
27	Having major changes in the scope of the project.	Project managers first finalize the main scope of the project then they go to additional scope after having agreement with the customer about it. The customer must agree on the needed changes to change the scope of the project and any related activities.	Risk averse knowledge
28	Level of knowledge of the project manager is higher than the one of level of knowledge of the stakeholders	Reporting the added value of the project manager	Experiential knowledge

In general the analysis of the source of knowledge behind each solution is according to its contribution to the success of the project. For example the sudden increase in the price of the raw material is solved by keeping aside a caution amount of money or having alternative suppliers which is obviously considered as a risk averse behavior and the knowledge about alternative suppliers or the amount of caution money that is needed is dealt with using the experiential source of knowledge. The more experience the project manager has the easier he can get alternative suppliers or determine enough amount of money that is needed as a caution in such cases. This does not mean that this is the only way to determine the right amount of caution money. For example the project manager may depend on specialty and education in determining this amount and may use some calculations for this purpose because this amount will differ from project to project and will not be the same, however; an amount of experience will interfere to judge the accuracy of calculations. The unexpected increase in prices due to changes in the Dollar is another change that could be dealt with in the same way using the same solutions. Project managers will not have the same solution and the same course of action for the same change because they simply differ in their styles and the source of knowledge they depend on and that they believe will lead to the success of their projects. Sometimes workers leave the work without telling that they want to quit in the middle of implementation processes. The right solution from the point of view of some project managers is that they keep an amount of money aside as a caution and depend on more than one experienced supplier especially for workers. Again this is the same source of knowledge that was used for changes in prices, but

not necessarily the only one. A group of causes led to the change in the time frame of the project implementation. Sometimes the weather condition is an obstacle, sometimes delays of machines and tools needed for implementation processes for any reason. This keeps the project manager waiting for an alternative, or sometimes the project manager deletes the deal with the customer and tries to find another new one. If this happens then the project manager is faced with a failure in the current project and hence the project manager is not depending on any source of knowledge because the unexpected instability is out of his or her control. One of the unexpected problems is when the actual loses percentage exceeds the expected one. This is another case where the project manager is not able to employ the knowledge in a way that leads to overcoming this problem and at the end we conclude that the project was a failure and this happens for many organizations where they have one or more of its projects showing failure while the rest of the projects are a success. The whole organization keeps this combination of projects because it fits with the general policy of the organization and because all in all there is a margin of total profits even if one or more projects are a failure. Some of the instability problems are caused by the organization as well like for example delay in finance. This kind of problems may dangerously lead to discontinuation of the project or at least delays in the time frame of the implementation of the project. This is a kind of organizational problem and thus it is uncontrollable by the project manager unless he or she has a financial caution for such cases. If there is prepared and planned financial caution then this refers to the experiential source of knowledge that the project manager uses to deal with similar cases in his or her organization. One of the instability problems is the lack of commitment from the suppliers. The solution is to find an alternative quickly and start contacting the alternative suppliers. This is also a risk averse knowledge as well as an experiential one related to the alternative and appropriate sources of suppliers.

Natural crisis and the condition of the weather are unexpected problems. Project managers still are able to compensate the instability periods of this type of problems by postponing the work and having extra shifts. This is a kind of solutions that is depending on experiential if it is repeated, but if not then this is an innovative knowledge because it will be tested for the first time and its relation to the success of the project is not measured yet. If the idea is taken from the experience of others then this is considered as experiential source of knowledge as well. This again differs according to the style of the project manager. Some of the project managers did not believe that they have something that is unexpected because of their long experience. This highlights the importance of experience as a main source of knowledge for the project manager. Sometimes this experiential knowledge is interacting with other sources of knowledge to create the decision that will lead to the project success and performance stability from the manager's point of view.

Some project managers said that the unexpected changes include changes related to customers. Changes related to customers are important to the project manager because it is directly related to the project success. The project manager copes with the needed changes, sometimes refers strictly to the contract with the customer and other times changes the contract to fit with the customer's needed changes. Both ways of dealing with customer changes were found in the sample of this study. If the project manager is trying to test something new for the first time to satisfy the customer then this is a third style of knowledge creation which is the innovative knowledge creation style and it was also found in the sample of this study. The first way of reacting to the customer changes by referring strictly to the contract is maybe a risk averse approach and the second one which his changing the customer satisfaction and raise the rate of customer retention.

One of the unexpected problems that affected the stability of the project performance is changing the project manager during project implementation. When the project manager is changed there is a period of instability until the new project manager understands the current situation of the project. During this period of instability the team plays a great role in performing as planned and especially if this team is experienced, so this is a source of regaining the performance stability by counting on the experiential knowledge. Some of project managers said that changes are represented by the interference of a third party after the starting up of the project due to customer's demand and then the customer does not agree on the updates of the third party. This is one special case that shows how important is to monitor the customer rapid changes and that these changes seriously may affect the stability and even the success of the project performance. In this case the project manager is very careful about the third party's added value and if this is leading to the project success or not, however; this interference is an opportunity for learning new experience. It is exactly like depending on an external consultant. This is considered as an experiential source of knowledge for the project manager. One of the unexpected changes is the few number of subcontractors or the inability to find more subcontractors during the project implementation. Scarcity of subcontractors is not something new or unexpected, but the time when it happens is unexpected. Mainly the experienced project managers are prepared for this kind of changes and plans a head to find immediate alternatives for this problem. We found that the more experience the project manager has the less feelings he or she has that this kind of problems is unexpected. This increases the readiness of the project manager to face this kind of problems and hence minimizes its negative effect on the stability of the project performance and its success. We rarely found that the project manager thinks of changing the type of raw material and replace it with an alternative one to overcome the scarcity of the subcontractors. Mainly the project manager uses this replacement only when there is a problem in the level of quality of the raw material itself. Even if there are changes in the prices of raw material or the dollar price, they still want to use the type of raw material that have achieved high levels of safety or that is accepted by the organization they belong to. This is because the time frame does not allow for the adoption of the new raw material repeatedly, so they keep this to the change they may want in the level of quality as a reason not because of the scarcity of the subcontractors. Changing the raw material by another one because of its quality and testing it using deployment processes before the actual implementation of the project starts is an innovative knowledge. There is another type of changes reported by project managers. It is called regulatory changes (by authority and government department). Project managers said that they just change what the government wants them to change because there is no other choice. The only choice is coping with those changes. They simply apply the required changes to the project. This can be considered as a risk averse source of knowledge because the project manager is coping with the governmental regulations to avoid risks that may affect the success of the project or the stability of its performance.

There are also changes in the time frame due to conflicts with other projects in the same organization. Minimization of dependency on other projects is a good solution for these kinds of changes. This dependency increases the level of complexity. as a conclusion we can find that less complexity may lead to better stability or having expected changes rather than having unexpected changes. Changes or delays in the time frame of the project implementation is expected if the project manager has experienced similar problems in the past. Most of the project manager deals with the changes in the time frame of the project differs from one manager to another based on his or her style. Some project managers will work for extra shift, others will postpone
the due date, however; it rarely happens because they rely on the early submission to make extra profit and to save costs.

Resignation of an important resource is another unexpected change that is reported during interviews with managers. Resignation of an important human resource forced the project manager to split his tasks among self and some other members until they were able to hire and train him. This example shows the importance of the team experience as a source of knowledge to deal with instability issues in the project. Another example was installing the system on French windows. The solution for this problem was to mock the system on English windows and then change the language after installation to display the application on French windows and it worked well. This was an innovative way to do this and was tested for the first time but the technical experience was partially part of the solution. This assures that in the real life depending one source of knowledge creation may not be enough to reach the optimum solution. The proportions of each source of knowledge may not be the same but the combination of sources is naturally the logical situation in reality. The separation of styles is for studying purposes and the research is focusing on the dominant style in the personality of the project manager. This self-reported dominant style is the independent variable of this research. This clarifies why we may find more than one source in reality used by one project manager in one situation. It is because it reaches better solutions and it is sometimes done unintentionally by the project manager. We will talk about this part in the observation part of this study.

One of the unexpected problems also is increasing quantities compared to the official contract so the project manager must make re-survey with a consultant to decide on what to do. For project managers most of the time if not all the time they are dealing with business customers. One challenge that may not be expected is the change of the management of the client company. This may cause that the approval cycle is debatable or changes in the seriousness of work. Another problem occurs when the resources are not available on time due to urgent cases. When these resources return back to the same project, the project manager may need to force these resources to work for extra time when they come back to the project. In this case it is very obvious that the project manager had based his decision on a source of knowledge that could be a previous experience or a risk averse knowledge due to some contract items in case of delays of project completion. To avoid this risk the project manager will work for extra shifts with his workers. Or he had experienced this solution before in similar problem and it works well every time especially that project managers declared that delays of resources and machines happens due to high levels of interdependency with other projects in the same organization. One of the project managers was forced to use containers to keep project materials in it and this happened because of the unavailability of transit space for materials since no store is dedicated for such a task. This is considered as innovative decision because it was not tested before and the project manager was experiencing its effect on the project performance and its stability for the first time. Weakness of stakeholders' level of knowledge about the project manager's added value to the project is another issue that was raised by one of the interviewees. If the project manager feels that the stakeholders are not understanding his or her contribution to the success of the project, this may affect the stability of the project performance and even is results. Stability may be affected by some environmental or contextual aspects that leads to the comfortability to work with certain group of stakeholders or the vice versa with other group of stakeholders. That is why we think that the experienced project manager will behave successfully in any project, however; in fact this is affected by the contextual and environmental atmosphere of the project. During the implementation process the project manager found that the measurements in one of the implementation processes are not conforming to the standards then he solved this problem by depending heavily on the safety and the measurement of safety was conforming to the

standard so he accepted deviation of the process as long as it is not affecting the safety for the customer. Strangely when this project manager was asked about the reason why this solution came up to his mind he said that the difference happens when you have experience. He added that he has been working on these types of constructional projects for more than 20 years; however when he was asked about this specific problem and if had experienced the same one before, he said that this happened for the first time. This leads to the conclusion that the experience may also become a source of new innovative solutions and may be affects the expectancy of the success of this new solution as well.

Another implementation non-compliance problem occurred in the field of IT projects. In this project the manager went back to the contract and made some agreements with the customer, then accordingly the customer retention rate was increased. And this is another example on the same point which is coming up with a new solution, non-tested one, and referring this to the experience not to the innovation. May be the project manager uses experience to increase the level of confidence in the new solution because according to the experience he expects the success of the new solution and that he is experienced on trying new solutions an these new solutions succeed most of the time.

Problems may happen in the level of quality of the site. For example one of the project managers used the contingency budget to allocate a consultant to be able to verify that the design will not have a negative impact or any critical problems in the future and he took recommendations from the consultant on how to increase certain limits of quality for the final product of the project. This solution is based on different type of experience which is others' experience not personal one. That is why the innovation here is not highlighted as a component of the decision making process. The holding company in another project assigned a supplier. By time the project manager discovered that the supplier had a technical incompetency problem in his resources, so he had to replace him with a better one quickly. This is a risk averse piece of knowledge that based the decision of the project manager. The checking of the performance of the supplier led to the discovery of the inconformity and this led to the decision of changing the supplier as soon as possible. This solution could also be related to the experience of the project manager and that if the project manager was less experience, he or she would have never been able to catch the early alarm of the risky situation.

After all the project manager creates new knowledge to make tailored decision for each and every situation. We can't say that one reaction will be suitable if the problem is repeated because even though the context and the environmental factors will not be repeated identically. The project manager moves quickly or slowly toward the creation of the new knowledge based on the dominant source of this knowledge that he relies on usually. If this manager relies on the risk averse sources of knowledge then the decisions will reflect this type of knowledge and so on. The twenty eight problems that were discussed in this part as problems that may lead to the instability of the project performance or that may affect the project results were general problems. In the following part the researcher will discuss the effect itself in the final indicators of the project life. The following part will analyzed the reasons of the deviation in the stability indicators of the project after its completion.

Reasons behind deviations between actual and planned stability indicators

After the completion of the project there are some indicators that show that the project is stable and the performance was successful. After asking the project managers and referring back to the literature we found that the profit, cost, and the needed time are the main three dimensions that the project manager focuses on when measuring the success of the product. Numerically the percentage of cost savings, profit raising, and time saving are three indicators that the project manager is a successful one. We will talk about the negative performance indicators and the reasons behinds it like for example when the actual costs exceeds the planned ones, or when the actual profits become less than the expected ones. We found out the reasons behind delays and extending the needed time for project completion from the project manager's point of view. These are indicators that there was instability in the project performance. We also considered that the regular control may discover partially some of these indicators during the implementation process of the process.

Why does the actual cost exceed the expected one?

First when we analyze the reasons behind the deviation between the planned costs and the actual ones we ask the project managers first about the reasons they give for this deviation. We can classify the reasons of this deviation into specific categories. Theoretically we can say that there are three categories. One is related to the plan itself and its quality. May be the target was not realistic and that is the reason behind deviation. Another category is related to the quality of the actual implementation and something related to the factors of production or the inputs of productivity of the project like the quality of the human assets or the quality of the raw material and machines maintenance and so on. The last and the third category is related to the context or the environment in which the planned work is implemented. Sometimes there are certain changes that are uncontrollable and the project manager is not able to close the gap between the plan and the actual implementation because of these uncontrollable changes. In the following table the researcher is trying to classify the reasons behind the gap between the actual and the planned costs into three categories as explained. The reasons related to the plan, the reasons related to the project inputs, and the reasons related to external uncontrollable factors:

Deviation due to the plan	Deviation due to the project	Deviation due to external
	inputs	uncontrollable factors
13. This rarely	16. The cost of the	20. Slight increase
happens when	project must be	in the cost is due
the plan is	higher than the	to changes in the
inaccurate	planned one	price of the
14. Some project	because	currency
managers see	knowledge itself	21. Because
that the actual	is a cost but it is	changes in
cost always	worthy.	prices in the
becomes higher	17. Other project	market are
than the planned	managers	always toward
ones because the	reported that	increasing not
scope of the	they are able to	decreasing
project is not	have less costs	prices
clear at the	than what was	22. There are
beginning of the	planned because	expected
project and	they are able to	changes in
because they	implement the	prices in the
deal with many	project in a	market and they
challenges that	shorter period of	are not expected
need extra time	time.	to decrease. The
to be handled		change is

and this time	18. Again there are	always toward
was not	project	increasing not
considered	managers who	decreasing.
before during	relate higher	23. Some projects
the planning	actual costs with	have higher
phase of the	longer period of	actual costs than
project.	time needed to	expected ones
15. Scoping issues	implement the	because of the
and	project.	material costs
interdependency	19. Replacing some	especially when
with other	of the team	they have less
variables are	members during	number of
strong reasons	the	available sub-
for having extra	implementation	contractors.
actual costs than	of the project is	24. Others found
the planned	another reason	that the reason
ones.	for having	behind having
	higher costs	higher costs
	than the	than expected is
	projected ones.	the increase in
		the dollar price
		25. Some changes
		happen and they
		are approved to
		happen during
		the
		implementation
		process and that
		is why the actual
		cost may
		become higher
		than the planned
		one; however it
		is slightly higher
		than the planned
		one.

