The Study of project risk management implementation critical success factors and construction project success: A correlation Study

دراسة حول تطبيق عوامل النجاح الحاسمة لادارة المخاطر المشاريع الانشائية و نجاحها :

دراسة حول العلاقة الارطباطية

by

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Abstract

Itswell known and popular that construction projects are highly complex and vulnerable to risks exposure that results in project success objectives variations and overruns if not managed effectively. Thus, project risk management addressed as one of the main components of PMBOK and knowledge in project management practices. The number of researches conducted in construction project risk management where focused on the implementation project risk management processes, identifying critical success factors of project risk management and different enterprise risk management frameworks to minimize the impacts of negative events possibility and its consequences of risks encountered in construction projects and enhance project success.

However, a gap between construction project risk management in theory and actual practice of risk management identified in UAE construction projects. In addition, the understanding of critical success factors of Enterprise risk management ability to be utilized in project risk management to ensure success in construction projects.

This study adopted mixed method, both qualitative and quantitative methods to bridge the gap between theory and actual practices of risk management. The study divided into two phases. The first part of the study is to rank the importance of Enterprise risk management critical success factors for project risk management implementation and the second part is to correlate the project risk management implementation to construction project success. The qualitative method conducted through reviewing extensively the academic literature reviews as the primary sources and conducting surveys and questionnaires as secondary sources. The quantitative method was conducting analysis through using SPSS software for the data collected from secondary sources to validate research questions and hypothesis. Furthermore the, results of the study presented the vagueness in determining the relationship between most important critical success factors and project risk management in addition to determining an exact definition of construction project success.

من المعروف غالبا ان المشاريع الانشائية غالبا ما تكون معقدة و تعقيدها يجعلها ضعيفة امام المخاطر المحدقة بها ومن بيئة العمل. هذه المخاطر قد تؤدي الى عدم مطابقة الاهداف المنشودة لتحقيق نجاح المشروع. في الواقع , قسم ادارة مخاطر المشاريع تشكل احد عناصر علم ادارة المشاريع و أنشتطها العملية. معظم الابحاث السابقة المختصة في ادارة المشاريع مخاطر المشاريع الانشائية كانت تتمركز حول كيفية تطبيق عملية الادارة , تحديد عوامل النجاح الحاسمة و تخفيف الاضرار من خلال تطبيق الاطار المتعامل به.

قمنا ببحث متعلق بادارة المخاطر مشاريع الانشائية في دولة الامارات العربية المتحدة فكان هناك فجوة بين الجانب النظري و بين التطبيق العملي.

في هذه الدراسة قمنا بقسم البحث الى قسمين, الاول يتعلق في الجانب النظري حول دراسة الاهمية تحديد عوامل النجاح الحاسمة و تحديد درجة أهميتها على مراحل المشروع الانشائي. بينما, القسم الاخر يكمن في طرح استبيان حول تطبيق هذه العوامل في المشاريع الانشائية ثم فرز و معالجة البيانات لتحري و التأكيد على صحة النظرية وهي علاقة درجة الاهمية عوامل النجاح الحاسمة على مراحل المشلاوع تضمن نجاح المشروع الانشائي.

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Chapter one: General Introduction

1.1 Introduction

This chapter going to represent the dissertation introduction. A description of research topic background will be presented in the first part where the next parts of this chapter going to present the aim and objectives along with research questions. Moreover, this significance of the study and limitation of the research will be justified in the following. Finally, a description of research structure will be presented to clarify the approach followed to conduct this research.

1.2 Research topic and background

Several studies revealed that project risk management is a vital contributor to project success in construction. Argument in literature revealed that construction projects continue to fail to achieve its success criteria due to poor implementation of risk management practices as pointed out by Serpella, Ferrada, Howard, and Rubio (2014). Studies by Cendrowski and Mair (2009) posit the fail of interactions between risks in silo-based risk management systems causes projects to fail to achieve objectives where Hussain et al.,(2015) urged the need to define project objectives at the initial stage of the project to achieve project success. The need for consistent relationship between critical success factors of project risk management and its implementation in construction project lifecycle will be investigated to understand the relationship between project risk management and project success.

1.3 Research aim and objectives

The earlier section, the importance of critical success factors of project risk management implementation in enhancing project success in construction projects drawn. In attempting to fill the gap between the relationship between project risk management and construction project success, the overall aim will be presented below:

The overall aim of this research will be the following:

‘To explore and determine the relationship between critical successes factors of project risk management implementation and construction project success.’

In order to achieve the aim of the dissertation, a number of objectives established as the following:

i. Exploring the terms of risk, risk management and project risk management critical success factors.

ii. Exploring the terms of project lifecycle and construction projects success criteria.

iii. Investigate the effects of critical success factors on project risk management processes.

iv. Investigating the relationship between project risk management implementation and construction project success criteria.

1.4 Research questions

In the light of research objectives, Creswell (2013) stated that hypothesis emphasize and help in finding relationships between variables in which purpose of the study can be achieved. In order to clarify the relationships between research objectives the following research questions established with their hypothesis:-

RQ1:- What are the correlation effects of Enterprise risk management critical success factors implementation in project risk management processes along project lifecycle?

H0: There is no positive correlation of Enterprise Risk management critical success factors on establishing of risk identification in pre-project phase

H1: There is no positive correlation of Enterprise Risk management critical success factors on risk planning in pre-project phase

H2: There is no positive correlation of Enterprise Risk management critical success factors on risk analysis in planning and design phaseand contractor selection and site mobilization phases

H3: There is no positive correlation of Enterprise Risk management critical success factors on risk classification in planning and design phase and contractor selection and site mobilization phases

H4: There is no positive correlation of Enterprise Risk management critical success factors on risk monitoring in execution phase

H5: There is no positive correlation of Enterprise Risk management critical success factors on risk controlling in execution phase

H6: There is no positive correlation of Enterprise Risk management critical success factors on risk communication in closing phase

RQ2: What are the impacts of project risk management processes on construction project success? The following hypothesis drawn to find out the relationships between project risk management processes and construction project success:

H0: There is no positive correlation of project risk management processes on construction project success

The significance of the study

These objectives established in the research will serve as an intermediate stage to achieve the overall aim of this study. The first and second objectives will describe different concepts of the terms risk, risk management, critical success factors of risk management, project lifecycle, project success in general and specific construction project success criteria.

The third objective is an attempt to investigate how linkage between critical success factors of project risk management and construction project success criteria from several points of view of academic and surveys conducted in UAE construction projects. The contribution of this research will fill the gap between theory in academic field and actual field of project risk management implementation in UAE construction industry.

1.5 Study Scope and limitations

The scope of this dissertation is to justify the effects of Enterprise Risk Management (ERM) critical success factors derived from literature on project risk management implementations and to find out the relationship of project risk management and construction project success. This dissertation is not focused on certain type of construction projects in UAE. Also, the perceived project risks and construction project success evaluation may differ between project stakeholders and types of construction projects in UAE. Since constraints in time, budget and data collection encountered, the amount of research information collected from many secondary sources are limited. Its noteworthy for readers to bear in mind that surveys are conducted only in UAE construction projects that results obtained from this research maybe unable to generalize on other types of project industries and in other countries.

Chapter two: Project risk management in Construction

2.1 Introduction

This chapter explore the literature of project risk management implementation and its relationship to project success. A brief description of risks encountered by construction firms in UAE will be addressed. This literature will extend to describe the project risk management process, critical success factors that going to influence the process and then the project risk management and its relationship to project success. A summary of the relationship between project risk management and project success will be presented to close this chapter from academic point of view.

2.2 Construction project risks in UAE

Generally construction industry and construction projects in particular have the nature of constituting risky activities where this notion pointed out by Zavadskas et al.(2010a). This notion supported by Iqbal et al., (2015) that construction project risks may affect project objectives such as time, cost and quality; they had posit that construction project risks top ranked are payment delays, funding problems, accident/safety, defective design, improper schedule, weak performance of subcontractors, exchange rate fluctuation, improper scope definitions and shortage of delays and material. Al Sayegh (2008), had pointed out that construction risks in UAE are mainly inflation prices sudden change, shortage of material and labor supply, unrealistic construction schedules, design changes and bad intervention of clients. Since risks may affect project objectives positively or negatively, it may affect the project success. Silva et al.,(2016) had argued that construction project success criteria are only time, cost and quality where it went beyond the Iron triangle (Cost, time and quality) in which it brings the notion that constructions risks may affect other success criteria of construction projects.

2.3 Literature review

2.3.1 Understanding the risk, uncertainty and project risk definitions

Several studies and researchers attempted to define the terms of risk and uncertainty and distinguish them from each other where, literature revealed still there is no agreement on definition as pointed out by Aven and Renn(2009). They posit the notion of risk to be described in terms of probability distribution, expected value, uncertainty and events.The Oxford English Dictionary had defined risk as the chance of danger, loss, injury or adverse consequences and the definition of at risk refers to expose to danger.