Before analyzing the reasons mentioned in the table we must report that a group of project managers said that most of the time the actual cost is conforming to the planned cost. Even when there is a deviation at the end of the project this doesn't mean that this deviation have started since the beginning of the implementation process. It may happen during the implementation or even discovered by the end of the project.

Actually fewer reasons were found in the planning category. Maybe because this is directly related to the planning skills of the project manager or related to the plan that was set by higher level management so the project manager is a little controvert when speaking about it. The first reason is obviously related to the inaccuracy of the plan and this rarely happens according to the project managers. Logically even if the inaccuracy of the plan exists, the learning curve will

help the project manager and his or her team to avoid the mistakes of planning. Accordingly we can expect that the planning inaccuracy and the planning mistakes become less by time and by gaining experience and by learning.

The determination of the scope of the project and the time needed for the planning process are two main reasons behind the deviation in project costs. Regarding the scoping issues it was highlighted by project managers as an important issue. The scope of the project includes all the needed work load that leads to the achievement of the project goals as agreed upon with the customer. If during the implementation process there are changes in the scope this is translated to changes in the working hours, amount of raw materials, schedules of production and shifts, and maybe number of workers and many other aspects of the plan. It is very important to take enough time to determine the exact scope of the project that will facilitate implementation and that will achieve the project goals during a specific time frame. This is related to the project manager's ability to determine this scope and maybe the previous experience related to doing this task in the past. We need to consider that the change in the scope may not happen because it was inaccurately determined during the planning process. It may happen because the customer introduced some changes during the implementation of the project and this requires changing the scope of the project from the planned scope. This means that the reasons that are related to the plan may be interacting with the reasons that are related to uncontrollable environmental factors and this is a real challenge for the project manager. Another aspect is the time needed for the planning process. The lack of enough time to finish the planning function properly will affect the entire project until the end of project completion. In this part the project managers said that the lack of time during the planning process may lead to the variation between the planned costs and the actual ones. This means that the lack of time during the planning process affects putting realistic plans and this interprets why some project managers in this part considered the deviation between the planned costs and the actual costs as a natural thing and that it happens a lot. Even the well-educated project managers in this sample were not able to tell that the achievement of the plan happens 100% accurately. We need to consider that the project managers do not consider that the deviation between the plan and the actual implementation as a failure as long as this deviation is between the acceptance limits of control and as long as they know what are the reasons behind it and how to fix it or at least minimize its effect in the future plans. One of the methods that will minimize the gap between the planned costs and the actual costs is giving enough time for the project manager during the planning stage of the project life. One more reason behind the gap between the planned costs and the actual ones is the high level of planned interdependency between the current project and other projects in the same organizations. The high level of interdependency leads to overlapped schedules of production and the project manager feels that the decisions of planning his or her own project implementation time frame is depending on the implementation time frames of the other projects. This causes other problems during implementation like delays because of waiting for a certain resource to avail after the other projects finish using it. The meaning is the delays in other projects may lead to the delay of the manager's project even if he or she sets a good plan. The level of planning in this reason is not only related to the project manager's planning skills. It is related to higher level of planning where the scope of planning includes more than one project working together at the same time. Shared resources represents reasons related to the input of the production which showing that this planning justification of the gap between planned and actual costs interacts with the other category of reasoning which is related to the inputs of the production for the project. We can conclude that the three proposed categories are not isolated. They are related to each other. We can also conclude that the success of the planning function increases when the level of interdependency on other projects decreases. This

is after considering the stability of other factors that may affect the success of the plan. Qualitatively there are four reasons related to the planning function and are responsible about the deviation between the actual costs and the planned costs. the lack of time needed for planning, the inaccuracy of determining the scope of the project, the high level of interdependency between the current project and other projects in the organization, and finally the inaccuracy of the plan itself and this is more related to the skills, knowledge, and capabilities of the project manager.

Moving to the second category of reasons behind the deviation between the actual costs and the planned ones, we surprisingly found that the knowledge is one of the reasons behind this deviation. The project manager considers that knowledge is a cost and that it leads most of the time to the increase of the actual costs relative to the planned ones. Acquiring this knowledge takes time, effort, and money and all of these items are at the end translated to higher costs. the project managers who think that the knowledge is costing money and is mandatory in each project do believe that the actual costs comes higher than the planned costs most of the time. Knowledge is considered as an input that is needed for all stages during the project life since the beginning to the end of the project. Another important input is the time. Project managers depend highly on the savings that occur when they finish their projects in shorter periods of time. They save wages of workers, using machines and fuel, and other savings by finishing the project in shorter period of time. This leads to achieving higher levels of customer satisfaction as well. On the contrary the delays and using extra time will maximize the gap between the actual costs and the planned ones. The project manager may use the time as a factor to manipulate gaps between the actual and the planned costs. If the project manager found that the gap is big then he or she can use the time to minimize this gap. Another reason is the change or replacement of team members of the project during implementation. To explain this reason the project managers said that daily workers are having their wages per day or sometimes per hour and they quit without any excuse when they find another place that pays more for them. They are like a kind of part-timers. The project manager experiences this problem repeatedly and is ready to find alternative suppliers of workers in case this happens during the implementation, but still there is a problem in replacing workers during the implementation stage of the project. The number of workers and their positions and tasks are scheduled and planned and the change during implementation causes instability in the implementation and needs time and cost to be fixed. So the main resources or inputs that leads to the deviation between the planned costs and the actual ones are the knowledge, the available time, and the replacement of workers during implementation. The time is the only source or input that may lead to maximization of the gap between the planned costs and the actual ones and at the same time could be used to minimize the gap between the actual costs and the planned ones. This doesn't mean that knowledge for example doesn't do the same role, but this is what was found in the sample of this study.

Then we come to the third category of reasons which is related to the environmental and the uncontrollable reasons. The group of reasons are limited and are focused on the change in the prices of raw materials or any other input. The changes differ from project manager to another. Some of the project managers think that it is unexpected when this kind of change happens and other group of project managers said that they always expect such kind of changes in the market and they get ready for it during the planning time and they keep extra money only for changes in prices of inputs or changes in prices of currencies. The project managers who are expecting the change and getting ready for it since the beginning are performing a risk averse behavior by doing this. Maybe because they feel that the gap is less when they behave this way, or maybe because the project they work on is existing in a rapidly changing environment and they realize

this. Sometimes it is the experience that tells the project manager whether it is better to invest the money in the project or to keep it as a caution for such changes.

Why does the actual profit become less than the planned one?

Again we will analyze the reasons behind the gap between the actual and the planned profits based on the same three categories proposed by the researcher. the category of reasons related to the plan, the category of reasons related to the inputs to the production process of the project or if the project is a service project then related to the production of the service until its final provision to the customer, and the third category is the category of reasons related to contextual or environmental variables that are uncontrollable by the project manager. The following table classifies the main reasons behind the gap between the planned or expected profits and the actual or achieved ones into three categories as mentioned earlier:

Deviation due to the plan	Deviation due to the project	Deviation due to external
	inputs	uncontrollable factors
26. We do not	28. Sometimes	29. Because of
expect exact	when we expect	shipping prices
figure of profits.	better results of	and changes in
We always	the project, we	currencies
expect a range.	can accordingly	which means
We put an upper	expect better	that the actual
limit and a lower	profit than what	profit may
limit to the	was planned.	become less
expected profits		than expected.
and the profit in		
this project is		
higher than the		
average		
expectations		
because the		
company is		
famous and		
trustful in the		
market by its		
customers and it		
has a history of		
success in		
similar projects		
in the market.		
27. Sometimes		
when we expect		
better results of		
the project, we		
can accordingly		
expect better		
profit than what		
the project, we can accordingly expect better profit than what was planned.		

Before speaking about the gap in the profits of the project, we realized that project managers tend to believe that most of the time the expected profits are as the same as the planned ones or even better and that they are trying all the time to find the reasons that leads to higher actual profits than the expected ones. Even when they rationalize the decrease in the expected profits they give uncontrollable reasons like the profits were calculated using a currency price that became less after the completion of the project so that is the reason that the profits became less. It is better for the project manager to believe that the less actual profits are due to external factors not due to internal ones. This is maybe related to the attribution theory and maybe keeps the project manager successful because if he believes that he failed in achieving the profit goal of the project then this will affect his or her future performance negatively. The project manager accepted to have deviation in time and cost easier than accepting having negative deviation between the actual profits and the planned ones as if this is an indicator on the project manager's failure not only the project failure. Some of the project managers said that when the profits of a certain project becomes less than what was expected the top management of the organization wants to ask first who is the manager of this project and then goes into the detailed reasons of failure especially if this project manager is the planner of the project. In worse cases the project manager is the founder of the project and is trustful by the upper management levels but then when the actual profits are less than the planned ones this level of trust decreases. To get out of this dilemma some project managers do not estimate an exact number or percentage of profits. They rather determine a range of upper and lower limits estimated profits and hence they get out of accountability about a certain concrete percentage which is more difficult to achieve, and this shows how sensitive is the estimation of profits at the beginning of the project. Some organizations are welling to compensate delays and higher actual costs by achieving higher profits. Accumulation of success in the marketplace and the sound reputation among customers may lead to this profit as well and this affects the expectations of the project. The project manager tends to put high figures of estimated profits during the planning phase of the project when he or his organization has a history of success in the market place and among competitors and customers. Like foe example if the organization is famous for its quality and safety then this opens new deals with the customer and raises the market share and hence the profit margin is higher and is estimated to stay higher in the future. One of the reasons of this kind of success that was reported in this study is insisting on innovating new ideas of implementation or of satisfying the customer so that the customer retention rate becomes higher and the word of mouth of customers brings in new customers. This makes the project manager optimistic when he or she plans and then he works on the best scenario not the worst one. The estimation of higher profits does not happen ones at the beginning of the project life. It happens also during the implementation process in some projects where the project manager has more information about the validity of the estimation of the profit that was written in the plan. This is considered as one of the inputs during implementation where the project manager can manipulate the implementation process to stay within the upper and the lower estimated limits of profit. One of the solutions during implementation is to cut down part of the cost or to save time so that the cost automatically becomes less. That is the reason why the project manager needs to check the ability to achieve the estimated profits during the implementation process. Sometimes this check shows that there are better results than the planned ones so the project manager raises up his expectations level and thinks of higher profits to be achieved by the end of the project completion. Sometimes it is the innovative methods or ideas that lead to higher profits. One of the uncontrollable factors that exist in the external environment is the changes in the prices of the raw material or if the raw materials are imported from another country and the shipping

prices become higher than the planned ones. In this case the actual profits become less than the estimated ones and the project manager does not control these reasons because it exists in the external environment. All what this project manager can do is to cope with these changes by different kinds of savings in time and costs and mentioned before. The gap in the profit affects the success of the project manager as we mentioned earlier so the successful project managers are the ones who can achieve the estimated profits or even higher than the estimated profits and this is a good reason for the project manager to ask to be paid more by the organization in which he or she works. This interprets why we observed that the project managers do not want to attribute the failure in achieving the estimated profits to personal reasons.

What are the reasons behind deviation between the planned time of the project and the actual one?

In the following table we are categorizing the reasons of the deviation between the planned time and the actual one into two categories; the category of reasons related to the inputs of the production process, the category of the reasons related to the environmental out of control changes:

Deviation due to the project inputs	Deviation due to external uncontrollable
	factors
30. Sometimes we take longer time because of delays in receiving the raw material needed for the project	39. Another reason may be the bad weather which is out of control40. Those who think that it will be lower than the estimated one
31. Sometimes the delay in submission reflects lack of experience of the project manager.	they refer this to changes in the prices of raw materials or currencies because this will affect the prices of the imported
32. One of the reasons is the delay in receiving tools and machines especially if the company runs more than one project at the same time.	Materials.41. For project managers who are working on service products.They think that their customer satisfaction of the public users is
33. We take longer time than the planned one, but when we are able to submit before the scheduled time then we can save a lot of costs. Each working day costs working hours, fuel for machines, and other types of costs. Accordingly the net profit becomes higher if we finish before the planned time.	 the main factor to be considered when calculating the actual profit. If they planned a certain amount of profits to be achieved then the level of customer satisfaction is higher than expected, this may become a good reason for achieving higher profits than estimated ones. 42. Having many risks also may
 34. We do our best to finish on time and we try to conform to the standard time to keep the expected level of safety. 35. Some project managers 	cause decrease in the actual profits compared to the estimated ones.43. Some managers think that if we add the interdependence scope
considered this as a conditional	of the project, achieved profits

matter. They think that if the	will be lower than estimated
time and cost of the project are	ones.
lower than estimated then this	44. In one of the cases the project
will consequently lead to higher	manager reported that the
profits than estimated ones.	achieved profit was lower than
36. Changes in the scope of the	the planned by 20% because
project is one of the main	they had many risks during
reasons of increasing the costs	project implementation and this
and changing the budget of the	has negative effects on the
project.	quality of the product that was
37. If the project is not consuming	supplied to the customer. It was
the contingency reserve in	very poor. Also the project life
complete then the final profits	cycle had lots of delays. This
will be higher than estimated	represents another good reason
ones. This is another reported	for the lower actual profits.
opinion about the comparison	When risks affect the project life
between the estimated profit and	cycle, product quality, and
the achieved one.	maybe customer satisfaction.
38. The nature of project	45. Sometimes the client has
management itself does not	unexpected decisions which
enable the project manager to	represent a good reason for
calculate or to estimate the	having lower profits than the
profits. It is an internal project	planned ones.
among other projects in the	-
organization. Accordingly the	
thing that is calculated is the ROI	
"Returns on Investments" not	
the profits. This is another	
opinion that adds more in depth	
view of the profit discussion.	
1	

As shown in the above table the research revealed that the project managers in general are not referring the deviation in the profit to planning reasons. This assures the importance of this indicator and to what extent do project managers consider it as an indicator on their own success as project managers. They tend to attribute the failure in attaining the goal of the profit as a personal failure in their management. This may interpret how they explained the deviation by reasons related to the implementation inputs or by uncontrollable external reasons. Most of the project managers who were interviewed thought that the actual profits of their projects will be as the same as the estimated ones or even slightly higher than the estimated ones. This may be related to their confidence of their planning ability or their belief that inability to achieve the expected profits is equal to the inability to manage the project successfully in front of the top management of the organization.

There is a consensus that the decrease is the profit may be caused by delays in the completion of the project. Longer period of time is translated to extra cost and hence less profits. This also shows the high dependency among the profit, time, and cost as indicators of the project success. Time affects cost and cost affects profits consequently. Moving to the analysis of the reasons that are related to the production inputs of the project we found that project managers may attribute the deviation between the actual profit and the planned one to the time needed to receive the needed raw material and in fact this is relatively complex because this delay does not have sole reasoning. Sometimes the delay in the delivery of the raw material is because of lack of punctuality of the supplier of the raw material or due to the vulnerability of the quality system in the supplier's organization which leads to the longer periods of inspection before the raw materials get in to the production process. Other reasons may be related to the interdependency with other projects in the same organization. The raw materials or other resources are locked in other projects and the current one has to wait until the other project managers finish using the same resource. The project manager can change the supplier in worst scenarios or if the problem with the supplier is repeated. However; we can still face the same problem in case of resource scarcity. The change of the supplier in this case becomes more difficult. Delays in the raw materials is still representing a repetitive problem that may hinder the achievement of the planned profit from the project manager's point of view. Experience leads to faster implementation of the project and better quality according to the project managers. The experience is considered as an important resource and it is and input to successful completion of the project. Lack of experience was reported as one of the existing reasons in the sample that may lead to the delay in the implementation and the completion of the project and hence leads to higher costs and deviations in the profits. This may mean that the more experience the project manager has, the less will be the gap between the planned profit and the actual one and vice versa. Experience in this study is a source of knowledge and the project manager qualitatively speaks about the relationship between the stability of the project performance that is represented by the less variation between the planned indicators and the actual ones in one hand and the experiential knowledge creation in the other hand.

Machines, tools, and equipment are highly highlighted by the project managers as a reason for the deviation in profits. The organizations usually run more than one project at the same time and economically they schedule the machines, equipment, and tools to work in more than one project in the same period of time. Shifting these inputs from one project to the other is sometimes delayed because of differences in punctuality of project managers in different projects or even due to uncontrollable reasons. Downtime that is consumed in maintenance and warming up for the machines is also representing unproductive time for the project manager and causes delays, however these kinds of delays are planned delays. The delays that are caused by interdependency are shortly noticed or unplanned so they are considered as indicators of instability. The interdependency is one of the factors that measure the complexity of the project in this study. The research proposes that the high interdependency on other projects leads to higher levels of complexity and this is a mediator that may lead to lower levels of project performance stability as revealed qualitatively in this part of the study.

At the beginning of the project implementation or in the middle of implementation the project manager may realize that there is delay whether because of expected reasons or because of unexpected ones. In this case the project manager may expect that this will affect the delivery on time and may lead to less profits. The project managers spoke about this problem and said that when they realize this delay at any phase of the implementation they overcome its effect by speeding up the processes of implementation. This can be done by having extra shifts or extending the number of working hours per day or even by increasing parts of the project inputs like number of workers or machines if possible and this leads to earlier submission then this early submission overcomes the delays and keeps the actual profits as the same as the expected ones. Theoretically this may not work, however; project managers believed that in reality this technique works well and is used as a preventive technique to keep the stability of the project profits at the end of the project. On the contrary there are other group of project managers who

believe that the standardized time that is needed to implement the project has to be consumed in full and strictly because this is related to the safety of the project and this means that finishing the project in less time may lead to deficiency in the level of project safety and this is very risky and dangerous in certain types of projects like constructions projects. This group of project managers think that the decrease in profits in the short term that comes from certain project may become less but this is not an indicator that the project manager has failed or that the project has failed. In the long run the continuous delivery of confidence in quality and safety will overcome this decrease in the profits. The long term profits will increase after building solid reputation so they accept short term variations in the project indicators only if this is related to conformity in other more important indicators. It was found that there are main factors that lead to expecting deviation in the profits of the project. The factors are repeated in different types of projects like for example IT projects, construction projects, and manufacturing projects. These factors are the cost, the time, and the scope of the project. Project managers expect deviations in the project profits when there are deviations in the time, cost, and scope of the project. If the implementation takes more time than the planned one, higher cost than the planned one, then the profits may become less than the planned ones. The change in the scope of the project that is mainly caused by customer demand leads to changes in the plan in shorter periods of time and during implementation and this has side effects on time and cost and consequently on profits. This leads to the conclusion that was qualitatively found. The conclusion is that project managers use monitoring of time, cost, and sometimes the consequences of changing the scope of the project as controllers of the deviation in profits or at least predictors of the possible deviation in profits of the project. One of the results that were found in this part is related to the risk averse style of project managers. The project managers who keep contingency reserve for emergency or calculated risks consider that this reserve as part of the profits of the project if not consumed. Sometimes it is not consumed at all and other times it is partially consumed and the remaining amount is added to the achieved profits so they consider it as part of it. This may show that the project manager was able to avoid risks and save money so the project became more profitable for the company. If we look at this from another point of view we can think of exceeding the amount of this reserve during the planning period so that the project managers makes sure that at the end of the project he or she will have better chance to have profitable project. The project manager in this case uses the risk averse knowledge to avoid risks and these risks include the risk of deviations in the project profits. In this case the organization does not consider this as lack of planning skills or blocking money that could have been invested in other projects. The organization considers this as a success for the project manager and repeat following the same plan in the future only because it leads to profitable projects, and this is what matters. Another important opinion of a group of project managers is related to the inability to calculate the profits of each project separately. They said that the project is part of a group of projects and it is not independently implemented so the thing that is calculated is called the ROI "the return on investment" not the profit of the project. They said that the profits is calculated on the level of the whole organization not for each and every project. This leads again to the importance of the interdependency as a factor in the project complexity that affects the profitability of the project whether in the short run or in the long run. It is obvious that the high complexity that is caused by the interdependency is qualitatively related to the higher levels of instability in the project performance. In general we can say that the main inputs that were found qualitatively responsible about the instability in the profits of the project are the time, the experience of the project manager or his team, and the interdependency among projects in the same organization and that changing the scope of the project may lead to changes in the time and cost of the project and hence lead to deviations in the profits of the project. We can also

conclude that there are two groups of project managers when speaking about the relationship between profits and time. The first group is with saving time and the early completion of the project and that this increases the profits of the project in the short run. The other group think that the standardized time has to be followed strictly because it is related to the safety of the project or to the conformity of more important quality indicators and this leads to higher profits on the long run, even if the short run profits are less. This depends on the range of quality between the upper and the lower limits that are accepted by the project managers. Some of the project managers do not accept the minimum and others do as long as the customer is satisfied. This is the first part of reasons which is related to the inputs of the project.

Another group of reasons is related to the external uncontrollable reasons that may face the project manager and lead to deviations in the profit indicators. The project manager can't change these kinds of reasons, however; he or she tries to cope with them. One of the uncontrollable reason is the bad weather conditions and this is out of control for the project manager. This reason was given mainly by the constructions projects because this kind of projects requires outdoor processes and workers are affected negatively by the high degrees of temperature and humidity. The project manager can cope with this problem by changing the morning shifts to afternoon ones or postponing the work to another day when the weather is better. Most of the time the workers are facing bad weather conditions during the summer. This is mainly gulf area and they wear helmets to protect their heads. This reason may cause sudden quieting from the work and or delays in the completion of the project. Organizations who depend on imported raw materials are highly affected by the changes in the raw material prices or by changes in the price of currencies. This is also uncontrollable. This raises the price of the final product of the project and is faced by the contingency reserve sometimes if it is repeatedly experienced. This problem becomes more serious especially if the raw materials are scarce or have no alternatives. In this case the project manager is forced to cope with the changes in the prices and deliver on time. Sometimes if the project manager is depending on sole supplier for a certain type of imported raw material then again the changes in the price of this type or changes in the dollar for example will lead to changes in the expected profits for the project manager. There is a relationship between the expected profit and the prices of the raw material. If the price of the dollar increases the purchasing price of the raw material will increase and then the cost will increase. As mentioned earlier the increase in cost may lead to decrease in the profits of the project. The trend of the raw materials price always goes up unless there is a better raw material in the market. One of the main uncontrollable reasons is the change in the customer satisfaction. It is the main factor in calculating the actual profit of the project. Project managers believe that if they planned a certain amount of profits and then the level of customer satisfaction was higher than expected then this means that there is a chance to achieve higher profits than estimated planned ones. Customer satisfaction is a reason for both the higher profits and the lower profits. Qualitatively there is a direct relationship between the level of the customer satisfaction and the ability to achieve the estimated profit. We can conclude that the project manager is more capable to achieve the estimated profits or even exceed it, if the level of customer satisfaction is high. The project manager is not sure if he or she can achieve the estimated profit is the level of customer satisfaction is low. This is risky because the taste of the customer and the expectations are affected by the performance of other competitors in the marketplace. The same customer who was satisfied in the last project may have less satisfaction with the current project. Again this is uncontrollable and the project manager is striving to increase the level of the customer satisfaction by fulfilling his needs and wants. In general the project managers think that the more risks faced during the implementation of the project, the less is the actual profit compared

to the estimated one. Most of the risks are considered risks because of the uncontrollability. Uncontrollability is related to the externality of the reasons. External and uncontrollable reasons are risky and affect the performance of the project and the estimated profit and may increase the gap between the estimated profit and the actual one. The interdependency of the project scope with the scope of other projects may lead to delays because of using the inputs of production in more than one project at the same period. This problem is a complex one and is related to the inputs and at the same time it is considered as an external uncontrollable factor for the project manager. The interdependence scope of each project is uncontrollable by the project manager. Seriously this leads to the decrease in the achieved profits if it affects the costs and the time of implementation. Modifications in the production schedules are possible solutions for this kind of reasons. Risks that face the project manager have some consequences that lead at the end to less actual profits. One of the consequences is the effect on the quality level of the project outcome. It affects the on time delivery as well and causes delays. Delays cause longer project life cycle. Lower quality, delays, and higher costs will definitely lead to lower profits by the end of the project completion because it will decrease the customer satisfaction. On the long run the organizations may lose market opportunities when they work in high risk environments. In one of the cases the project manager reported that the achieved profit was lower than the planned by 20% because they had many risks during project implementation and this has negative effects on the quality of the product that was supplied to the customer. It was very poor. Also the project life cycle had lots of delays. Sometimes the less satisfaction leads the customer to have unexpected decision and wants changes that literally leads to lower profits than the planned ones. In general we can conclude that the most critical uncontrollable factor behind the lower actual profits is the customer satisfaction and the project manager faces many consequences because of the high level of interdependency with other projects which is uncontrollable. The project manager is able to expect some of these reasons directly before it happens especially if they are repeated or experienced before by the project manager. The contingency reserve helps the project manager to stay confident about achieving the estimated profits and shall be increased when managing projects in risky environments.

Do you expect the real time needed to implement the current project will be longer or shorter than planned? And why?

We will use the same classification of the reasons behind the deviation of the previous stability indicators in this indicator which is time. The study classifies the reasons behind the deviation in time of implementation into three categories. The deviation due to the planning function, the deviation due to the project inputs, and the deviation due to external uncontrollable factors as shown in the table below. The research will design two tables; one for the project managers who think that the project will take more time than the planned one. Another one for the project managers who think that the project will take less time than the planned one:

Deviation due to the plan	Deviation due to the project	Deviation due to external
	inputs	uncontrollable factors
46. Unplanned	48. Facing problems	54. There are new
vacations during	in the raw	requirements of
the planning	materials during	the project that
stage	implementation	will take more
47. If there is less		time
experience		

about the	49. Lack of clarity	55. Some project
planning of the	of the scope of	managers
project then the	the project	reported the
project is again	50. Lack of	main reason for
expected to take	experience	the extra time is
longer time than	about new	due to external
the planned one.	projects	factors and
	51. Less experience	changes in those
	in general	factors.
	52. Missing the	
	scope of the	
	project is	
	another reason	
	for taking longer	
	time.	
	53. If the nature of	
	the project is	
	characterized by	
	complexity then	
	it leads to longer	
	time of	
	implementation	

In this table there are three categories. The first category shows the reasons behind taking extra time due to planning process. The planning process is the process that intervenes between the end of the last project for the project manager and the start of a new one. In this stage the project managers sometimes need rest but are not able to take it during the implementation time. They prefer to have rest at the beginning of the project to overcome any problems after they come back from their rests. This is applied to the team members and the workers as well and that is interpreting the unexpected vacations that are taken by the project manager or anyone of his staff during the planning period. This may affect the quality of work during this stage and the project manager depends highly on the previous planning experience in similar projects. This reason is more critical if the project manager doesn't have enough experience and if the project is new to him or her. Regardless of the vacations and whether these vacations are expected or not, the project manager's experience about planning is highly related to the completion of the project on time. If the project manager lacks experience about the project or about how to plan for it then the project is expected to take longer time and the project manager and his or her team are expected to experience delays. These delays become less by time and project after project this delay becomes less. These are the two main reasons that are related to the planning process.

Another category of reasons is the category that is related to the inputs of the project and the project manager experience delays in the time of implementation due to some change in the production inputs. Problems of the raw materials are the main reasons related to the inputs of the project. Problems or the raw materials are related to the availability of the resource. Is there any delay in availing the resource to the project then the actual time is expected to be more than the planned one? Punctuality of supplying the raw material to the project on time is necessary to avoid such reasons. Replacement of low quality raw materials with better quality ones is another reason of delays related to the raw materials. The project managers said that they try to

find more that subcontractor and more than one supplier for the raw material to be ready for such kinds of delays. Ouality of the raw material also affects the quality of produced units and may cause reworks and hence delays in the completion of the project. Some project managers depend on the monitoring of the performance of the supplier and the systemization of the delivery and the level of quality of the raw material to avoid this problem. The scope is another input that affects the delivery on time and the scope has many issues. One issue is the clarity of the scope of the project and the needed workload to finish the project. If the scope is not clear for the project manager then this will affect the implementation process negatively. Another issue is the determination of the scope. If the manager missed the scope and it was changed for any reason like the demand of the customer or the policy of the organization then this may lead to changing the implementation processes and nonconformance with the plan and this causes delays in the completion and even delays in the implementation of the production processes as well. One common reason for delays that is mentioned by project managers is dealing with new projects or new parts of project. This represents lack of experience with the new aspects of work and this slows down the implementation process at least for the first time. This leads to the conclusion that the experiential knowledge leads to less deviations between the planned time and the actual one. Even if the project manager is experienced and there is a new requirement that comes from any external source then this leads to delays in the implementation because of newness of the components of the project or the needed changes. This may lead to the fact that the innovative knowledge that is characterized by newness is taking longer period of time to be implemented successfully. Most of the project managers referred the delays in the implementation time to external factors that are out of control. Changes are the main external reasons. Changes may happen in the market conditions, legislations, customers' tastes and demands, organizational schedules or decisions, changes in prices and currencies' prices, and changes in the technology ... exe. Some said that the nature of projects leads to taking longer time usually. The nature of the project is related to its complexity and this something external and this means that the project manager needs more time if the project is a complex type one. Further explanation about the complexity will come later in this chapter.

Then we will move to the second group of project managers who think that the actual time is less than the planned time which is something positive from their point of view. The following table shows the two categories that classify the reasons behind this positive gap between the planned time and the actual one.

Deviation due to the plan	Deviation due to the project inputs	
56. Some project managers reported	57. Those who have reported that	
that there is a relationship	the actual project time will be	
between the project manager's	shorter than the planned one	
experience and the time needed	referred this to knowledge.	
for planning	58. One of the managers said that he	
	used the library to find ready-	
	made small solutions that would	
	take longer time to be developed.	
	This refers to educational type of	
	knowledge	
	59. Others reported that based on the	
	dependency of this project on	

common resources with other	
project, if there was delay in	
other projects, then this means	
that we can finish this project in	
shorter period of time because it	
will have the first priority over	
the other interrelated projects	
during the same period of time.	
60. Some project managers reported	
that there is a relationship	
between the project manager's	
experience and the time needed	
for implementation	
61. If the level of experience is high	
then the time needed for the	
project becomes less.	