Some researchers such as Hopkin (2008, p.11) had pointed out that this context refers to negative consequence. Moreover, Hopkin (2008, p.11) stressed the notion of risk can be a positive consequence or risk being related to uncertainty of an outcome. Furthermore, other definitions of risks pointed by several bodies such as Institute of Risk management (IRM) had defined risk as the combination of event probability and consequences where consequences could be negative or positive. ISO 31000 Guide 73 defined risk as the effect of uncertainty on objective since uncertainty refers to positive, negative or deviation from expected. ISO 31000 had posit the events can be categorized in terms of being an opportunity, hazard and uncertain.

In project management context , PMI(2000) defined risk to be an uncertain event or condition that if it occur it may have positive or negative effects on project objective. This notion stressed by Hopkin(2008, p.11) in project management where an alternative definition of risk to be the event with the ability to impact mission, strategy, projects, routine operations, objectives, core processes, key dependences and delivery of stakeholder delivery.

Author	Risk Definition
Aven and Renn (2009)	• Risk as an event expose human stake where uncertain outcome may occur. • Risk is the combination of event, consequence and uncertainty.
Hopkin(2008 p.11)	risk to be the event with the ability to impact mission, strategy, projects, routine operations, objectives, core processes, key dependences and delivery of stakeholder delivery.
ISO 31000	risk as the effect of uncertainty on objective since uncertainty refers to positive, negative or deviation from expected.
IRM	defined risk as the combination of event probability and consequences where consequences could be negative or positive.
(Kaplan and Garrick 1981; Kaplan 1991)	risk is defined as a set of scenarios si, each of which has a probability pi and a consequence ci

Table 1 Different risk definitions

Source: author

According to Sharma and Swain (2011), Smith et al.,(2008) and PMI (2000) described construction projects risks to be associated in all stages of the projects begins with evaluation, sanction, construction and operations. In the context of this dissertation, project risk definition selected according to PMI(2008).where project risk defined according to PMI(2008 p.275) as uncertain event or condition that if it occur, it have an effect on at least one project objective. Differentiation between project issue and project risk is an important to construction practitioners in quantifying of risks and to assess them for an efficient minimization and managing of these risks. According to M. NextGen (2015) book , a definition for project issue found that stating project issue as event being realized and no longer can be mitigated and resolution required. This definition stated earlier by Schuchat (2006) he defined project issue as an event related to project that arise during the daily activities of the project that need a satisfactory solution in order the project to proceed as planned where decision need to be taken outside the scope of daily activities. M. NextGen (2015) book added the notion of realized risk but no actions taken to mitigate them as project issues.

Its noteworthy to understand the difference between uncertainty and risk in construction project management. Uger(2005) described the argument in literature of risk and uncertainty concepts where similarity notion of these concepts to senior managers presented. An agreement on both concepts differences pointed out by Toma et al. (2012) and Uger (2005) see Robert E.Rubin's book- In an Uncertain World. Merna and Al-Thaniy(2008, P.7) described uncertainty to be a prophecy where it cannot be predicted since it does not depends on past data or experience. Moreover the ability to predict based on past experience could serve bases of potential risk. Since risks and uncertainty could be used interchangeably, they are not the same and distinguishing between them stressed by Merna and Al-Thaniy (2008, p.13). Defining uncertainty had long attempts over decades. According to Merna and Al-Thaniy, they defined uncertainty as the inability to attach the probability to likehood of an event to occur. A broader description of uncertainty brought by Smith et al.(2006) suggested that risk can be broken into three dimensions and these are known risk, known unknown and unknown unknowns based on the ability foresee these risks. Researchers such as Toma et al., (2012) stressed the notion of distinguishing between risk and uncertainty by considering probability prediction as a key. Moreover they posit that probability prediction based on information. When information insufficient, those levels generate uncertainty, absolute uncertain and state of risk. Knight (2012) urged the notion of distinguishing between risk and uncertainty by suggesting the measurement of outcomes by quantifying them. Chapman (2006) posits that risks can be eliminated or mitigated due to the ability to measure and quantify the probabilities of events while uncertainty cannot be eliminated or controlled due to lack of measuring the probabilities of the future. Hence as mentioned earlier project issue according to M. NextGen (2015) the state of being highly predictable on event and outcome occurrence and no action taken to mitigate. Below diagram adopted from Clenden (2011) describe Smith et al(2006) notion of risk and uncertainty.

		INFORMATION AVAILABILITY	
AWARENESS		KNOWN	UNKNOWN
	KNOWN	Known Knowns	Known Unks
	UNKNOWN	Knowable Unks	Unknowable Unks

Figure 1: The Project Uncertainty Matrix

Source: Adapted from Cleden (2011, p. 49)

In the context of this dissertation on construction project management, Nistor(2005) concluded that risks can be a part of uncertainty. Since risk constitute a part of uncertainty, Smith et al., (2006) stressed that risks occur when there some knowledge about the event to occur where uncertainty develop when not enough information about occurrence of events but little knowledge exist that it may occur. Cleden (2009) had argued that risk occur when there is a gap in which constitute a threat to project while uncertainty is the intangible measure of what is not known where it is the gap of knowledge we don’t know. Finally

Webb(2003) earlier stated that risks are situation where risk exposure could be positive or negative while uncertainty is the outcome where person have no knowledge. A table below summarize differences between concepts in reviewed literature.

No.	Author	Risk definition	Uncertainty definition
1	Smith et al. (2006)	Risks occur where there is some knowledge about the event	There might be not enough information about the occurrence of an event, but we know that it might occur.
2	Cleden(2009)	Risk is the statement of what may arise from that lack of knowledge. Risks are gaps in knowledge which we think constitute a threat to the project.	Uncertainty is the intangible measure of what we don"t know. Uncertainty is what is left behind when all the risks have been identified. Uncertainty is gaps in our knowledge we may not
3	Webb(2003)	Risk is a situation in which he possesses some objectives information about what the outcome might be. Risk exposure can be valued either positively or negatively.	Uncertainty is a situation with an outcome about which a person has no knowledge.

Table 2 : Differences between Risk Vs Uncertainty

Source: Author

2.3.2 Understanding the concepts of risk management frameworks

Risk defined according to PMI(2008) and Hilson and Simon (2007) as uncertain event or condition have negative or positive influence on project objective. Cagliano et al.,(2014) pointed out the significance of managing risks in projects had increased since it determine success.Moreover their study stressed out that variations in quality, cost and time are results of poor management of risks. This research focus on project management institute (2013) definition of projects where project defined as a temporary endeavor undertaken to achieve a unique product or service or a result.This can reveal that project have a beginning and end where end is considered when project objectives are achieved, (PMI, 2008).   In literature several project risk management processes and frameworks described managing risks in projects where PMI (2008) described the process in terms of risk identification, qualitative, quantitative analysis and response. However Gjedrum and Peter (2011) extended this notion of project risk management steps by discussing the ISO 31000 risk management framework. Moreover the aim of ISO 31000 is to standardize the process of risk management in different countries where it addedestablishing the context and continuous communication and consultation to the PMI (2008) traditional project risk management process. Gjedrum and Peter (2011) stated that establishing the context includes setting goals and objectives that may vary according to the structure of the organization while communication and consultation must take place throughout the process and should include both internal and appropriate external stakeholders. Managing risks in silos identified by Zhao et al.,(2013) where they stressed for the need of managing risks in an enterprise level to overcome silo based risk management which constitute traditional project risk management. Furthermore , Project risk management focus on project level goals time, cost and quality while Enterprise risk management focus on holistic view of corporation goals.Zhao et al.,(2013) they posit that there would be no contradiction between the frameworks. From this notion COSO ERM plays into act where it is defined according to the Committee of Sponsoring Organizations of the Treadway Commission (2004), ERM is defined as: *"a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives. (p. 2)"*. Describing the steps to implement the enterprise risk management approach, Burnaby and Hass(2009) proposed ten steps for ERM for an efficient implementation of COSO ERM framework and these are, mandate from the top, ERM department buy-in, control framework decision, determine all risks, assess risks, business objective measures and performance, objectives and control summary, monthly ERM reporting systems, analysis by ERM department and continuous monitoring the process.AS/NZS 4360:1999 on the other hand described that managing of risks are integral part of management process where multifaceted process, appropriate aspects of which are often best carried out by a multi-disciplinary team. It is an iterative process of continual improvement.AS/NZS 4360:1999 stated that there are seven steps or elements of risk management and these are establishing the context, identifying, analyzing, evaluating, treat, monitoring, communicating and consulting of risks.

Caglianoet al.,(2014) stated that different risk management processes and frameworks established since the 90s where PRAM (2004) pointed out the commonality in structure and goals of these frameworks.   Moreover these frameworks commonalities could share three main steps in which they are called macro phases. These phases describe the main levels of project risk management where the first phase is to understand and clarify the objectives of the project and planning risk management accordingly. The second phase consist of risk identification, analysis and response plans such as contingency plans. Finally, the last phase is risk monitoring and communicating. A table constructed to reveal comparison between risk management frameworks according to Caglianoet al.,(2014):

PRM steps	ISO31000	AN-NSZ1999	COSO (2004)	PMI(2008)
Establishing context	Establishing context	Establishing context	• mandate from the top, • ERM department buy-in, • control framework decision	
Risk identification	Risk identification	Risk identification	• Risk identification	Risk identification
Risk analysis	Qualitative and Quantitative analysis	Qualitative and Quantitative analysis	Risk assessment	Qualitative and Quantitative analysis
Risk evaluation	Evaluate	Evaluate	Measuring objectives and performance	Risk classification
Monitoring and controlling	Monitor review of risk assessment	Monitor review of risk assessment	Objective and control summary	Risk response
Communication	Communicate risk assessment	Communicate risk assessment	Monthly ERM reporting	

Table 3: Different Risk management frameworks and commonality

Source: Author

Definition brought by Cooper et al.,(2005) earlier combine the similarities discussed frameworks of risk management where risk management process, involves the systematic application of management policies, procedures to the task established to identify risks, analyzing, assessing, treating, monitoring and communicating of these risks. Caglianoet al.,(2015) posit the need to define the project objectives during setting the risk management plan and resources to treat activities constitute risks. Furthermore, they brought the notion of necessity to identify causes of risks, analysis to determine the probability and consequences effects project outcome in terms of cost, quality and time. Finally they posit the developing of actions to respond to those risks to increase opportunity and reduce threats.

A detailed diagram of risk management process adopted from Standard Australian and Standard New-Zealand(2004) will help in describing risk management process:-

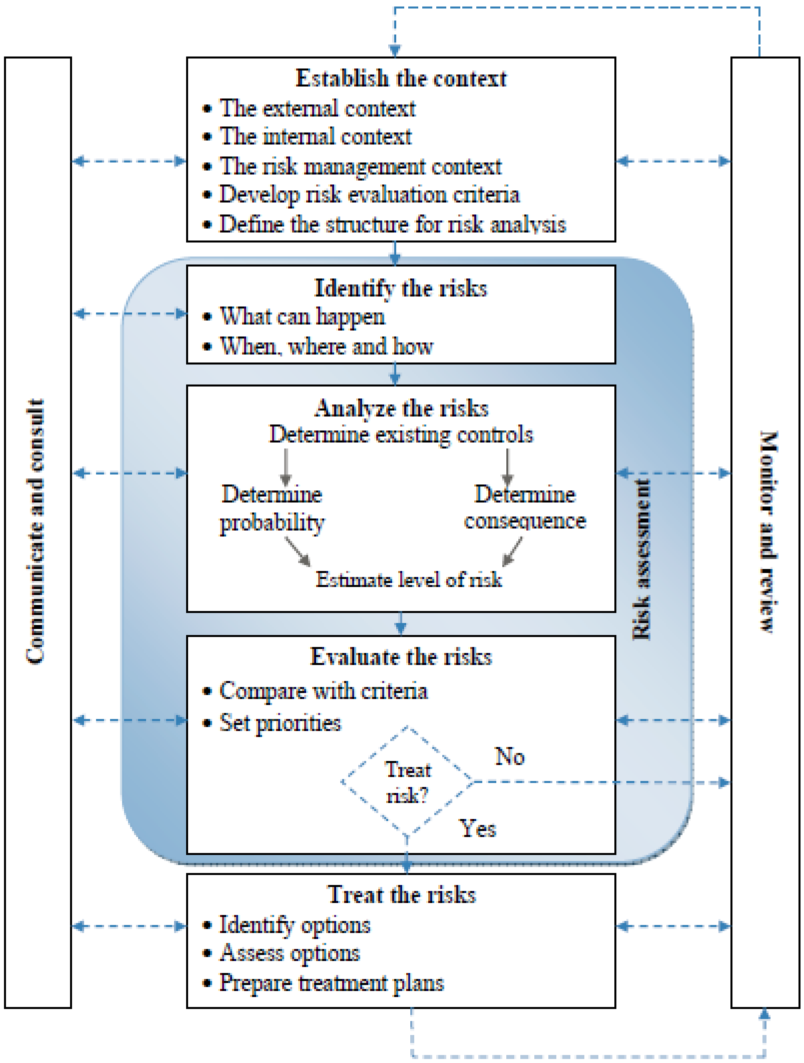

Figure 2: The project risk management process

Source: Adopted from Standard Australian and Standard New-Zealand(2004)

2.3.2.1 Establishing of Context

Establishing the context is the first step in risk management process. According to standard Australia and standard of New Zealand (2004), it pointed out that organization need to identify the parameters to be considered while managing risks and sets the scope and criteria to establish the rest of the process. Moreover, this step includes five main steps and these can be summarized as the following:-

- The external environment in which an organization seeks to achieve its objectives.
- The internal environment in which an organization seeks to achieve its objectives.
- Risk management context where it defines the objectives, strategies, scope and parameters of the organization activities where risk management need to be applied.
- Establishing risk evaluation criteria where it define the acceptable level of risks.
- Defining the structure of risk analysis.

2.3.2.2 Risk identification

The aim of risk identification step is to find out risks and uncertainty factors where it recognize potential sources of risk events as pointed out by Rutkauskas (2008) and Zayed et al. (2008).

This step need to be performed by many project stakeholders as much as possible as suggested by PMI (2000) where during the identification process; potential risks fall in different groups that several approaches to classify risks and its sources stated by (Baloi and Price 2003, Jaafari
2001, Leung et al. 1998, Li et al. 2005, Mbachu and Vinasithamby 2005, Tah and Carr 2000, Zhi 1995). Study conducted by Osipova (2008) construction project risks fall within the following groups and these are:

- Internal or controllable risks such as construction, design and relationships.
- External or uncontrollable risks such as financial, economical, environmental etc.).
- Force majeure risks.

Figure below adopted from Zavadskas et al. (2010) journal to help in demonstrating risk factors allocated on project lifecycle

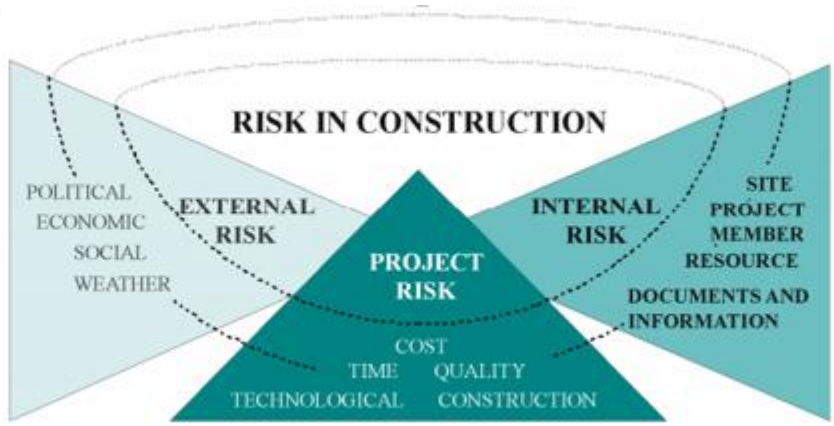

Figure 3: The risk identification along PLC

Source: Adopted from Zavadskas et al. (2010)

2.3.3 Risk assessment

This stage of risk management process describe the risk analysis where it aims to collect the data about potential risk identified where it includes short listing of these risks with the highest impact on the project where these are derived from threats from the identification as stated by Cooper et al. (2005). Usually many literature reviews had offered many models for risk assessment in which these models are based on qualitative and quantitative methods. Kishan et al. (2014) also added that this step is to enable decision makers to be more precise in the process of risk management through accurate and objective computation of risk; this step will collect all practical possibilities and test them against the end results of decisions taken. Qualitative methods of risk assessment could be such as expert judgment, experience and intuition and a quantitative method such as probability analysis, sensitivity analysis, simulation analysis and scenario analysis as pointed out by Renault, B.Y. et al. (2016).

Selection of the right method of risk assessment depends on many factors, according to Lichtenstein (1996) he listed these factors where it is up to the organization to choose what are the factors may they perceive that are crucial where below these factors are listed:

- Cost of method to be used where this include employment cost and cost of method itself.
- The adaptability of the method to the organization where it should fit the requirements.
- Complexity of method where it describe it limits and simplicity.
- The feasibility of the method, degree of completeness.
- The method should be easy to understand.

- Validity and credibility.

According to Azari (2010), a brief of risk analysis tools will be briefed which are commonly used in construction industry where they are divided into two categories and these are quantitative and qualitative risk analysis tools.

2.3.2.2 Quantitative risk analysis tools

According to PMI (2009), it estimate the impact of risks in a project where Heldman(2005) stated that it is suitable for medium to huge project that require software and professional personal. The brief include many quantitative risk analysis tools in which it includes Scenario Technique, Modelling technique-sensitivity analysis and Diagramming techniques.