In the above table it is very obvious that the savings in the implementation time happens mainly due to reasons related to the inputs of the implementation. Less reasons occur during the planning process. In general it is clear that the project managers do not think that the savings in the implementation time are attributed to external or uncontrollable factors and this is reasonable because the savings in time are considered as a positive indicator or even an indicator of success and this is mainly attributed by the project managers to internal sources, abilities, knowledge, and skills. Even when we analyze the reasons related to the planning project we will find that the project managers talked about the experience of planning they have as a reason for the savings in time. Other than this reason no other reasons are given for saving time during the planning function. Other than experience some project managers refer taking shorter period of time to the knowledge they have. Some spoke about the sources of this knowledge and said that they used libraries to find ready-made small solutions that would take longer time to be developed so they started where others end. This refers to the educational type of knowledge. If other projects in the organization are delayed or need extra time to be implemented then this means that the current project needs to speed up the to finish in a shorter period of time because it will have the first priority over the other interrelated projects during the same period of time. This is the first part of the research where we talk about the interdependency as a positive factor affecting the performance indicators of the project. Experience of implementation not only experience of planning is an important input to the savings in time. Qualitatively project managers are indirectly relating their experience to the savings in time. The more experience they have the less time they will consume to complete their projects.

Those project managers who think that the actual time will be as the same as the planned one did not show reasons for this. This is simply because the implementation is going as planned

Others reported that they put a change management plan so that they consider the possibility of both; longer or shorter time during the change management planning period.

Project performance – stability and instability:

In the following part the study is about the performance of the project which is the dependent variable in this research. The project performance reflects the effect of the four proposed knowledge creation styles that were analyzed qualitatively in the previous parts of this chapter. Do you consider the performance of the current project a stable one and why?

In this part we are analyzing the reasons behind perceiving the project performance as a stable one. The project stability is measured by quantitative measurements but at the same time the project manager has an opinion about whether he or she considers that the quantitative indicator is as expected or below or above expectations. The formulation of the expectations about the project performance starts at the planning stage but it develops and may change during the implementation stage. By the completion of the project the manager has an opinion about whether the actual indicators were expected to happen or were not. The project managers who believe that the project performance is stable refer this to different reasons and these reasons are somehow related to their knowledge creation styles.

In the following table we are classifying the reasons that were given by the sampled project managers into four groups. Reasons related to the experiential knowledge creation style, reasons related to the specialized knowledge creation style, reasons related to the risk averse knowledge creation style, and finally reasons related to the innovative knowledge creation style.

Reasons related to the	Reasons related to	Reasons related to the	Reasons related to
experiential	the specialized	risk averse knowledge	the innovative
knowledge creation	knowledge creation	creation style	knowledge creation
style	style		style
• Yes,	• We have	• Yes,	• Usually
because	our	because	the
we are	progress	we are able	stability
running	indicator	to avoid	to the
the project	s to	risks	project
as planned	check if	• Stable as	performa
and what is	the	long as	nce
happening	project is	there are	depends
is as the	stable or	no	on the
same	not and	implement	quality
exactly as	the	ation	of the
what is	indicator	obstacles	planning
planned.	s are	till now.	for the
• Very	showing	• Another	project.
stable as	that it is	factor that	If there
long as we	stable to	causes the	is proper
are	a certain	stability of	planning
running	extent	the project	then this
the project	and it is	performan	will be
as planned	within	ce is the	reflected
• Another	the	collaborati	on
factor that	normal	on of the	higher
causes the	ranges.	team and	levels of
stability of	• If the	the	stability.
the project	project	supplier	

performan	manager	support As	Another
ce is the	and his	long as the	factor
collaborati	team has	credits of	that
on of the	higher	the project	causes
team and	base of	are paid	the
the	knowled	then is it	stability
supplier	ge then	still stable.	of the
support.	the	The point	project
• The	project	when the	performa
stability	perform	project	nce is the
also is	ance is	manager	collabor
related	expected	discovers	ation of
according	to be	that the	the team
to other	more	project is	and the
project	stable	not able to	supplier
managers	than	pay its	support.
to the	without	credits	• Consider
ability to	knowled	then it is	ing all
pass the	ge.	not stable.	the
milestones	• Another	This is	changes
as planned.	factor	another	that are
Another	that	point of	under
reason is	causes	view for	control
the ability	the	one of the	and that
to pass the	stability	interviewe	are
intermedia	of the	d project	managed
te	project	managers.	by the
acceptance	perform		change
s. Also the	ance is		manage
stability of	the		ment
the project	collabor		process.
performan	ation of		This is
ce is found	the team		still
to be	and the		consider
related to	supplier		ed a
the official	support.		stable
time			project
schedule.			performa
If there is			nce. This
high level			is one
of			opinion
commitme			that
nt with the			reflects
official			that the
time			manager
schedules			is ready
then the			for
level of			changes

project		and that
stability is		he reacts
expected		to the
to be high.		needed
• Some		changes
managers		so he
said that it		consider
is is		s this an
considered		evidence
to be stable		that the
even if		nroject
there are		project
deviations		nce is
in the		still
implement		stable
ation		Other
because		project
those		manager
deviations		s
are		reported
considered		that
slight ones		during
not sever		the
deviations		project
• There is a		life cycle
• There is a noint of		there is a
view about		stage of
the		instabilit
etability		v that
that talls		usually
that if the		happens
delays are		early at
instified		the
then we		beginnin
can still		g of the
consider		project.
the project		At this
nerforman		period
ce as a		there are
stable one		some
• Other		changes
• Oulei project		in the
managere		plan
depend on		until the
the regular		project
nrogress		manager
reports and		feels that
on		the
UII	1	

periodical		custome
meetings		will be
with their		satisfied
with their		have the
customers.		by the
		end of
		the
		project
		This
		1 1115
		change
		in the
		plan
		increases
		the
		uic 1 i
		planning
		period
		and cos
		and this
		is where
		VOU
		you
		usually
		find the
		instabilit
		y in the
		performa
		nce of
		the
		une masia at
		project.
		• . Other
		project
		manager
		s depend
		on the
		regular
		progress
		reports
		and or
		periodic
		al
		un
		meetings
		with
		their
		customer
		S.
		~ -
	1	

As shown in the above table most of the reasons are related to the experiential knowledge creation style and the innovative knowledge creation style and that less number of reasons is

related to both the specialization knowledge creation style and the risk averse knowledge creation style, however; there is possibility that the project manager has reasons that reflect more than one style of knowledge creation. It is also possible that the project manager changes the source of knowledge creation throughout the different stages of the project life. During planning for example the project manager may use the experience and mix it with the innovation and then during implementation the project manager doesn't accept changes and consider the plan as a standard that must conform with the implementation and this reflects the routine process of implementation and this is related more to the experiential and much less to the innovative knowledge creation style.

In general we can find some behavioral characteristics for each style that show how the project manager perceives the project performance as table or nonstable and the way he or she interprets this performance condition.

Knowledge management and team management are common factors that are mentioned by the project managers as drivers of better stability levels. The project managers in different kinds of projects believe that the knowledge management and the team management are necessities. Knowledge management then is part of the job description of the project manager. Creating this knowledge is a component of the knowledge management and this research is focused on finding the different styles of knowledge creation by project managers to be able to answer the question of how do project managers create new knowledge?

Talking about the reasons of the performance stability of the project that are related to the experiential knowledge creation style we found that this style sticks to the plan and perceives that the project performance is stable as long as it is exactly as the same as the plan, or with slight acceptable deviations within the control limits of the standardized plan. Accordingly this style of experiential knowledge creation managers is concerned with the routine steps that are previously plan. This doesn't mean that this style is not giving some space to the innovation because this may happen during the planning process but then after that the experiential project manager is not willing to accept change during implementation. During the planning process the experiential manager makes sure that there are milestones and check points during each stage of the project implementation to make sure that the processing performance is conforming to the plan and to discover any deviations immediately and bring it back to the standard. One of the indicators is the conformance with the official time schedules as found from the interviews. It was highlighted that this kind of managers is stressing on the commitment and following the official time schedules of implementation and they consider that this means that everything is going well. This interprets why some project managers who have long experience and who are well organized and who stress on commitment fail at the end to satisfy their customers. Simply because this is sometimes not enough to satisfy the customer's expectations. During the early stages of the project life cycle the project manager keeps controlling the commitment with the official time schedule and if this control gave the expected results then the project manager can easily tell that the project performance will stay stable until its completion. This can be true and maybe the experienced project manager found that this is the best practice during his work as a project manager, however; it is not the optimum performance even if it is a stable one. This is relative to the quality of planning at the beginning of the project. Experiential managers are threatened when they experience sever deviations. In this case they start to perceive that the project performance is unstable. Their rationalization is that the sever deviation means that the plan is not implemented well and this is their main concern. We can exclude the cases where the experiential project managers can rationalize the sever deviation and find the route cause behind it in a way that is enabling the project manager to fix it in the future so it may not happen

again. This is adding to the experience of the project manager and is a source of learning however during its occurrence the project manager perceives the performance of the project as unstable. Regular progress reports are evidence based documents that enable the experiential manager to compare the actual performance with the planned one and check if there are deviations. Meeting with customers during implementation is not the main concern of this style of project managers unless they believe that the result will not change the implementation a lot. Sometimes this style of knowledge creation depends on the experience team of workers and the experience of suppliers. This is additional experience and it helps in increasing the stability level of the project performance. The purpose of this added experience is not to introduce improvements during implementation because this is relatively not accepted by the experiential manager. It is for the assurance of commitment and conformance with the plan and the official time schedules that are previously planned by the experiential project manager.

The group of specialized knowledge creation style managers refer to scientific progress indicators to check the progress and stability of their projects. They believe that they need to work with specialized and well educated workers and this supports the stability and success of their projects. They also want to deal with specialized and well educated suppliers in their fields because this is supporting the success and the stability of their projects' performance. They believe that if the project manager and his or her team have higher base of knowledge then the project performance is expected to be more stable than without knowledge. They keep learning and training and they refer to books and references as a source of knowledge.

Then we move to analyze the reasons related to the risk averse knowledge creation style of project managers. They believe that their project are stable because they are able to avoid risks. Some of them showed that they have obstacles and that the project performance stays stable as long as there are no implementation obstacles. Sometimes these risk averse managers ask for support from the team of workers or the suppliers to avoid risks or to pass obstacles. Many of the risk averse project managers think about the obstacle as financial ones. They believe that as long as the credits of the project are paid then it is still stable. The point when the project manager discovers that the project is not able to pay its credits then this is an indicator on instability of the project performance. So risks, obstacles and especially financial ones are the main concerns of the risk averse project manager.

Then we come to the qualitative analysis of the innovative style of project managers. They believe in the principles of quality and that the work and the performance need to be continuously improved. This continuous improvement can take place at any stage of the project implementation if necessary. They said that the stability of the project performance depends on the quality of the project plan. This plan is improved project after project and is not repetitive for similar types of projects. The improvement of the plan leads to what they call the proper planning and this proper planning leads to higher levels of performance stability. They start using innovation in the early stages of the project which is the stage of setting the plan of the project. They wouldn't refer to readymade plans and repeat it even if it was successful, but they'd rather improving it. They use the other members in their teamwork and the suppliers as sources of improvement ideas for better and innovative performance that distinguishes their company and give it superior competitive advantage over other competitors in the eyes of their customers. This is the fourth style of using others in the knowledge creation behaviors of the project manager. These innovative project managers are not against change and they accept it. They depend highly on the change management department to support in controlling changes that occur during implementation. This control may happen by trying new methods in the implementation and/or introducing new standards in the plan. When they control this way they are still considering the performance of the project as a stable one. They are ready to change or to react to needed changes and by this readiness they have stable performance. If they are not ready to change or to cope with change then for them this is an indicator that the project performance is not stable. We can summarize the relationship between the innovative style and the stability of the project performance in one statement which is the readiness to change or to cope with change. These innovative managers think that the change must happen at least during the early stages of the project life cycle. They clearly said that there is a stage of instability that usually happens early at the beginning of the project. At this period there are some changes in the plan until the project manager feels that the customer will be satisfied by the end of the project. The customer demand and expectations are the drivers of the needed change at the beginning of the project. They take longer periods of time in the planning process compared to other styles of the project managers. They change their project plans and use modified or new ones and this increases the planning period and even the planning cost relatively. This is where we can usually find the highest levels of instability in their project performance. For this purpose and to keep the next stages stable they highly depend on regular meetings with their customers and they are welling to change based on the customer feedback. If there is contradiction between the official time schedules and the customer requirements then they change their schedules to respond to their customers even if this leads to delays in the completion of their project. They are welling to change items in their contracts if it leads to higher levels of customer satisfaction. When it comes to the customer satisfaction they are welling to change the control limits and find innovative solutions and try it for the first time and this means that they are risk takers. This interprets why some project managers take longer periods of time to finish their projects and even higher costs than the planned costs but at the end the project is a success. The public sometimes doesn't expect that such delays in the implementation are leading to success but it could happen with the innovative project managers.

In general, we can notice that the project manager depends on the team members and the suppliers and that all styles do this. The difference is how they use the support of the team members and the suppliers. This interprets mentioning this point in each and every column in the above table and explaining it differently according to the characteristics of each style.

Other than the relationship between the styles of knowledge creation and the stability of the project performance, there are group of managers who were not able to decide on whether the project performance is stable or not because judging the stability is not something they can expect and they said that they can judge the stability of the current stage of the project implementation not the whole project. We can conclude that some managers think that during the implementation of the project they can't decide on the overall performance if it is stable or not.

What are the main reasons behind the instability of the project performance?