Scenario Technique-Monte Carlo simulation, this method is based on statistics which are used to assess risks through simulation. Mun (2006) stated that this technique generate scenarios while simulation to make forecasting and estimation.

The second method is Modelling technique-sensitivity analysis where it generates the events that have the greatest impact and value where those events are weighted against project objectives. This technique explain the highest level of uncertainty or risk on the objective, it is more sensitive. The results demonstrated in a spider diagram where the disadvantage is that each variable considered alone where Smith et al. (2006) stated that it is better fit during the initial phase of the project.

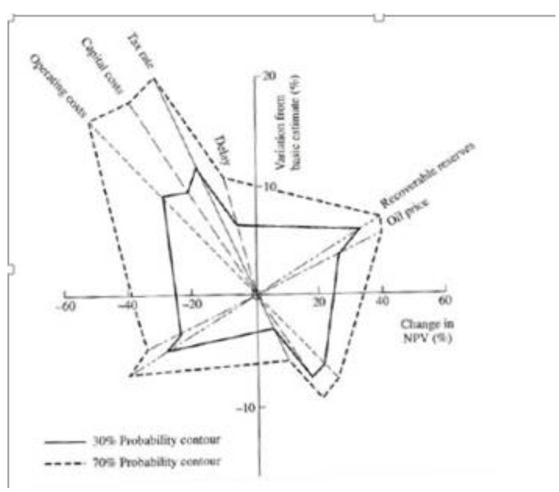

Figure 4: Sensitivity analysis

Source: Adopted from Smith et al.,(2006) The third quantitative method in this paper is the Diagramming technique where this technique described by Heldman (2005) is very important when high risk would affect the two main objectives of the project and these are time and cost where it is in the form of decision tree. The decision tree have two main types and these are the Fault Tree Analysis (FTA) and Event Tree Analysis (ETA). Cooper et al.(2005) had described the FTA method used to find out the probability of risk and to find out the risks that could contribute to the failure of one event and determine the causes of that event. Usually it is sketched as a tree where the branches describe the sequence of events and possible outcome where they are the causes of the problem. By having many branches, the tree give many options to choose.

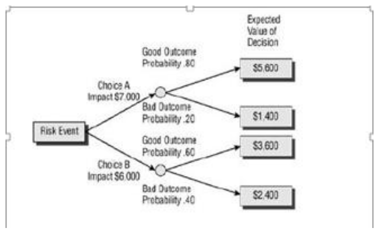

Figure 5: Diagramming technique

Source: Adopted from Heldman(2005)

2.3.2.3 Qualitative risk analysis tool

Gajewska and Ropel (2011) had described the qualitative risk analysis tool that is based on descriptive scale which is used to describe the impact and Like- hood where Cooper et al.(2005) it used when a quick assessment required which project ranges from small to medium size projects as stated by Heldman(2005) also, this method is usually used when inadequate, limited or unavailable numerical data as well as limited resources of time and money (Radu, 2009). The main aim is to prioritize potential threats in order to identify those of greatest impact on the project (Cooper et al. 2005), and by focusing on those threats, improve the project’s overall performance (PMI, 2004). The complexity of scales (Cooper et al. 2005) and definitions (PMI, 2004) used in this examination reflect the project's size and its objectives. During the phases of the PLC, risks may change, and thus continuous risk assessment helps to establish actual risk status (Cooper et al. 2005).

According to PMI(2004) there are four main qualitative risk analysis tools and these are risk probability and assessment, probability/impact risk matrix, risk categorization and risk urgency assessment where they will be discussed in brief in the below section of this paper.

Starting from Risk probability and assessment method, it evaluates the specific risk in terms of Like- hood, the second step is to evaluate the impact the projectobjective where it is assessed against the opportunities and negative effects that result from threats. PMI(2004) described the probability from very unlikely to almost certain and the impacts from very low to very high.

Furthermore, risk impact on a project's objectives is assessed regarding its positive effects for opportunities, as well as negative effects which result from threats. For the purpose of this assessment, probability and impact should be defined and tailored to a particular project (PMI, 2004). This means that clear definitions of scale should be drawn up and its scope depends on the project's nature, criteria and objectives (Cooper et al. 2005). PMI (2004) identifies exemplary range of probability from 'very unlikely' to 'almost certain', however, corresponding numerical assessment is admissible. The impact scale varies from 'very low' to 'very high'. Below a diagram demonstrate the risk probability and assessment tool.

Defined Conditions for Impact Scales of a Risk on Major Project Objectives
(Examples are shown for negative impacts only)

	Relative or numerical scales are shown				
Project Objective	Very low /.05	Low /.10	Moderate /.20	High /.40	Very high /.80
Cost	Insignificant cost increase	<10% cost increase	10-20% cost increase	20-40% cost increase	>40% cost increase
Time	Insignificant time increase	<5% time increase	5-10% time increase	10-20% time increase	>20% time increase
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Scope reduction unacceptable to sponsor	Project end item is effectively useless
Quality	Quality degradation barely noticeable	Only very demanding applications are affected	Quality reduction requires sponsor approval	Quality reduction unacceptable to sponsor	Project end item is effectively useless

This table presents examples of risk impact definitions for four different project objectives. They should be tailored in the Risk Management Planning process to the individual project and to the organization's risk thresholds. Impact definitions can be developed for opportunities in a similar way.

Figure 6: Definition of impact scale

Source: PMI(2004)

The second method probability/impact risk matrix, this is the step conducted after Risk probability and assessment method where it serve as basis for the quantitative risk assessment. Westland (2006) computes the priority score as the average of the probability and impact. The range of priority score, the rating and color are assigned to indicate the importance of each risk (Westland, 2006). To rank the priorities, the impact is multiplied by probability where the results will be generated in the diagram adopted from PMI(2004). Colours and numericals combination shows which risks are high, medium and low which help in drawing the responses of these risks.

Probability and Impact Matrix

Probability	Threats					Opportunities				
0.90	0.05	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.05
0.70	0.04	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.04
0.50	0.03	0.05	0.10	0.20	0.40	0.40	0.20	0.10	0.05	0.03
0.30	0.02	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.02
0.10	0.01	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.01
	0.05	0.10	0.20	0.40	0.80	0.80	0.40	0.20	0.10	0.05

Impact (ratio scale) on an objective (e.g., cost, time, scope or quality)

Each risk is rated on its probability of occurring and impact on an objective if it does occur. The organization's thresholds for low, moderate or high risks are shown in the matrix and determine whether the risk is scored as high, moderate or low for that objective.

Figure 7: probability and impact matrix

Source: PMI (2004)

The third and fourth method are risk categorization and risk urgency assessment where according to PMI(2004), Risk categorization is a way of systematizing project threats according to e.g. their sources, in order to identify areas of the project that are most exposed to those risks. Tools which can be used in this method are work break down structure (WBS) or risk breakdown structure (RBS) as mentioned in the diagram below.

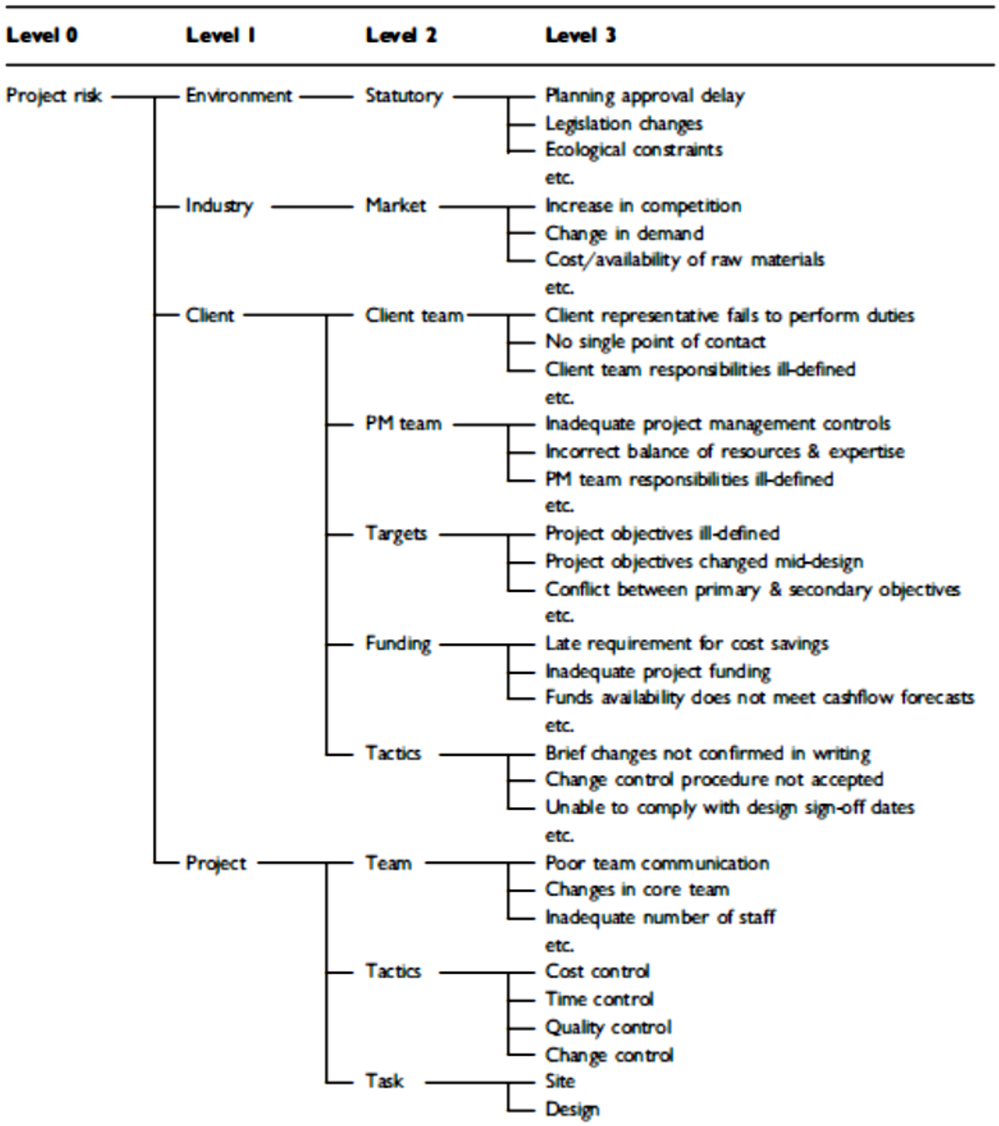

Figure 8 : Risk Breakdown Structure

Source: Hillson (2003, p.89)

2.3.2.4 Risk response

The third step in project risk management is the risk response to the identified and assessed risks where there are four main risk response strategies according to IEC (2000), PMI (2000) and Smith et al. (2006) and these are risk avoidance, reduction, transfer and retention. Szymanski (2017) had described these four risk responses.

He described risk retention or acceptance in the form active or passive where it is accepted to certain level in which all consequences are accepted in terms of lack of time, resources and financially.

Risk avoidance in terms of eliminating the risks by preventing its occurrence from the entire process where risks beyond the acceptable level are not acceptable. On the other hand, risk reduction described as the actions taken to reduce the probability of an event and finally the risk transfer as transferring the hazard to another entity in which it can overcome the risk or directing the loss to another entity.

2.4 Project risk management implementation along project lifecycle

Understanding the effects of project risk management on construction project lifecycle could fill the gap between project risk management critical success factors and project success. Its noteworthy to understand the project lifecycle. According to Gajewska and Ropel(2011) stated that projects like any business it have a beginning and end that include many activities where they described project lifecycle as a tool to improve project performance. Smith et al.(2006) had stated that project lifecycle may differ from one project to another or from an industry to another where they concluded its hard to define a certain number of phases to be used as a template that fit all types of projects. Smith et al. (2006) argued that best project lifecycle phases could be divided into eight succeeding phases and these are Pre-feasibility, feasibility, contract/ procurement, implementation, commissioning, hand-over and operations. In contrast, Westland(2006) stated that project lifecycle consist initiation, planning, execution and closure phase based on early Pinto and Prescott (1988) study. In an early study by Ward and Chapman(2003), they stressed out the need to break phases into steps in which this fragmentation would facilitate the identification of risk and enhance more efficient risk management process. Same period Bennet(2003) posits a typical project lifecycle framework that goes in line with project complexity where it consist of six phases and these are pre-project phase, planning and design phase, contractor selection phase, contractor mobilization phase, project operation phase and project termination phase. He supported that notion since construction projects highly complex in nature and require a special project lifecycle framework. In this study Bennet(2003) framework selected to describe main activities in each phase, a diagram below presented according to his study.

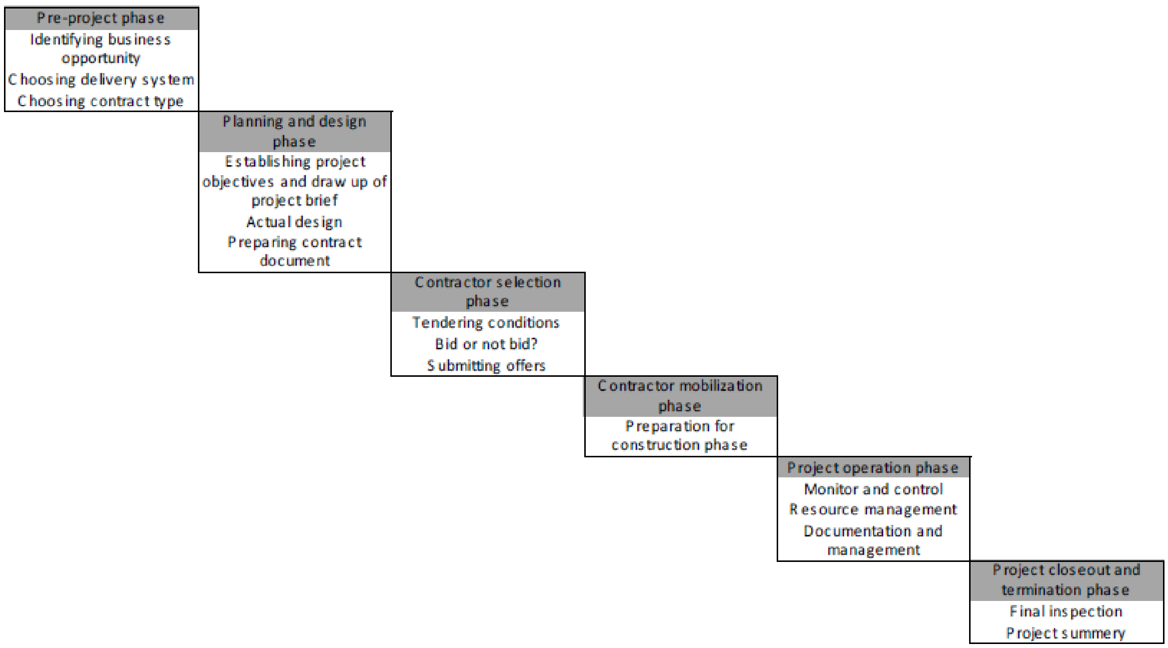

Figure 9: Construction PLC

Source: Bennet(2003)

Westland(2006) described the Pre-project phase as the phase in which business opportunity and problem identified where many proposals established where scope, time, cost and main activities planned. Moreover, this phase define the project delivery system where relationship between project actors established such as client, consultant and contractor. Bennet(2003) described that planning and design phase include three main steps and these are project brief in which detailed objectives identified, planning such as site investigation and constructability analysis in which it identify the building is easy to construct and its impacts on cost, time and quality. Moreover, after study is accomplished a design process begin and last activity is the established contract document. Potts(2008) stated in contractor selection which is defined by Bennet(2003) added that price is notalways the case to select a contractor where it depends on qualifications, resources and bid price. After contractor selection, Bennet(2003) added that activities such as project mobilization are contractor responsibility where permits and license need to be initiated. Bennet(2003) described the main activities in operational phase are monitoring and control, document management and resource management. Finally, the project close-out phase which includes delivery of the project such activities such as clean-up, inspection and hand-over to client in order to accept it. Westland(2006) stressed for the need of conducting an overall project assessment to prepare for future projects. As stated earlier by Ward and Chapman (1995), faults in project management process can be a major source of project risks. Since risks could be within project management process itself, it worth to understand those risks that could occur in project lifecycle phases or between those phases. Ehi-Uujamhan, (2015) and Gajewska and Ropel(2011) had brought the notion of developing a risk definition between project teams to be aware of risks in project lifecycle. Ehi-Uujamhan, (2015) posits the need to establish risk register to define risk; moreover risk register is a table that includes risks that accompany project are prioritized where Lee et al.,(2012) stated that each phase constitute risks. Reviewing literature, a gap in importance of risk management process implementation along project lifecycle phases identified where an argument in Ehi-Uujamhan, (2015) and Gajewska and Ropel(2011) study describing which phase is the most important to implement risk management process. Ward and Chapman(2003) stressed that unmanaged risks in early phases would cause issues in later phases. From this notion Razet al.(2002) highly insisted that risk management is important in all aspects of project lifecycle starting from initial phase up to termination phase. Early study by Akintoye and Macleod (1997) highlighted the need of project manager to be able to identify all types of risks on timely manner to provide the required measures. Moreover it helps in eliminating, mitigating risks that cause hindrance to performance. Lyons and Skitmore (2002) posit that risk management is more used during planning and execution phases while Elkington and Smallman (2002) argued that notion and stated that it is more used during the conceptual phase. According to that notion, its important to identify the elements of risk management process need to be used in each phase of project lifecycle. According to Ehi-Uujamhan, (2015), in the pre-project phase, many alternatives proposed where risks associated with each alternative need to be identified. Westland (2006) earlier stated that risks in this phase should be identified and assessed. Hence Ehi-Uujamhan, (2015) and Westland (2006) posit the need of establishing risk plan during the planning and design phase, it should identify all risks associated with planning and designing. Moreover they pointed out that risk plan could solve issues before they shift to the next phases where they could be mitigated; they brought the idea of necessity of all stakeholders of the project contribute in risk planning in that phase. The need for conducting risk assessment in each phase of project lifecycle argued by Ehi-Uujamhan, (2015), Westland(2007) and Westland (2006) based on the notion of risks decrease while project progressing along project lifecycle. Smith et al.(2014) described that its highly essential to conduct risk management during the execution phase where more emphasis on monitoring and controlling processes to ensure activities performed according to plan and risks identified in the previous phases are controlled. According to a study conducted by Rafindadi et al. (2014), sources of risks classified in five categories and these market risk, general project risk, risks in feasibility and design phase, risks in construction phase and risks in operating phase. Other researchers such as Szymanski(2017) had grouped construction project risks according to project lifecycle and these groups are Preliminary design risks, Tender risk, Detailed design risk, Construction works and financing risks.