In this part we will relate the reasons of instability of the project performance to the four proposed styles of the knowledge creation in this research. We will create the same table we created in the last part but for instability of project performance. We will add to the table a fifth column that talks about reasons of instability that are related to the external environmental reasons:

Reasons rela	ted	Reasons related		Reasons related			Reasons	related	Reasons	related
to	the	to	the	to	the	risk	to the innovative		to co	ntextual
experiential		specialized		averse		knowledge		changes		
					creation s	tyle				

knowledge	knowledge	knowledge		
creation style	creation style	creation style		
knowledge creation style Lack of workers' experienc e Improper data collection Miss planning Experienc e determine s the level of stability Knowledg e determine s the level of stability Knowledg e determine s the level of stability Managem ent styles determine s the level of stability Managem ent styles determine s the level of stability Communi cation determine s the level of stability If some factors were not taken correctly into considerat ion since the beginning	knowledge creation style Lack of specializa tion Overlappe d specializa tions and interferen ce of other departme nts in the work of the project manager Improper data collection Miss planning Knowledg e determine s the level of stability Managem ent style determine s the level of stability Communi cation determine s the level of stability Some factors were not taken correctly into	knowledge creation style Improper data collection Miss planning Knowledg e determine s the level of stability Managem ent styles determine s the level of stability Communi cation determine s the level of stability Communi cation determine s the level of stability Communi cation determine s the level of stability If some factors were not taken correctly into considerat ion since the beginning of the project then this may lead to instability afterward s. Tight schedule	 Improper data collection Unclear requiremen ts Miss planning Knowledge determines the level of stability Manageme nt style determines the level of stability Communic ation determines the level of stability Communic ation determines the level of stability Lack of clarity of the scope the project Misunderst anding the client expectation s, not knowing about the internal cycle of the client work will lead to instability in the project performanc e. 	 Increases in currency prices Increases in the prices of raw materials Changing project manager during implementa tion Human aspects like conflicts among team members Delays in receiving equipment Lack of capital Overlapped specializati ons and interferenc e of other department s in the work of the project manager Hesitating senior management Unclear requiremen ts Top manageme
or the project	ion since	implemen	resources are an	nt style determines
then this	the	tation	important	uciermines

	may lead		beginning	٠	The		factor		the level of
	to		of the		project		affecting		stability
	instability		project		manager		the stability	•	Lack of the
	afterward		then this		needs to		of the	-	clarity of
	s		may lead		control		project		the scope of
•	5. Tight		to		the scope		performanc		the project
•	rigin		instability		of the		e	_	Ti alta
	of		afterward		or the	•	U Inconvecto	•	11gnt
					project to	•	maccurate		schedule of
	implement	-	S. Ti ale4		be able to		surveys		implementa
	tation	•	1 ignt		nave		during the		tion
•	The		schedule		stability in		preparation	•	Increase in
	project		OI		his project		phase of the		the Dollar
	manager		Implemen		performan		project will		value
	needs to		tation		ce		definitely		causes
	control	•	Human	•	Human		lead to		instability
	the scope		resources		resources		instability		in the
	of the		are an		are an		in the		project
	project to		important		important		project		performanc
	be able to		factor		factor		performanc		e.
	have		affecting		affecting		e later on.	•	Misunderst
	stability in		the		the				anding the
	his project		stability		stability				client
	performan		of the		of the				expectation
	ce		project		project				s, not
•	Human		performan		performan				knowing
	resources		ce		ce				about the
	are an								internal
	important								cycle of the
	factor								client work
	affecting								will lead to
	the								instability
	stability								in the
	of the								project
	project								performanc
	performan								e
	ce							•	Unexpecte
								-	d
									u milestones
									mnestones

As shown in the above table there are many reasons that are considered as common reasons among different styles, however each style interprets the reason differently. Other than the reasons related to the knowledge creation styles of the project managers there are reasons that are related to the contextual uncontrollable factors in the internal or external environment of the project and this enhances the conceptual model of this research where it is proposed that there are some mediating variables in the context of the project that may affect the stability or instability of the project performance. The interviews revealed eleven different reasons of instability that are qualitatively related to the experiential knowledge creation style. The first reason is related the workers and team members experience. This experiential knowledge creation style perceives the experience of the team members and the workers as an important factor in achieving the stability of the project performance. This means that the experiential project manager tends to prefer working with the experienced workers because this speeds up the implementation process and increases its stability and minimizes the number of errors during implementation. They talk about the experience in general as a determinant of the level of the stability of the project. This includes the experience of the project manager himself or herself as well as the experience of other stakeholders and mainly the workers and the suppliers who help in the implementation of the project and the production processes. They think that the level of stability increase if the level of experience increases. This means that there is a relationship between the level of experience of the project manager and the level of stability of the project performance. This qualitative study is followed by a quantitative one so there is a comparison between the findings of the qualitative study and the quantitative one later on with analysis and interpretation of this comparison. The project manager collects information to take decisions. The type of information he or she needs is related to the previous experience and the history of success to be retrieved and used again in the current planning and implementation of the project. The second type of information the experiential project manager uses is the information about whether the actual implementation is conforming to the plan or not. If the type of experiential information is not fitting with the requirements of the current project or if the actual information about the conformance between the implementation and the plan does not reflect that there is conformance, then this is an indicator on instability of the project performance and this is how experiential project managers assess the improper information from their point of view. The time, accuracy and cost of data collection matters for all project managers regardless of their knowledge creation style. The improper collection of data affects measuring the conformance to the plan in the first place for this style of managers. We will talk later about the different effects of the improper data collection for the other proposed knowledge creation styles. During the planning stage of the project life cycle, the experiential project manager focuses on repeating successful plans or parts of plans. Sometimes the project manager misses the plan due to the large difference between the previous projects and the current one. If the experience of the project manager is not containing knowledge that is related to similar parts of the current project, then the experiential project manager misses the plan and the manager's experiential knowledge is not a strength in this case. Missing the plan will affect the rest of stages after that and hence will affect the overall project performance. When this experiential style of project managers talks about the value of the knowledge they mean the knowledge that is built by accumulative experience over the past years of working as a project manager. This style of managers are aware that project managers have styles when they manage the knowledge of the project and they are also convinced that this style affects the stability of the project performance. The experiential project manager communicates with workers to make sure the implementation is conforming the plan, the workers have enough experience, and suppliers have enough experience, and slightly communicates with customers for the purpose of introducing new changes in the project. When the experiential style communicates experience to the plan and the implementation, the stability of the project increases. The experiential project manager decides on the correct factors that should be included in the plan and implementation by referring to his or her experienced factors in previous projects. Ignoring any of these "correct" factors may lead to instability afterwards. Some factors need to be taken care of at the very beginning of the project life cycle. The experiential project managers are convinced that the experience leads to faster implementation, higher quality, and less errors and reworks. This may lead to putting relatively tight implementation schedules and this sometimes is a reason for instability during implementation especially if the context of the project includes variables that

are beyond the scope of the experience of the project manager. It rarely happens that the experiential project manager needs to slow down the implementation procedures if he or she is sure that the processes are routine ones and managing it is experienced before. The experiential style of project managers tends to have high control over the scope of the project because he or she has experienced the importance of the determination of the project scope in the successful implementation of the plan. This contributes to the stability of the project performance until the completion of the project. The experiential project manager thinks that is more capable than less experienced project managers in determining the relationship between the determination of the scope of the project and the successful implementation of the plan. Less experience may lead to less ability to plan for the project because of the lack of determination of the scope of the project. This means that the scope determines the needed plan and that the plan determines the needed implementation and that the successful implementation leads to the stability of the project performance. The control of the scope from the experiential project manager is important, however other styles of project managers believe that the scope is important and this will be discussed when we talk about the rest of the styles. Also all the styles highly estimate the importance of the human asset as an important factor in achieving the stability of the project performance. For the experiential project managers they prefer to work with the experienced human assets whether in the teamwork or with suppliers of the project. This is how they evaluate the strength of the human asset. It is mainly about the experience of the human asset as an important source of performance stability. Maybe this is because the manager doesn't have to exert extra effort to train the less experienced staff members or the new comers. Maybe because the experienced workers usually have a degree of independency when they solve problems and they do the problem solving better than the less experienced workers. This in turn will save time, money, and effort from the project manager's point of view. Even if the project manager didn't consider the experienced staff as a source of knowledge, he or she will trust the actions taken by them.

Why do the specialized project managers think that the project performance is unstable? To answer this question we asked the project managers about the reasons behind instability from their point of view and we found that the project managers who are educated in the field of project management and/or well trained and who depend on scientific references as a source of knowledge for their project management have a list of reasons. In the following lines will go through the analysis of those reasons. The first reason that is obviously directly related to the specialized style is the lack of specialization. The specialized project managers believe that the lack of specialization and the existence of project managers who didn't study the project management is one of the main reasons behind the instability of the project performance and the reason from their point of view is that the education includes case studies, best practices, and the latest methods of successful performance in similar projects and this shortens down the journey to achieve stability. In the case of lack of education the project managers depend on try and error approaches or in best scenarios they depend on repeating successful experience that happened in the past but this means that it is successful but not necessarily is the best practice or the latest one. To reach the optimum levels of performance productivity and stability the specialization is an important source of knowledge. This style of project managers respects the specialization and believes that the overlapped specializations is considered as a kind of interference in other's work and this is another main reason behind instability of project performance from their point of view and we can notice clearly that this reason is also related to the style of specialized project managers. Each specialization has to function in the suitable area and working on something that is out of the specialization area according to their point of view is leading to the instability of project performance. Project managers start collecting

information about the scope of the project and the needed specializations to perform the different tasks in the plan and they stress on checking the certificates, education, training courses, and less important is given to past experience. They don't mind is the staff members they work with are fresh graduates if they are educated on the needed specialization. Other factors like experience is important to them but comes in the second place after education and learning. They collect information about these specializations and consider the improper data collection in this area as a reason of instability later on in the project performance and that the lack of the needed specializations will negatively affect the stability of the project performance. They properly place each member in the right place based on the certificates and education he or she has. Another reason behind the instability of the project performance is the miss planning problem. Weakness of the plan is related to the educational level and quality of the project manager. They believe that they are more capable to plan for their projects than the less educated project managers and that they can easily refer to the references to improve their plans. They also believe that the education enables them to take all the possible variables that are related to the project performance into consideration which may not happen with other knowledge creation styles like the experiential one for example. They depend highly on the scientific references when the want to create new knowledge to use it for planning for their projects and they believe that this is contributing to successful implementation and stability of the project performance. They keep on improving their level of education and learning and continuous training and they consider this as the type and source of knowledge that leads to higher levels of stability and they think that the lack of this educational knowledge is responsible about the lack of stability. The specialized project managers believe that the style of the project manager determines the level of the project stability and this is a common belief among the different styles of the project managers. Each style is convinced that the stability of the project performance is highly affected by his or her style of managing the project. Since the beginning of the project the specialized project managers communicates with sources of knowledge that lead to the successful implementation of the project. On the top of the list is the communication with scientific sources and specialized team members based on the needed tasks to be implemented and of course this is determined after the specific determination of the scope of the project. If there is miss communication since the beginning of the project life this will be reflected on the instability afterwards. Again the same reason that was given by the experiential project managers which is the tight schedule of implementation was given by the specialized project managers. They follow scientific steps and this may conflict with some changes in the real life. If there is no room for dealing with sudden changes in the schedule of implementation then this change may lead to the instability of the project performance. Sometimes the reason behind the tight schedules is that the specialized project manager takes care of many variables and factors in the plan and this makes it more complex when it comes to the implementation stage. In general, the specialized project managers may design more complicated plans than the other styles and this is relatively depending on the level of education and training they have. Simplification of planning is not always leading to more stability. It may cause the instability if it is ignoring important factors and variables. For example the precautions of the risk management are a lot of precautions. Other styles may use the experienced ones, and this style may increase the number of precautions because they were educated that each one of these precautions will have a certain benefit and this may increase the complexity of implementation, however sometimes this leads to better levels of stability. This style of project managers believe that the specialized and well educated team members are more independent when they solve problems and that they are able to solve problems successfully because of their specialization and education. Hence this will positively affect the project stability. They also believe that working with less specialized or less educated human assets will lead to less quality and in return will lead to less stability of the project performance and even less customer satisfaction at the end of the project.

The risk averse style of project managers collects data about the possible and estimated risks that may happen during the different stages of the project life. The improper data collection at the beginning of the project may lead to the instability of the project performance afterwards. This lack of data or improper collection of data may lead to inability to estimate all the possible risk or may lead to overestimating some risk which leads to more complexity by increasing the amount of preservatives and precautions and this hinders the simplicity and the smooth implementation and may be the speed of implementation. Data collection about the estimated risks is one of the major concerns during the planning stage of the project life for this risk averse style of project managers. They spend time in planning and managing risks and avoiding it because they believe that this plays a great role in achieving high level of stability in the project performance. The ignorance of the risks that may arise during the implementation of the project leads to poor planning and this poor planning is another major reason behind the instability of the project performance. This risk averse style believes that the more knowledge about risks and how to avoid it or manage it the better is the stability of the project performance. This is the main concern of this style. This means that the project managers who have less knowledge about the project risks are less able to stabilize its implementation and its performance especially when implementing this project in a high complexity and rapidly changing environment. The way the project manager deals with the risks determines the success and stability of the project performance. This style believes that the project manager has to give higher priority to the risk averse knowledge and they are concerned with the sources of this knowledge because they believe that this is the type of knowledge that will enable them to stabilize the project performance throughout the whole project. The risk averse project managers are communicating with workers and stakeholders for the purpose of calculating the possible risks and to assure that the plan will be implemented properly and that the manager is ready to manage any obstacles and the plan includes certain steps to deal with the estimated risks and these steps are communicated to the related stakeholders. If this happens properly then this means for the risk averse project manager that the performance of the project is expected to be stable. Lack of communicating the possible precautions to the team members and sometimes to suppliers will lower the level of performance stability from the risk averse style's perspective. The risk averse project managers are concerned with taking early steps to plan for factors that may cause risks to the successful implementation of the project. Ignoring the factors that may lead to risks during the project implementation may lead to project instability afterwards. The risk averse project managers believe that the risks tend to increase relatively when the project takes longer period of time. If the project manager wants to minimize the estimated risks, one of the solutions is to finish the project as early as possible because this means savings and less exposure to unexpected environmental changes like changes in currencies or raw material prices. This interprets why this style of project managers prefer to have tight schedules of implementation, however this is sometimes represents a reason of instability because of the stress that arises during the implementation phase of the project life cycle. Speed of implementation is accompanied with the tight schedule of implementation and this increases the possibility of implementation errors and reworks. Here we can find contradiction between project managers. Some of them consider the tight schedule of implementation is a reason for better overall stability. Other project managers think that this leads to under processing instability. As a conclusion the stability of the project is divided into two parts; partial stability of project performance during phases of implementation and before the project completion where the

project manager keeps records and measures the ratios of stability for production processes, and the overall stability that is measured after the completion of the project and before delivering its final product to the customer or even after because the level of customer satisfaction may represent an indicator on the stability of the project performance and even the success in the project completion. Ability to achieve the plan of the project and to have conformance between the expected performance and the actual one is considered as the main indicator on the stability of the project performance and whether during implementation for each stage or after completion it reflects the extent to which the project performance is stable. One of the main factors that help the risk averse project manager to determine the plan of managing estimated risks is the specific determination of the project scope and this is determined in collaboration with the customer. If this happens clearly and remains stable till the end of the project, then the project managers expects higher levels of stability in the project performance and in this point the risk averse project management style is similar to other styles. All of them are insisting on the clarity of determination of the scope of the project and keeping it stable during implementation and that this will help to achieve higher levels of stability. To avoid risks the human assets play a great role because they are responsible about reporting any cases of nonconformity and especially the inspection staff members. The early detection of risks helps a lot in its successful management with the least cost and this enhances the level of project stability as well. The staff member who is hiding mistakes to avoid punishment are representing obstacles of risk management because their behavior may lead to greater damage and consequently higher costs. The risk averse managers therefore tend to use many tools to inspect, prevent, or detect possible problems during the implementation of the project and they put this on the top of their priorities.

Now we come to the analysis of the innovative knowledge creation style and how they interpret the instability of the project performance. This style of managers is concerned with the collection of data from all possible sources and is open to new knowledge and change. They think that lack of proper data collection will affect the innovative knowledge creation process. They collect data and information in the light of the needed requirements of the project. If the requirements of the project are not clear then the innovative managers are not sure about the data they need to collect and the knowledge they would need to create to stabilize the project performance. The unclear requirements may also affect the planning process and the innovative project managers may miss planning for the project. Consequently this will again affect the stability of the project performance afterwards. They prefer to continuously improve the quality of the created knowledge during different stages of the project life cycle because they think that knowledge determines the level of stability of the project. They use main resources then subresources, and maybe sub-resources and sub-sub-resources to improve the knowledge creation process and they give this the highest priority in their project management. They believe that the innovative knowledge creation style is one of the secrets of achieving the success of the project as well as the stability of its performance. They said that on the long run the knowledge creation is a key to the customer satisfaction, marketplace competitiveness, and building a history of success that leads to stability of future projects' performance. They also think that the innovative knowledge creation is a reason to gain customer's trust and future contracts. When the customer experience distinguished performance and at the same time new and stable one, this will increase the percentage of customer retention from the perspective of the innovative project managers. The innovative knowledge creation style communicates in all directions to collect data and use it for better knowledge creation, then the innovative project managers expose their innovative ideas to different stakeholders and communicate it to improve it and innovate better ideas and more stable ones that are more able to achieve the project stability and

success. We can conclude that the innovative project manager is focusing on the communication process in all directions to achieve better performance and better stability. The clarity of the project scope and what exactly is required by the completion of the project is enhancing this stability and the direction of innovation. The project managers innovate in the light of the scope of the project and it helps them to implement the project using new techniques and methods. The purpose in this case is to reach better stability ratios like for example when innovation leads to less costs and higher profits, or when the innovation leads to simplification and speed of implementation. All these indicators are increasing the stability and the success of the project process and performance. On the contrary if the innovative project manager has no clear information about the scope of the project since the beginning of the project, then this will lead to missing the direction and which methods and techniques would better achieve the stability of the project performance; however if the scope of the project is specifically and clearly determined and then it was changed during the implementation project, this style is the best one to deal with the change in the scope because the innovative project managers tend to accept change and are open to it relatively more than the other styles as found qualitatively. One of the critical keys to success and stability is listening to the customer voice and responding to the customer's needs and wants. The innovative project manager doesn't want to meet the customer expectations only, he or she wants to exceed it to delight the customer and to increase the ratio of customer satisfaction and retention and for more opportunities and better competitiveness in the future. This interprets giving high importance to the customer from the innovative style perspective. The innovative project manager considers misunderstanding the client expectations as one of the main reasons behind the instability of the project performance or even the main reason. Moreover that the innovative project managers think that they should learn about the internal cycle of the clients organization and work and that this learning will lead to higher capabilities to achieve higher levels of stability in the project performance. Without enough information about the client and his expectations, the project manager will not be able to perfectly create the right innovative knowledge that leads to the optimum stability levels and the highest rates of customer satisfaction. We can conclude that the learning about the customer expectations will not only affect the stability of the current project on the short run, it may also affect the level of stability on the long run and for future projects. The input to the innovative knowledge creation as we mentioned before comes through communication in all directions and comes from gathering data from all stakeholders to be able to improve ideas and its stability, validity, and reliability. The human assets are main components of this process. They are the inputs to the innovative knowledge creation process and they use its output as well. Accordingly the innovative project managers consider that the human assets represent an important factor affecting the stability of the project performance. The innovative project managers collect information and data from the human assets, and not only that, they also prefer to work with innovative workers to enrich the creation of innovative knowledge. The innovative project managers said that we encourage the innovation of the workers by rewarding the successful ideas and even the attempts to innovate to motivate the innovation climate during the implementation of the project and they think that this is importantly and positively affecting the performance stability as well as the successful completion of the project. If the workers feel that their innovative ideas are rewarded and appreciated then they will participate in making it happen and succeed. This encourages them to be involved and to participate on one hand, on the other hand it makes them encouraged to speak loudly about their mistakes and problems as opportunities for improvement and innovation not reasons for punishment by the project manager and this becomes part of the culture they experience when working with innovative style of project managers. Moreover that the innovative project managers are welling to

actualize ideas and not only keep it on shelves. They believe that innovation includes the implementation of created ideas to check if it will work or not and to improve it in its contexts. To be able to do that they use many tools and techniques like simulations and functional deployment before implementation to be able to control the cost and the stability of the project performance. The lack of these characteristics in the human assets would cause the instability of the project performance from the innovative style's perspective. The data collection has to be implemented properly and continuously to test the quality of the newly created ideas and if it is practically workable or not. The accurate surveys were found to be perceived as one of the important tools especially during the preparation phase of the project and the innovative project manager believes that the inaccurate surveys will definitely lead to the instability of the project performance later on because it is an input to the innovative knowledge creation. Upon this input the process and the output of the innovative knowledge creation is built. Inaccurate surveys may lead to misleading information and consequently misleading process of innovative knowledge creation and this in turn will affect the stability of the project performance because there will be a doubt that the innovative knowledge that is built on inaccurate surveys will be able to lead to customer satisfaction. As we said before this style considers the customer satisfaction as the driver of the project performance stability on both the short run and the long run.

In this section we found that not only the style of the project manager is the driver behind the perceived reasons of the performance instability, but also there are some uncontrollable factors that are listed by the different styles of project managers and they define these reasons as uncontrollable and this is not related to the style of the knowledge creation they use. This mainly depends on the characteristics of the environmental context in which the project is implemented. These factors include the increase in the currency prices or the increase in the raw material prices. This change directly affects the expected costs and cause a gap between the planned costs and the actual ones which represents instability in one of the indicators of the performance stability in this study. This is uncontrollable, however; the project manager can cope with this change by different ways. Experience, education, risk averse, and innovation are different approaches to find ways of coping with these uncontrollable changes. Sometimes keeping higher amounts of money as a precaution is the solution to this from the risk averse project manager's point of view. Sometimes the experiential project manager repeats a routine procedure that was successfully taken in the past and that led to performance stability like having a list of alternative suppliers with cheaper prices or substitute raw materials. The education gives the specialized project manager another type of solution to these problems which is found in a scientific reference about for example a new technology which was applied and tested before by others and which will overcome the changes in the price of raw materials. Or the innovative project manager may come up with a new innovation that saves money and this overcomes the change in prices and adds value and competitive advantage to the project. Many approaches may be found to deal with the uncontrollable changes and each approach to find the best solution depends on the style of the knowledge creation the project manager has. One of the unexpected changes that may happen is the change of the project manager himself or herself during the implementation of the project and this means that the project manager's style will change. In this case the team members will experience instability in the performance until they cope with the new style and until the new manager creates the knowledge that he or she needs to get back the stability of the performance again to the project. There is no doubt that changing the project manager after the project starts will cause instability in the project performance for a while; however in some cases after this instability the new project manager can achieve better results and higher ratios of performance stability to approve that he or she is

the right project manager to this project especially if the change of the project manager was because of the need of better qualifications for the current project. One of the aspects that may happen in any project and that is related to the environmental context of the project is the conflict among team members. Conflicts and disputes are healthy to a certain level which is called the productive level that leads to innovative ideas and that forces each party of the disputes to come up with his best. After that level if the dispute increases it will become unproductive and will hinder innovation and productivity and this is unhealthy for the project stability. The conflict and the disputes may increase in certain contexts especially at the beginning of the project life cycle. The formulation of the staff at the beginning of the project is accompanied with high levels of conflicts among team members. By time the roles are stable and the workload is distributed clearly and thus the level of the conflict becomes healthy and productive and this means that it stays existing because it is healthy and it is not something negative that we have to avoid. The different styles of project managers said that they have experienced the conflicts to the extent that leads to the project failure. The mentality of workers and accepting each other's opinions are factors that led to failure of the project and higher costs and even failure to satisfy the customer by the end of the project. Some project managers said that they were forced to pause some processes until they can resolve conflicts that happened among workers to be able to proceed on. Project managers prefer to work with cooperative workers rather than wasting time to resolve conflicts that hinder the productivity of the project. The project managers consider this type of conflict as a reason behind its instability that may happen in one project and not happen in another one. The project manager tends to avoid working again in future projects with the trouble makers in the project or the closed minded or less flexible workers. Conflict is not the only aspect in the human asset that may lead to instability. The qualifications, level of experience, cooperation, team working, and other specifications will definitely lead to better stability or if not available will lead to lower levels of stability. Sometimes everything is well planned but there is unexpected delays in receiving the equipment of the project. The usually happens when there is high dependability between the project and other projects in the same organization and they both use the same equipment. This is a sign of high complexity of the project environment and it leads to the project instability. Dependability may include tools and/or human assets. Some of the project managers spoke about the delay in receiving the capital needed to start implementing the project or even the capital that is needed in the middle of the implementation process. The upper management is responsible about the lack of capital and the project manager knows in advance about the needed capital during the planning process. When there is nonconformance between the planned amount of capital and the actual amount of capital then the project manager is faced with an external risk that is caused by this nonconformity. The small organizations and the new ones tend to have this type of problems more than the old and or big ones. This may lead to a conclusion that the new and small organizations are relatively less stable than the big and/or old ones. The experience and learning, the history of success and reputation, and the well tested risk management plan are some of the factors mentioned by the project managers about the reasons that lead to the conformance between the planned and the actual capital. Moreover that the success in the previous projects leads to more profits and this increases the number of future projects if related to the customer satisfaction. Successful investments builds a sound reputation that forms a valuable asset that can attract new customers and new projects. Therefore the project managers in general feel more stable when they work with the big and successful organizations than working in small new ones even if they are the owners of the small organizations not only the project managers. Some of the project managers reported that they experienced interference in their work coming from upper management or from other departments. The upper management sometimes is following

centralized system and policies and the project manager refers to the upper management when he or she wants to introduce any changes to the project. Some project managers said that there is no room to change the plan after it is approved by the upper management because the upper management considers the plan as the source of accountability for the project manager and he or she has to prove by documents that he followed the plan strictly and this mainly happens in the public sector projects. We found that even when this project manager wants to innovate something new in the project this innovation must be presented to the upper management before the start of the project not after it and has to be detailed and well written to get the approval and the capital for it. This means that the project manager has no chance to introduce or try any innovations after the start of the project. This shows that sometimes the project manager is forced to use a certain knowledge creation style due to the context in which he or she is working. Some project managers said that there is high level of dependency between different projects in their organizations and this high dependency cause a lot of kinds of interference from other project managers. For example the interference in the scheduling of working hours, amounts of raw materials and timings of receiving it, receiving equipment, workers' shifts, and supply of tool. This is another external factor that may decrease the stability of the project performance during its implementation and may lead to delays in the completion of the project. Some of the project managers came with new innovative ideas and thought that it will lead to higher profits but then they were faced with an external obstacle which is the hesitating senior management. The senior management of the organization especially in the public sector or in the limited budgets organizations is strictly following the items of the budget and the plans.

Sometimes the project manager in the small organizations especially when the owner of the organization is at the same time the project manager has higher level of freedom to change and is more flexible when compared to the public sector organizations and this shows the importance of the contextual effect on the project stability. The project manager in the small project thinks that the flexibility will lead to more performance stability and the public sector project managers tend to believe that the strict conformance to the plan is the main reason behind the stability of the project performance and in order to reach this conformance there are measurements and inspection reports that reflect the progress of implementing the project according to the plan which was not heavily found in the small projects. There is another factor that was found and represents an obvious difference between the public sector project based organizations and the small project based organizations. In the public sector organizations there is higher importance of the certification and the training and education of the project manager, while in the small project based organizations the project manager is depending highly on the experience to proceed on in the different stages of the project life cycle. The project manager in the small project based organizations is concerned with the profits gained by each and every project and redistribute the invested capital based on the experience with the customers and the profits gained by each final product. In the large project based organizations especially the public sector ones there is more focus on measuring the success of the project by its effect on increasing the effectiveness and efficiency in the customer's organization. This may represent an interpretation of the hesitation of the top management. Hesitating senior management has different reasons. We can conclude that the senior management hesitates because of different reasons and that those reasons are mainly contextual reasons that force the senior manager to follow a certain policy. Profit based policies, effect on the customer's organization based policy, and experience with the customer and the profit from each final product based policy, strict plans and centralization of accountability based policy, and innovative preplans ideas policy. Sometimes the project managers receives unclear requirements for the project. This happens when the plan is put by the senior management and the project manager's role is implementation only and this means that the unclear requirements is an external factor that may lead to the instability of the project performance. This also happens if the project is existing in a rapidly changing environment like for example when the project is a technological one and the customer has special requirements that are tailoring the technology to his or her organization. This sometimes makes the requirements unclear for the project manager. There is also a positive qualitative relationship between the unclear scope of the project and the unclear requirements of the project. If the scope is unclear then the requirements of the project implementation tend to become unclear as well and vice versa. Sometimes there is an interaction between the style of the project manager and the style of the senior manager and this interaction leads to determining the level of stability of the project performance or at least affects it. The support of the senior management and believe that the project manager is authorized to work independently and the synchronization between the style of the knowledge creation of both the senior manager and the project manager were highlighted by some project managers. For example some said that if the senior manager believes in the value of innovation he or she supports this by allocating financial resources to award to innovators. Other senior managers care more about the feedback of the customer and whether the project manager can achieve the goals of the project smoothly and the customer is satisfied or not. Other senior managers focus on the schedules and the time of implementation and completion and if the project manager is able to deliver the final product of the project on time without delays and is meeting the expectations of the customer. Based on the style of each senior manager we can expect how project managers tailor themselves to fit with the style of their managers. Maybe if the senior manager is changed the project manager starts to change the way he or she manages the project based on the measurements of stability from the perspective of the new senior manager. Accordingly we can conclude that the top management style is an external factor that affects the stability of the project performance and the style of knowledge creation. In fact the senior management especially in large project based organization is responsible about many external factors that may affect the stability of the project performance like determination of the scope of the project based on the contract that is signed by the top management and the customer without the presence of the project manager. In this case the project manager plays the role of the implementer of the contract only and must deliver what is promised by the top management to the customer to keep his job with the organization. This may include determination of the delivery date and in this case this may affect the implementation schedule and leads to tight schedule of implementation and hence leads to the instability of the project performance because the working team doesn't have enough time to implement the project and must implement it properly and this increases the level of stress for the project manager and his or her team and especially the less experienced ones. The relationship between the senior management and the customer may lead to negative effect on the project manager's work. This happens because the project manager may work better if he learns about the internal cycle of the client work or about the client expectations and the priorities of the client. In this case the project manager becomes more capable to satisfy the customer or even to negotiate with the customer based on the capabilities he or she has. When the project manager is only implementing the project, the organization determines the success of this project manager based on his or her ability to achieve the goals they have set for him without any open channel with the customer and the project manager is considered as an internal resource of the organization that is used to meet the customer's expectations under the name of the company. This interprets why some project managers complained about the unexpected milestones they have from their top management. The top management interferes in the specialized work of the project manager by forcing unexpected milestones during the implementation of the project and evaluates the success of the project manager based on meeting
these milestones and this cause interruption in the workplace for the team members who are working with this project manager. One of the reasons that was given by the project managers for the unexpected milestones is the increase in the dollar value and that this increase forces the top management to ask for earlier completion of the project. The dollar value affects the prices of the raw materials especially the imported ones and affects other inputs to the production process and this means that the early completion of the project is a way of saving expenditures and thus overcoming the increase in the dollar value. This early completion is a reason behind the instability of the project performance.