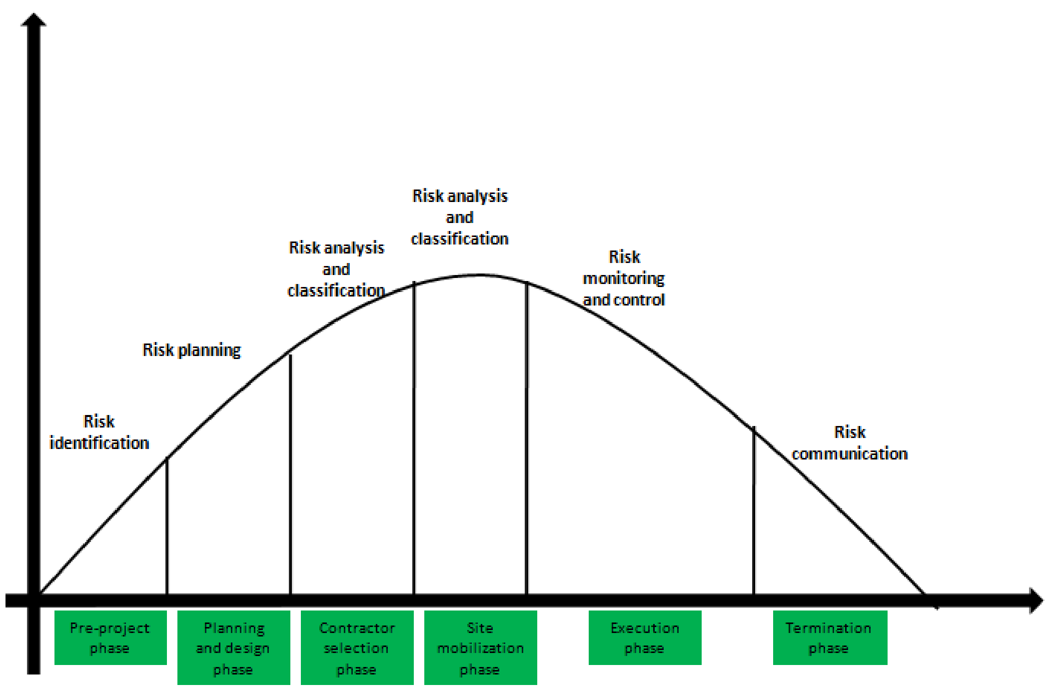

Figure 10: Utilizing RM elements over PLC

Source: Author

2.5 Enterprise Risk Management (ERM) critical success factors for project risk management implementation

Despite the extensive literature in project risk management practices, the area of study that cover critical success factors (CSF) identification and body of knowledge not sufficiently developed as concluded by Yaraghi (2011).Furthermore, he urged that in spite well developed body of knowledge about the design and implementation of risk management processes, there is no accepted globally standards and guidelines that help organizations to design and implement an effective risk management system. His study concluded that critical success factors (CSF) would fill the gap between risk management literature and risk management processes practices. Moreover, the notion of effective risk management system brought by Hosseini et al. (2016) starts by identifying the critical success factors for that system.Shehu and Akintoye (2011) and Ranong and Phuenngam (2009) stated that based on Rockart (1982) who first developed the critical success concept to discuss risks and prerequisite to achieve project success. Shehuand andAkintoye (2011), (Rowlinson and McDermott 2005 and Thomsen, 2008) posit that critical success factors are the main areas and fundamentals of projects to achieve success that ensure that project processes are integrated. In this paper, it attempt to fill the gap of effective project risk management processes along project lifecycle by examining the correlation effects of critical success factors on project risk management elements. Deroset al.,(2006) stating that critical success factors defined as a range of enablers which put in practice will enhance the chances for a successful implementation and adoption by an organization that set as a benchmark. Critical success factors argued byJaramillo and Marshall (2004) and Keck et al. (1995) to be as fundamentals of project to achieve success where they stated that critical success factors are tasks need to be prioritized by project team to ensure success of projects.Kishk and Ukaga (2008) concluded that critical success factors are important to manage to ensure project success. Since Lui et al., (2013 and 2011) brought the notion of Enterprise risk management and Project risk management both deal with risks that face the organization, there is no contradiction between them since each type of risk management process deals with risk in different level where ERM critical success factors could be examined in project risk management context.

Zhao et al.(2013) study listed and ranked 16 ERM critical success factors and these are Commitment of the board and senior management, ERM ownership, Risk appetite and tolerance, Risk-aware culture, Sufficient resources, Risk identification, analysis and response, Iterative and dynamic ERM process steps, Leveraging risks as opportunities, Risk communication, A common risk language, A risk management information system (RMIS), Training programs, Integration of ERM into business processes, Formalized key risk indicators (KRIs), Objective setting and Monitoring, review and improvement of ERM framework. Earlier, Kishk and Ukaga (2008) had listed 8 critical success factors for project risk management and these are defining clear goals, management support, developing detailed project plans, creating clear defined control mechanisms, communication ability, acceptance, client consultation along the project duration, competent professionals and trained, flexible project manager and project owner interest.

- **Top management supports**

  According to Eccles et al., (2012) stated that board of directors and top management plays a big role in adopting sustainable business practices that ensure proper decision making to be conducted such they have the power to craft vision and abilities. Since sustainability became an issue in business, board of directors started to feel the importance and strive to understand risks emerged from sustainability issues as addressed earlier by Dowling (2006). So risk management function realized by board of directors and top management to be their responsibility as mentioned by Abdul Aziz et al., (2015).

- **Corporate culture**

  Since corporate culture is an important area to ensure business sustainability, it is defined as the beliefs and behavior draw the employees in an organization coping with business complexities as pointed out by (Bertel, Papania, and Papania 2010) and Shore (2013). Since greater risk awareness in corporate culture, it can ensure a competitive advantage as concluded by Richter (2012). To ease this notion, risk culture defined by Banks(2012, p.23) as an internal sensibility reflected in the daily thoughts and actions of employees toward respecting risk. This notion supported by Segal(2011) where he described risk culture can give early signal to events that can threaten corporate survival.

- **Risk communication**

According to Coccia (2005), he stated that one of the critical success factor for Enterprise risk management is communication along with the promotion of behavior changing through the organization. Duckert (2011) brought the notion of common risk language development would establish terminologies that contribute in breaking the silos between layers of organization and support risk culture. Earlier in literature, Espersen (2007) had brought the notion of making risk language easy to understand among organization staff is to establish a risk terminology glossary as a common reference resource.

- **Training programs**

  Training programs which constitute the communicating the main ideas of Enterprise risk management implementation to the organization members that help in reducing anxiety and misunderstanding where it clarify the philosophy and polices, values and processes as stated by Zhao et al., (2013). Other researchers mentioned the need of training in terms of sharing best practice, knowledge and relationships as stated by Hampton (2006).

- **Risk ownership**

  Risk ownership was described by Zhao et al.,(2013) in terms of owning a centralized risk management and take responsibility to oversight risks where this notion was supported earlier by Banham (2004) where this practice described by him to be consistent of ERM in other industries. This notion supported in Marchetti (2011, p.17) study where he pointed the key roles and responsibility of board of directors to oversight the risk management functions.

- **Risk appetite**

  Risk appetite described by Zhao et al.,(2013) as the amount and type of risk an organization willing pursue and retain while risk tolerance is an organization or stakeholders willing to bear risk after risk response in order to achieve objectives as stated by (International Organization for Standardization, 2009a, p. 9). This notion supported by McDonald (2004) where he defined risk appetite as strongly hinging between procedures and monitoring with involvement of management board, centralized ERM and effective communication and building a foundation of risk awareness in business culture as a key success factor.