In general, we can say that the external factors that cause the instability of the project performance are mainly classified into the external factors that are related to the top management policy and support, the external factors that are related to the customer expectations, the external factors that are related to the level of dependency in the contextual environment, the external factors that are related to the uncontrollable economic factors like changes in the prices of the imported raw materials of the project.

To summarize this section we can say that the instability of the project happens and all project managers have experienced the instability of the project performance and that the reaction of the project manager to this instability differs according to the style of the knowledge creation the project manager has. Each style of the knowledge creation has certain interpretations of the instability of the project performance, however; this doesn't mean that these interpretations differ from each other. Some of these interpretations are the same and the different styles are concerned with similar factors, but they react to these factors differently. Other than the effect of the style on the interpretation of the causes of instability in the project performance, we can find that there is a list of external uncontrollable factors that are facing the project manager regardless of the style of knowledge creation he or she has. Some of these uncontrollable factors exist in the internal environment like factors related to the top management policies and the interference of the other project managers or other departments, and some exist in the external environment like the unexpected changes in the customer expectations or in the dollar value. The effect of the instability of the project performance can be identified at the beginning of the project when there is no clear scope, no clear requirements, no space for getting direct feedback form the customer, or no ability to participate in the planning or budgeting process for the project, and even no synchronization between the style of the project manager and the style of the senior manager.

Accepting instability due to external reasons	Accepting instability due to internal reasons	
• Increase in the price of the main resources of the project	• Lack of experience for some employees	
• Conflicts with customers about finishing touch of the project	• Delay of needed financial resources	
Lack of suppliers commitment	Mainly having problems with the human resources management	
• We face instability in the availability of clients in the market (end user of the project).	 Delays in project implementation and not being able to submit in the planned due date to the customer. 	

In which aspects of the project performance do you as a project manager accept instability?

 This never exceeds 10% of our estimations. Low number of customers or no customers affects the performance of our projects in general. 	
 Instability is mainly found in the availability of resources for the project and this instability may represent 20% deviation in the plan. We have instability of about 5% in the availability of resources. We accept instability that is represented by changes in the project resources 	• The escape of some team members may represent a source of instability and we can afford the escape of a maximum of 30% of team members and are able to manage it.
• We accept instability that is represented by changes in the project scope.	• At the beginning of the project during the initiation stage we accept 20% of instability in the performance indicators and this percentage comes down by time.
• Instability happens most of the time when we have a third party for our project.	• We are forced to deal with instability in the project performance and we don't have the choice to accept it or reject it. All what I do as a project manager is to plan to avoid it but it happens though.
	• We may face instability in the quality of performance within the planned time and budget. The accepted instability will not exceed 5%.
	• We face the highest percentage of instability in the project performance during the initiation phase and it does not exceed 10% of the planned performance.
	• Instability happens because we always need to measure and inspect and this takes more time and may cause delays. We try to

balance between the time duration and inspection processes.
• Instability can occur during planning or implementation phases by 10% deviation
• If the changes percentage exceeds 20 to 30% it would be worthy to revisit the business objectives and the scope of the entire project.
• Instability happens most of the time when we have a third party for our project.

From the above table we can notice that the instability that happens in the project performance is mainly due to internal reasons. The number of reasons behind the instability that comes from the internal environment is higher than the number of reasons of instability that comes from external environment. This doesn't mean that the causes of external environment are less important than the internal reasons. The external reasons may have higher effects on increasing the instability of the project performance especially when talking about resources and customers as shown in the table above. Startup stage, human assets, time needed for inspection, and delays in the needed financial resources are the main reasons behind instability in the internal environment of the project.

In this part we argue that the project manager may accept the instability in his or her project performance and that this happens under certain conditions. Rigidity of planning and implementation is the approach that is used by some project managers to avoid the instability in the project performance, however; some project manager expect the instability and accept it temporarily to be able to reach the stability afterwards. In this part we will analyze the reasons of accepting the instability in the project performance and the project manager's logic behind it.

The project managers believe that it is natural to experience changes in the price of the main resources of the project and that this kind of change is moving in the direction of increasing prices not decreasing on the long run. In the case of experiencing the changes in the prices of the main resources of the project and especially if there are not substitute cheaper resources then the project manager is forced to accept the instability that is caused by this change in the price of these main resources.

The instability in this case happens because it will affect the costs and maybe the estimated profits of the project. It may increase the price of the final product of the project, if not for the current project, then for the future ones. There are individual differences among project managers in the level of acceptance of this change in the prices. We mentioned that some of them have a list of other suppliers as a precaution, other have a financial preservative as a precaution, few have scientific references and brainstorming sessions to innovate or find better solutions for keeping the quality and overcoming the increase in the price. This again depends on the style of knowledge creation they use. We still have a number of project managers who

accept the change in the prices of main resources and work with this increase even if this means higher costs and less profits as long as the project is still able to cover its total costs.

Another reason that the project manager accepts the instability in the project performance is when the project manager works with less experienced employees. In this case the project manager is coaching these employees and they are still in the learning stage. They are new hires in the organization or in the project or they work for the first time with this project manager so he or she orients them and trains them on how to work with him or with her. Sometimes the less experienced employees are experienced and specialized work wise but they are less experienced regarding the cultural aspects of the project or organizational environment so they take some time to learn about the culture and cope with it. In this case the project manager expects and accepts the instability of the project performance for in the short run and temporarily until the less experienced employees take enough time to learn. One of the instability reasons in the project performance happens in the last stage of the project. It is during the delivery stage when the project is delivered to the customer. During this stage conflicts may arise with the customers about the finishing touch of the project. Sometimes the customer argues about finishing details and the project manager responds to this argument to gain the customer satisfaction and retention. In this stage the project manager may add extra tasks to the plan to respond to the customer needs and this causes acceptable instability in the project performance. The project manager believes that the project is still profitable and/or leads to future profits because of this instability and this is the reason behind accepting it.

We mentioned that the project manager may deal with external reasons that cause performance instability and that one of these external factors is the delay in the needed financial resources. This factor is coming from the upper management and causes delays in the implementation processes of the project. This delay is one of the reasons of instability but the project manager is forced to cope with it. There is no chance to find extra money from other sources outside the organization for which the project belongs. In small or new projects where budgets are still small this problem is more probable to exist. The project manager tends to accept the instability of project performance that is caused by this financial delay because it is out of his or her responsibility. In this case the organization is responsible about justifications provided to the customers. Another main reason of the performance instability is the human resources management that takes time and effort from the project manager. In large projects the number of workers is relatively big number which means that the span of control of the project manager is bigger and this may lead to instability especially if the project needs designing skills. If the project manager is required to provide tailored product to the customer the supervision becomes more difficult especially in large projects. In this case the project manager expects that and gives more time for designers and more space for supervision tasks and accepts the instability in performance that is caused by this reason as long as it leads to better quality of the final product. The larger the span of control the project manager has, the more instability in the performance due to human resources management problems. This is perceived qualitatively from the sampled project managers. The project manager deals with suppliers of resources. Some of these resources are main resources and dealing with suppliers becomes more difficult if the main resources are scarce ones. The project manager also deals with suppliers for other resources and raw materials. If the number of suppliers is small or if there is sole supplier for certain items the dealing with suppliers becomes more sensitive to change. The project manager sometimes has a substitute list of suppliers and this enables him or her to keep the performance of the project stable. If the project manager is forced to deal with suppliers who lack commitment then this negatively affects the stability of the project performance and the project manager accepts this temporarily and plans to change it in the future in a way or another. The project manager needs

to work with suppliers who deliver the needed quantities of the raw materials on time and conforming to the required specifications to assure the quality of production. This commitment of the supplier facilitates the inspection processes and saves time for the project manager and hence affects the performance stability in a positive way. The suppliers of some resources were found to be in other countries which means that the project manager deals with shipment risks and this may affect the stability of the project performance. The project manager keeps insurance and strict conditions clear in the contract with suppliers to control the risk of lack of commitment from the supplier's side, however; the project managers said that the delays that are caused by suppliers are expected and that this is related to the market conditions and ratios of demand on certain resources. If the project manager is forced to accept delays in the shipment of a certain resource for example, then he or she may overcome this delay by working extra shifts after receiving the resource. The implementation processes may become slower than the planned ones. The rationalization behind this is that the actual wasted time is higher than the planned downtime of the implementation and production processes. The skills of workers plays a great role in speeding up the implementation process. The stability and the implementation are mutually related. If the project performance is stable then the implementation goes smoothly and quickly towards the completion of the project. If the performance is instable then the implementation gets slower. On the other hand the implementation affects the stability of the project. If the implementation is conforming to the plan this leads to the stability of the project performance and vice versa. Delays in the project implementation may also exist because of lack of knowledge. This knowledge includes specialization knowledge, experiential knowledge, risk averse knowledge, and innovation knowledge creation. Sometimes the problem is the plan itself and that the plan is not realistic so the implementation is affected by that and includes problems. The relationship between the plan and the implementation is very important in determining the success of the implementation. Any delay in the implementation whether because of internal reasons like skills or planning or external reasons like changes in the supplier commitment and delays in receiving project inputs may affect the completion due date of the project to the customer unless the project manager has a precaution for this. Delay of delivering the project to the customer is an indicator on the instability of performance in the last stage of the project performance even if this happened because of delays in earlier stages of the project life cycle. This means that the project manager until the last stage of the project life cycle was not able to manage the delay that happened in the implementation in earlier stages of the project life cycle. Some of the project managers reported that they repeatedly face the problem of the escape of team members during the implementation process and this may cause the instability in the implementation process. It was found that the project managers prepare precautions for this escape and that they can afford the escape to a maximum of 30% of the team members and are able to manage it, however; they still perceive the escape of team members as a main source of instability in the project performance. In general the project manager accept the instability that occurs at the beginning of the project during the initiation process. Project managers said that at this stage they accept up to 20% of instability in the performance indicators and this percentage comes down by time. This is due to the combination of new components coming together at the beginning of the project and the need for some time to understand the system of the work and do it routinely, then the rest of the stages become more stable and the project manager considers the instability at the beginning of the project as a temporarily accepted instability. The project managers in general believe that the instability in the project performance is a must and that they experience the instability in the project performance in each and every project and by different percentages. They perceive that part of the instability is the project performance is normal and is acceptable regardless of the type of the project and its

context. They admit that it is impossible to achieve the plan by 100% accuracy. The optimistic project manager in the sample did not exceed the 90% accuracy. This means that the instability is expected and if it is limited then it is accepted by the project manager. One of the project manager said that I am forced to deal with instability in the project performance and I don't have the choice to accept it or rejects it. All what I do as a project manager is to plan to avoid it but it happens though. Again this is an indicator on the readiness to avoid instability, however; it is unavoidable for project managers in general even if it is perceived as negative and must be avoided. The limitations on the time and the budget are good reasons to have instability in the project performance. Tight schedules and limited financial resources lead to the instability from the perspective of the project managers. The study reveals that all project managers expect the instability in the project performance and they differ in the percentage of instability they are willing to accept. Some managers never accept more than 5% instability in the project performance and other project managers accept up to 20% of performance instability in certain aspects like the quality of performance and in certain stages like the initiation stage. Some project managers assure that the highest percentage of the performance instability happens at the initiation stage and it doesn't exceed the 10%. From the responses we got from the project managers we can think of a lower limit of instability which is 5% and an upper limit which is 20% and that the rest of the project lie in between these two limits. 10% instability in the project performance for example represents a normal and within the range percentage in this sample. The definition of instability is not the same for the project managers. We found that some project managers refer to the quality of performance to reflect the stability of the performance. Other project managers refer to the time delays as a sign of the instability of the project performance. There is a dilemma that causes instability for the project manager. It is about choosing to proceed on in the implementation process or to stop for inspection. The inspection process takes time to measure and report the deviation and to work on it and the accuracy of the inspection is positively related to the costs of the project. If the project manager needs to have higher level of accuracy in the inspection process, then the cost of this inspection becomes higher and the inspection will take more time. This dilemma is one of the main concerns for the project managers. They are trying to balance between the time needed for implementation and the time needed for inspection. They are also trying to balance between the cost needed for implementation and the cost needed for inspection. This balance determines the level of stability of the project performance and it is not an easy task to find the balance that achieves the optimum stability in the project performance. Another very important reason for instability is when the project manager or his or her organization lack of clients in the market who are the end users of the project. For example the construction projects that last for two to three years. At the beginning of the project the organization markets the expected final product to the potential customers in the market and some of the project managers said that the percentage of customers never exceeds 10% of our estimations. This is not the case in other projects where the project is based on a deal with a certain customer and a duration to submit a tailored final product to this customer. Like for example when we interviewed IT companies who build online and mobile smart customer service system for banks. They have their offers and they do not start implementation unless they have a deal and a contract with the customer. In the constructions this is somehow different because the customers come later after the start of the project. The project manager and his or her organization start the planning process before the customer is aware about the existence of the project. There is high probability that the flow of customers is less than estimated and that the final product is sold in a longer period of time during and after the completion of the project. This kind of projects has this kind of instability and this is expected in certain industries as explained and the project manager accepts this