- **Allocation of sufficient resources**

This critical success factor refers to the allocation of adequate time, staff, funds, knowledge and expertise to implement enterprise risk management as stated by Zhao et al.,(2013). They pointed out the need for continues allocating resources in order to improve the enterprise risk management implementation. (Gates, 2006; Muralidhar,2010) stated that insufficient allocation of time, staff, funds, lack of internal knowledge could hinder enterprise risk management implementations.

- **Objective setting**

  A clear objectives setting are crucial to be identified in all levels of the organization to achieve Enterprise risk management implementation success as stated by Zhao et al.,(2013). On the other hand, COSO (2004) denoted the importance of recognition of objective setting as a precondition to risk identification, assessment and response. This notion supported by Hopkinson (2011) in which he stated the importance of construction companies management to clearly identify the objectives in all levels of the organization and investigate deviations from plans and against the objectives. Another notion that supports objective setting is stated by Wood (2005) where a practical linkage of risk register and mitigation plans with planned corporate objective is a key success factor in objective setting.

- **Risk identification, analysis and response**

  Risk identification, analysis and response critical success factor refers to the actual execution of enterprise risk management process where it is linked to generic risk management steps as pointed out by Zhao et al., (2013). Such to implement Enterprise risk management, a formalized process need to be implemented where it starts with identification of potential risks internally and externally. Those risks need to be prioritized by using analysis tools and then risk mapping and appropriate risk response measures to deal with those critical risks. Other researchers supported that notion such as Lemos et al., (2001), Roth and Espersen (2004) had stated that key risk management success to the performance success of formal risk management process starting with risk identification, planning, analysis, response, monitoring and control. A table constructed below to describe critical success factors of project risk management.

2.6 The relationship between project success and Project risk management implementation

This section of the chapter going to present the relationship between critical success factors of project risk management implementation and project success to fill the gap in this context. A gap in literature described by Alshibly et al. (2015) in the relationship between project risk management and project success had been mentioned earlier by Fewing(2005) stated that studies lack the relationship between project risk management and project success that recognized as one of the most important tool to ensure project success.

As risk management became an important role in project management Taherdoost and Keshavarzsaleh (2015), stressed out that it had been ignored by project managers. Rodrigues-da-Silva and Crispim (2014), stated that project risk management is a process consist of chain decision agents practices in which these decisions ensure project is operated within certain conditions such as time, cost, quality and other parameters etc.).As risk in construction project management perceived as a measure of probability and consequence of not achieving project goals, Toth and Sebestyan (2014) added that these project goals in construction project management would be in terms of time, cost and quality. Masromet al.(2015) posit that if the goal of the project is success, then the accepted objectives are the criteria to achieve the goal. Argument raised early by Atkinson on the incomplete definition of project success criteria where project management referred project success criteria to be in terms of cost, quality and time as pointed out by Masromet al.(2015). This notion interpreted early by Atkinson(1999) as biased definition of project success criteria would be source of repeated project failures.

Since construction projects as stated earlier, continue to fail to achieve its success criteria due to poor implementation of risk management practices concluded by Serpella, Ferrada, Howard, and Rubio (2014) so it’s necessary to define the project success criteria in the initial phase of the project where Hussein et al.(2015) stated that the importance of defining project success criteria will up front the project to manage it.

Chan et al. (2002) stated that the concept of project success criteria had been studied for long time but still there is no agreed definition in which Low and Chaun (2006) posit that project success criteria go further than cost, time and quality. Filling the gap of defining project success criteria stated by Serpellaet al.(2014); Albert et al.(2017) pointed out through assessment of clear project success criteria in order to measure performance.Other authors stated that defining success criteria of a project could be different depends on the type of the project as pointed out by Cserháti and Szabó, (2014); Müller and Turner, (2007); Shenhar and Dvir,(2007); Chang et al., (2013).

2.6.1 Project success criteria

Understanding project success criteria had many notions, starting from PMBOK, (2013, p.35) project success defined as a project is completed within scope, time, cost, quality, resources and risk approved between project management and senior management. Success Criteria by itself have a definition where it is defined Chan and Chan (2004) as" the set of Principles or standards by which favorable outcomes can be completed within a set specification.". This term had another definition in which Atkinson (1999) earlier describe it as project success measuring tool. Linking project success criteria to construction industry will be discussed in the following section.

2.6.2 Construction project success criteria

In literature, it revealed that there is no agreement on success criteria in construction projects as stated by Elattar (2009). , Silva et al.(2016) study had attempted to fill this gap by defining success criteria in construction as "The perceived degree of achievement of predetermined performance objectives and participants' expectations of the execution of a construction facility or a service". Their definition will be utilized in this study to identify success criteria in construction projects to find out the relation between critical success factors of project risk management implementation and project success in UAE construction industry. They pointed out that success criteria in construction went beyond the Iron triangle (Cost, time and Quality). Radujković and Sjekavica (2017) had argued that success criteria in construction need to be divided into two concepts and these are project success criteria and project management success criteria where it is a bit confusing. It is pointed out that project management success is according to complying with the creation process (Albert et al, 2017).

The awareness of differentiation between project success and project management success in which even failure of project management, project still can be successful (Rolstadås et al., 2014). Since reaching the time, cost and quality, project management can be considered as successful as pointed out by Albert et al.,(2017). Through reviewing Silva et al. (2016) study, project success included, client satisfaction, employee satisfaction, learning and development, profitability, cash-flow management and environmental performance along with project management success criteria.

Success criteria in construction had many categorizations in literature where some researchers such as (Brudney and England, 1982; De Wit, 1988; Pinto and Slevin, 1988: 1989; Smith, 1998; Belout, 1998; Atkinson, 1999; Crawford and Bryce, 2003 as cited in Takim and Adnan, 2008) mentioned construction project criteria could be divided in terms of efficiency and effectiveness. Time, cost and other specifications refers to project efficiency success criteria while project effectiveness success criteria can be referred to achievement of project objectives, user satisfaction and the use of the project according to Takim and Adnan(2008). Time and cost had characterized that no researchers argue about them to be most important criteria of success as mentioned by Chovichien and Nguyen, 2013; Al-Tmeemy, 2011; HeraviandIlbeigi, 2012; Khosravi and Afshri, 2011).Quality as a construction project success criteria had been stressed by Chan et al.(2002) as one of the most criteria important to client or project owner. On the other hand Savindo(1992) and Parrif and Savindo (1993) had stated safety issues being considered for long time. Recent study by Heravi and Ilbeigi (2012) stated that safety index as an executive project outcome. Also they had mentioned client satisfaction index as important project success criteria through surveys conducted in their study.

Cash-flow management as a success criteria stated by (Gunasekara, 2009; Kazaz et al., 2012; Gunathilika et al., 2013; Gudienea et al., 2013) as a critical aspect of financial success where this factor was mentioned many times in their study. Heravi and Ilbeigi (2012) supported that notion by billing performance index as important to project success.

2.7 Chapter summary

Project risk management is a tool to enhance project success where integration of it key processes helps in smoothness of its execution along project lifecycle through considering its critical success factors. In fact project risk management help organizations to establish and clarify its objectives in which these objectives identify project success criteria of the construction project. Once project success criteria are identified, project risk management can identify, analyze, classify, mitigate and control risks along project lifecycle in early manner so, it serve as an early warning tool to flag variances between actual and planned performance toward achieving project objectives. Thus project risk management critical success factors serve as the foundation of this research to examine the correlation between project success in UAE construction industry and project risk management practices implemented.