instability. In certain periods of time or seasons and based on the economic and political conditions the project managers and their organizations face the problem of low number of customers or no customers and this significantly affects the performance of the projects in general in their organizations. This is another factor related to the market and the customers in the market and is related to uncontrollable reasons like political or economic reasons so the project managers tend to accept the instability that is caused by lack of customers to a certain extent in the short run and without threatening the expected profits of the projects. One of the solutions we found in the sample for this decrease in the number of customers is the hiring of sales people who target potential customers actively and try to get deals with them. This is a sort of cooperation between the project management department and the marketing department where they need to exchange information heavily and continuously to succeed and this may represent another new source of knowledge which comes from people who have experience and knowledge about the market and they are specialized in the field of marketing. This is used to innovate and improve in the performance of the project as well. Other than that this feedback that comes from the marketers is used to avoid potential risks and for better risk management. Another aspect of instability is the instability of the availability of resources. The resources of the project are important to keep the flow of production running smoothly and it is important that the project manager does not block money by storing large amounts of resources that are not needed during the current stage of the project. Therefore there is a dilemma in this matter. The project manager needs to choose between safety of availing resources at any time during the implementation of the project which enhances the stability of the performance, and the cost of storing. Sometimes it is not possible to store the resource simply because it is used by more than one project like some equipment. Other than that there is the scarcity of resources and the market problems like changes in the prices of resources and lack of commitment from the suppliers' side. All these factors makes the unavailability of the needed resources at any time of the project life cycle expected and may be accepted to a certain extent. One of the interviewed project managers said that there is a group of project managers working on different projects in his organization. All of them have instability ratio of about 5% in the availability of resources. This indicates that they expect it and accept it to a certain extent. This doesn't mean that they don't manage it. They try to manage this 5% and overcome any delays resulted from this instability. The unavailability instability arises during the implementation of the project in most cases. In general, we can say that the instability can occur during the planning phase and also during the implementation phase or maybe even after that. One of the sampled project managers said that the instability that occurs in his project during both the planning and the implementation phases represents 10% deviations than the planned performance. Again this percentage is within the range that was concluded qualitatively in this sample which is between the 5% up to the 20% deviation in the performance stability indicators. It is found that there is no project manager believes that the instability ratio of the project is possible to equal to zero%. It is also obvious that if the instability exceeds the upper limit which is 20% the project manager translates this as a drawback or a weakness in his or her management. We can also conclude that although some kinds of the instability of the project performance are accepted this does not mean that the project manager is not considering it as something negative or is not trying to minimize it. Accordingly minimization of the performance instability is a target for the different styles of project managers. Even the innovative project manager knows and accepts a certain amount of instability in the project performance for the purpose of achieving better stability in the future. All sampled project managers perceive the instability of the project performance as a condition that occurs temporarily. One of the highest areas in performance instability in this sample is the area of availability of resources and it was found that this is the only area where

the project managers reported that the instability may exceed the upper limit which is the 20% deviation in the plan. Dependability on other parties in general is a reason for uncontrollable changes that may cause instability in the project performance and this means that the undependability on other parties is a reason for decreasing the instability in the project performance. The project managers as we said do accept the instability that is represented by changes in the project resources and the scope of the project for different reasons explained earlier. If the instability ratios exceed the 20% and is between the 20% and the 30% project managers would find it worthy to revisit the business objectives and the scope of the entire project and change it. In this case the plan itself needs to be changed and it will become unrealistic and this is mostly the interpretation of the very high percentages of instability in the project performance. One of the indicators that assure that the dependability increases the instability in the project performance is that we found that the project managers believe that the instability happens most of the time when they have a third party for their projects. The interference of a third party like a consultant for example will increase the dependability of the inputs of this third party and will cause some conflicts and this will slow down the completion of the project. Again we can conclude that in general the project managers tend to believe that the relationship between instability and dependability is positive. If the dependability increases the instability may increase and vice versa and this is found qualitatively. One of the things that were found is that there are few project managers who refuse to accept any kind of instability, however; it happens. They work hard on the 100% conformance between the plan and the actual implementation and this is their main concern so they refuse the idea of accepting instability even due to uncontrollable reasons.

THIRD – THE GROUP OF QUESTIONS THAT ARE RELATED TO THE EFFECT OF COMPLEXITY ON STABILITY

The level of complexity of the project affects its stability

In the following lines the research is analyzing the relationship between the complexity of the project and the instability in its performance.

Complexity is related to the number of components of the system in which the project manager is functioning. It also refers to the level of dependency and interrelationships in the organization. It also refers to the environmental and the contextual complexity as well as the size of the project itself. In the following table the researcher is classifying the effect of complexity on instability based on the dimensions of complexity that are mentioned in the conceptual model of the study.

Effect of complexity	Effect of complexity	Effect of complexity	Effect of complexity
due to project system	due to project system	due to project system	due to project system
size on instability	variety on instability	interdependencies on	context on instability
		instability	
Planning for large	The plan becomes	Interdependency of	Cultural aspects of
sized projects	complex if it	the plan on the plans	the plan
	includes dealing with	of other projects in	
	many stakeholders	the organization and	
		on the overall plan of	
		the organization	

Customer needs may require increasing the size of the project	Customer needs may require dealing with many suppliers and/or investors	More than one project are implemented at the same time to fulfill the customer needs leads to higher interdependency among projects	Customer needs are components of the project environment which may change it rapidly
More complexity is a motive to increase the principles and the relationships that leads to the successful implementation of the project even if this increases the size of the project system	More complexity is a motive to increase the principles and the relationships that leads to the successful implementation of the project even if this increases the variety of the project system	More complexity is a motive to increase the principles and the relationships that leads to the successful implementation of the project even if this increases the interdependency of the project system	More complexity is a motive to increase the principles and the relationships that leads to the successful implementation of the project even if this increases the complexity of the context of the project system
	It is more difficult to find workers to implement certain specialized tasks in complex projects		Arab countries have its own mechanisms of implementation and certain policies and legislations to make decisions about the projects.
Over planning and over structuring causes radical changes in time schedules and costs when there is a need to change the plan	Over planning and over structuring causes radical changes in time schedules and costs when there is a need to change the plan Delay in receiving the resources needed for implementing the project.	Over planning and over structuring causes radical changes in time schedules and costs when there is a need to change the plan Delay in receiving the resources needed for implementing the project.	Different culture background people might have would complicate communication and delay project progress

In general the complexity leads to dealing with more challenges. Challenges of dealing with many components and variables, or challenges of interdependency with other parties whether inside or outside the organization, and/or cultural challenges. This means that the project manager's job to achieve the stability of the project performance becomes more difficult when there is high level of complexity. What are the variables that are responsible about increasing the complexity that negatively affects the stability of the project performance? The above table summarizes these variables and classifies them into four categories of complexity that occur in the project based organizations. In the planning stage the complexity increases when the plan is prepared for a big sized project. It also increases if the plan is highly depending and interrelated

with the plans of other projects that will be implemented in the same time or will overlap with the current project in parts of it. Also if the plan is depending on the overall plan of the whole organization this means that the plan is relatively more complex and this is normally what happens because we can rarely find that the project manager is independently working without synchronization with the overall plan of the whole organization to achieve the strategic goals of the organization. The plan becomes more complex in case the project manager is forced to deal with a large number of stakeholders. In some cases we found that the project manager is only the implementer of the plan so the number of stakeholders he or she deals with is limited and this decreases the complexity of the plan because the project managers is not thinking of satisfying many parties to finish the project successfully. If the size of the project is large then this means that the project manager is dealing with large number of workers and this means wider span of control and more responsibility. This also means larger number of equipment, resources, suppliers, and tools. Higher number of reports and inspection processes and maybe dealing with higher number of investors. This increases the complexity of the planning process for the project manager and this means that the planning stage in a complex environment is relatively more difficult than the planning process in less complex environment. The cultural context may increase or decrease this complexity. In some organizations the culture is supportive in a way that enables the project manager to consider some components of the plan as naturally understood and no need to include its details. In other organizations the culture is hindering the smooth implementation of the project and therefore the project manager is forced to explain each and every detail in the plan to avoid any cultural conflicts and this may increase the complexity of the project plan. The customer needs is one of the main variables that increases or decreases the level of complexity in the project. If the customer needs are rapidly changing because of competition this means that the environment in which the project is functioning is rapidly changing, simply because the customer is one of the components of this environment. This increases the instability of the project performance and the project manager keeps an eye on the changes that happen in the customer's needs, wants, tastes, and demands to be able to achieve the customer satisfaction and retention. The project manager will sometimes need extra time to do this and maybe some extra inputs to the implementation process to be able to satisfy the customer. Like special type of resources, dealing with more and new suppliers, asking for more investors to fund the project and to fulfill the customer's needs, and refer to the customer periodically to get feedback and to introduce any need changes based on this feedback. All these aspects cause challenges for the project manager to achieve the stability in the project performance. Sometimes the customer is a huge organization and the project is divided into number of sub projects and therefore the dependability among those projects increases and this increases the complexity and hence increases the instability that the project manager may face because of higher level of complexity. Some of the project managers considered that the complexity is a motive to increase the relationships and the principles that assure the successful implementation of the project. In this case the project manager accepts the increase in the size, the dependency, the variety and the complexity of the project system and they think that this leads to better performance and more successful one. The complexity of the project in their perspective is a motive for better performance and even a cause for it. Complexity leads to consideration of higher number of variables and hence this leads to better control and thus the level of performance stability increases. This is an opposing point of view. Most of the project managers believed that complexity contributes to the instability of the project performance, however; we can notice that there is an opposing point of view that considers this complexity as a motive for having better and thorough planning and implementation so this is equal to higher level of stability and consequently higher level of success for the project. Some of the

project managers refer to the policies and legislations of the Arab countries as part of the environmental complexity that they have to deal with to manage their projects. They explained that the Arab countries have their own mechanisms of implementation and they have certain policies and legislations to make decisions about their projects. In such cases the project manager may have some legal challenges to be able to achieve the stability in the project performance. The instability that is caused by legal mechanisms and policies will force the project manager to cope with it because it is uncontrollable but at the same time it is expected. If the legislations are experienced before then the instability that is caused by this legislation becomes less due to experience on how to deal with it. This means that contextual complexity is related to the legislations of the country in which the project is implemented. The variety of the components and variables in the project system may require performing certain specialized tasks. Project manager believe that it is more difficult to find workers to implement certain specialized tasks in complex projects. The routine work is much easier to be implemented than the tailored one. The complexity of the project increases when there is need to designing tasks more than routine tasks. The availability and the cost of designing tasks is higher and difficult to acquire. Project managers think that this has a great effect on the project stability. Different cultural backgrounds people might have would complicate communication and delay project progress and this is related to the context and the cultural environment of the project. The culture as we explained is found to be a facilitator for performance stability only if it reinforces it. It can hinder the performance stability if it doesn't include the needed values for better functioning or if it includes diversified subcultures. We observed that the cultural diversity is higher in the gulf area projects and it is less in Egypt, and Palestine for example. The point is that the project manager is facing more challenges because of this diversity. One of the opinions about complexity explains how the over planning and over structuring leads to higher levels of complexity and that this is one of the reasons of having less stability in the project performance and the project environment as well. Over planning and over structuring is related to the relationship with stakeholders, the determination of the scope and the time schedule of the project implementation, the variety of the system components, the number and procedures of inspection processes, and so on. High levels of inspection, centralization, conformance to the plan, formality, standardization will lessen down the level of stability by affecting the morale of workers and increasing stress at work. Moreover that the project managers explained how the over planning and over structuring cause problem when they need to change. They said that if they need to change the current rigid plan then this leads to radical changes in planned time and costs. Accordingly the radical changes in the planned time and costs will be translated to less levels of stability. So it is better have normal levels of structuring, flexible plans, room for informality at work, and even for innovation if possible. This over structuring and over planning may be related to the size of the project, the variety of the project system, and/or the interdependency of the project system with other projects in the organization. Simplification of the components of the plan and the structure that are related to the size, variety, and dependency will enhance the stability of the project performance from the project managers' perspective. One more factor that is considered a reason for more complexity is the delay in receiving the resources for implementing the project and this may happen because the project needs a variety of resources and this means that the project manager deals with larger number of suppliers and this increases the complexity of the work. The probability of lack of resources, delays in delivering some resources, problems with suppliers and resources prices will increase when the number of resources increase and then the stability of the performance will decrease. This is more probable to happen in the big sized project more than the small ones. Also the dependability on other stakeholders increases when the number of needed resources increases.

Other than the suppliers there are other types of stakeholders like more investors, or the government if the resources are imported from other countries, banks, and people responsible about insurance and shipment, and others. Sometimes the project managers deals with few stakeholders and the organization takes care of the majority of the stakeholders and deals with them and other projects where the project manager is the owner of the organization the project manager is responsible about dealing and following up the relationship with different stakeholders to assure the stability of the project performance and its success. The level of complexity does not affect its stability

After analyzing the reasons of complexity that leads to the instability in the project performance, we designed the following table that shows the different and main effects that were found on the stability of the project performance because of complexity and the possible ways to avoid these negative effects from the project managers' perspectives.

Effects of complexity on instability of project performance	How to avoid the effect of complexity on instability of project performance
• Complexity leads to delays of submission	This needs more coordination among projects to avoid loses
• In case the project manager faces any unexpected problems in the project this will affect the stability of its performance	• Higher level of complexity is related to the need for more experienced project manager.
• Complexity greatly affects the success or the failure of the project.	• Based on the functional needs, sometimes we need to change the plan or the style of project management.
• Yes because it greatly affect the delay in implementation	• There has to be one clear vision without complexity
• It will cause the lack of ability to recognize the risks related to the project.	• We must take into account both flexibility and possibility to introduce changes in the plan.
• Complexity leads to increase in time needed for implementing the project, and consequently leads to decrease in profits.	• Project environment must comfort the workers in the project and also it is better if they have common culture
 If there are cultural problems this will highly affect the success of the project. Different culture background people might have would complicate communication and delay project progress 	 More complexity needs more planning

• The outdoor climate for example is one of the factors that may affect the project stability	• More complexity needs more time
	• Before looking to complexity we must look to the project environment
	• The degree of project attraction is more important
	• Easiness of communication, common aspects, and using the right language
	• If there is high level of awareness about the project dimensions and its importance
	• If the goals and number of activities needed are clearly determined complexity will not affect project stability

In general, the effects of complexity on the project performance are including facing unexpected problems, delays, percentages of success or failure of the project, level of project risks, costs and profits of the project, and complication of communication.

In this part we analyze the opinion of the project managers who think that the project complexity does not affect the stability of its performance.

One of the points of view discussed the importance of the project environment as a controller of the project complexity and said that we must care about the environment of the project from which the complexity comes and by dealing with this environment we do not want to measure the effects of complexity on the project stability. As long as we can deal with the environment of the project positively and successfully there is no effect of the complexity on the performance of the project according to this point of view.

Another point of view is giving higher importance to the level of project attraction. This group of project managers said that it is more important for us to measure the project attraction to the customer and this enables us to work positively with the complexity and bring on the performance stability because the return on investment in this case will be high. This increases the importance of the project to the project manager and thus becomes a priority in managing the project. In case the project manager is managing an attractive project, then he or she accepts complexity and he or she is highly motivated to control the stability of the project performance. Less effort is exerted with less attractive projects.

Other reasons behind the ability to minimize the effect of complexity on performance stability is the easiness of communication among team members and with external stakeholders, common aspects between the project manager and top management, the project manager and the workers, the project manager and the suppliers, the project manager and the customer, and the project manager and the investor. Common aspects facilitated the job of the project manager and decreases the complexity and its effect on the performance stability. Common aspects increases the number of supporters of the project manager and his work. Also this requires using the right language and especially when working with diversified cultures. All these aspects related to communication, common aspects, and used language are parts of the cultural environment of the project which again highlights the importance of the project environment on the stability of the project performance.

Another point of view explains the importance of having high level of awareness among workers about the project dimensions and its importance. This is plays a great role in decreasing the effect of complexity on the stability of the project performance. If workers are aware about the project importance and its contribution to their personal success, they will be motivated to make it happen successfully and to deal with larger number of variables and demands to succeed especially if the goals and number of activities needed to be implemented are clearly determined. In this case the project managers believe that the complexity will not affect the project stability.