2.8 Conceptual framework

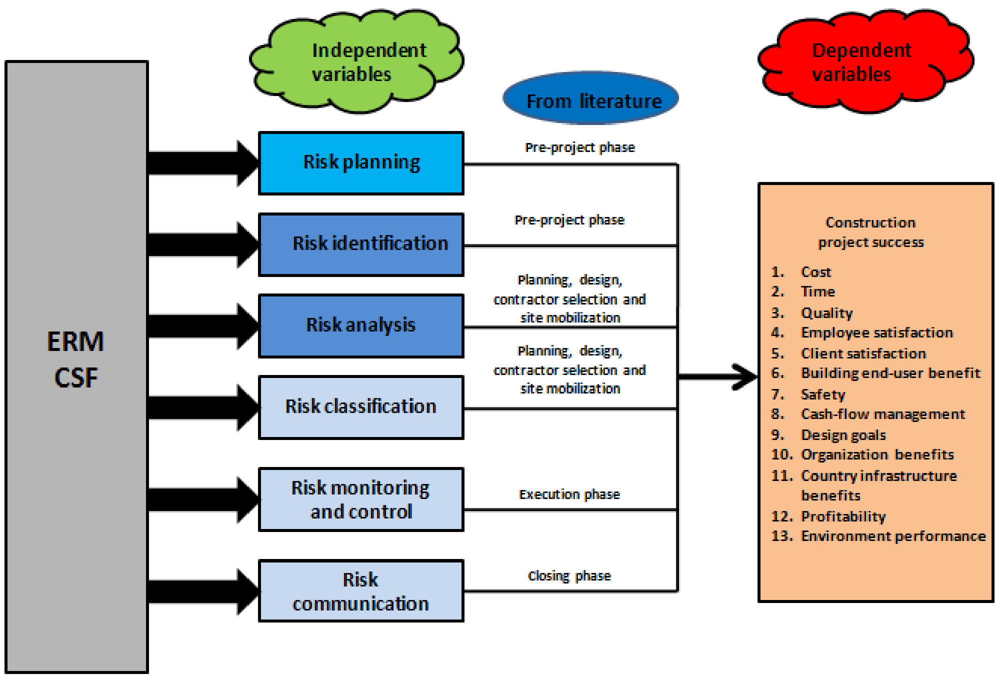

Figure 11: Conceptual framework

Source: Author

Chapter Three: Research Methodology

3.1 Introduction

This chapter of the study going to describe the research methodology utilized to conduct the research and achieve its objectives. Research methodology aim is to clarify the analysis of any subject where it provide a comprehensive hold on research subject as stated by Saunders et al.(2009). Early study by Bell (2005) and Brown (2006) brought the notion of the facilitating of research methodology in data collection method as well as how to analyze them in which it helps in achieving the aim and objectives of the research. Later in this chapter, it is going to describe the tools and techniques utilized where it includes the research philosophy, approach, strategy, choices and time horizon.

The aim of this research is to answer the question of how critical success factors of project risk management implementation would contribute in project success in UAE construction industry.

Since, the problem is identified in the first chapter, the research objectives defined. A research process flow-chart established to give the reader a brief on steps conducted to implement the research project. Sources of data collected explained in the research process flow-chart where a conceptual framework will be established to help in modeling the relationship between critical success factors of project risk management and project success in UAE construction industry as stated earlier.

3.2 Research process flow-chart

To have an overall idea about this research a diagram below constructed to demonstrate the steps of this research process and main steps that is taken to accomplish this study. Each step will be described in the sketch to ease the notion of each step conducted in this research endeavor.

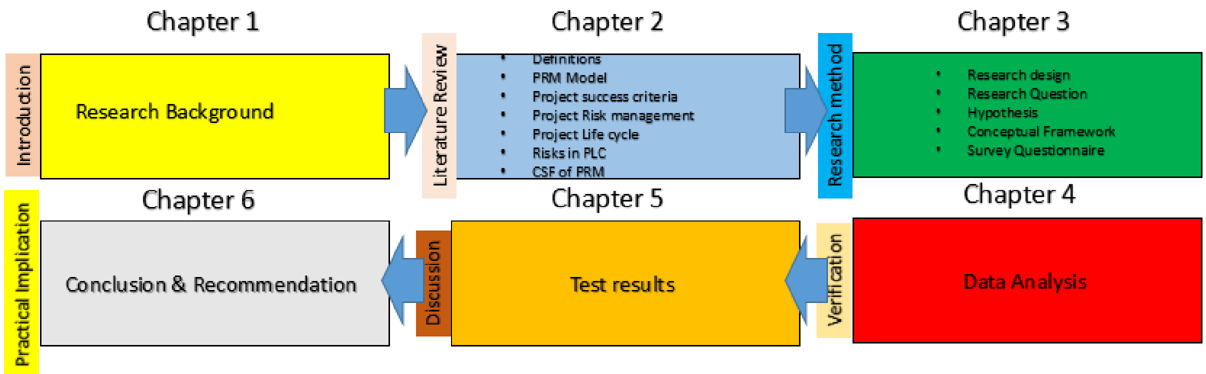

Figure 12: Research Process

Source: Author

3.3 Research design

This research design based on adoption of Saunders et al. (2009) concept which is Research Onion. Describing the process of this concept, it goes through layers. Each layer constitute a series of decisions until it formulate the design and data collection. Below diagram state the Research onion concept derived from Saunders et al.(2009).

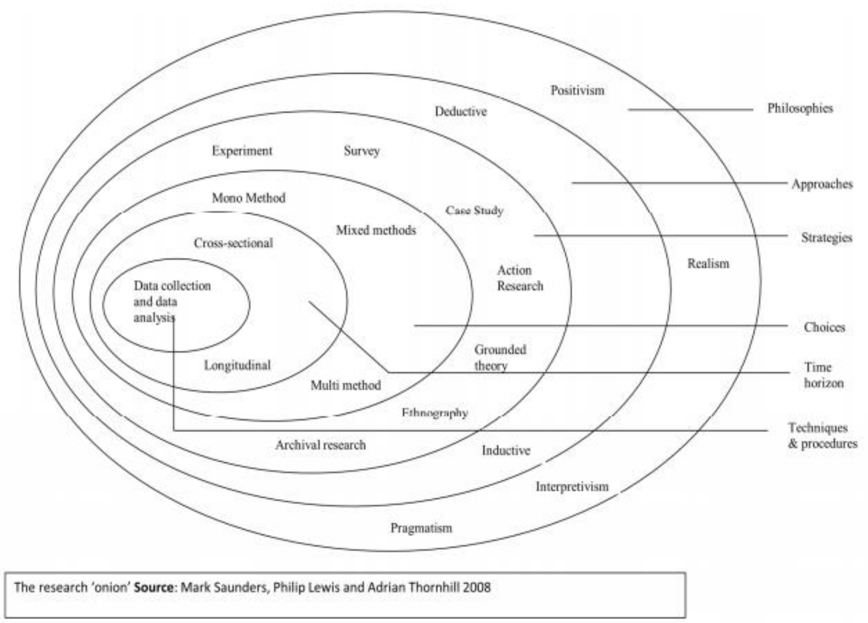

Figure 13: Research Onion concept

Source: Saunders et al.,(2009)

3.4 Description of Research Onion concept

Research Philosophy, the philosophy of the research is based on how you view the world with some assumptions where research strategy adopted is based on these assumptions as stated by (Saunders et al. 2009). The nature of this research philosophy is based on Positivism where it is based on principles that researcher opinions and believes does not matter but information used should be scientifically proved and based on findings as stated by Hellbone and Priest (2009). Since this research depends on survey based to collect data from several types of construction projects in UAE, it is related to Positivism.

Research Approach, (Saunders et al. 2009) had described research approach consist of two types of approach and these are inductive and deductive approaches where the deductive approach helps in developing a theory and hypotheses and design research strategy to test these hypothesis. On the other hand, the Inductive approach it will collect data and generate theory. In this research, deductive approach will be adopted since hypothesis will be formulated and tested. To justify the selection of deductive approach in this research, a number of critical success factors of project risk management, different construction project lifecycles and project success criteria in construction studied. Each part of these studies constitute theories where they will be tested through building hypothesis to find the relationships between them. The outcome of hypothesis will ease the establishment of a framework to relate critical success factors of project risk management implementation to project success in UAE construction industry.

Research Strategy, (Saunders et al. 2009) had defined research strategy as the road map to reach the research goal and answer the research question. Some of these research strategies listed as the following, experiments, surveys, case studies, action researches, ethnography, archival research and grounded theory. In this research, it is going to adopt the survey strategy where Wimmer and Dominik (2006) described survey strategy can be divided into questionnaire and interviews. To justify the selection of this strategy, because it is easy to apply. Sapsford (2007) stated earlier that survey can present a sample of a population in which where grouping and comparison can be conducted. According to Fowler (2008), survey can enhance a more depth of data collection for conducting a comparison and numerical analysis and explanation of research topic.

Research choice of method, according to Saunders et al. (2009), there three main methods to select and these are Mono method in which single data collection technique is used, or use more than one data collection technique and data analysis procedure Multiple method and Mixed method which is based on qualitative and quantitative methods for data collection techniques and analysis procedures. The research method chosen is the mixed method where it include both qualitative and quantitative methods. To justify the selection of research choice of method, this research relied on collecting secondary data from literature review regarding to critical success factors of project risk management implementation, different in construction project lifecycles and project success criteria in construction. On the other hand to develop hypothesis and testing it, quantitative method used to collect numerical data for analysis through questionnaire.

Time Horizons, Research time horizon described by Saunders et al.(2009) divided into two types and these longitudinal and cross-sectional time frames. According to Yin (1998), cross-sectional would answer research questions to existing problems in a fixed timeframe. To justify this selection, this research is an attempt to find out the actual critical success factors of implementing project risk management and its contribution to project success.

Technique and procedures, (Saunders et al., 2009) had stated that data collection and its analysis is the inner most layer of the research onion where the researcher should ensure no bias in the data collected where the data analysis is done against the framework since this process called the interpretation of data. Also (Saunders et al., 2009) added that deductive approach related to data as working from theory to data where hypothesis derived from theory. Data analysis techniques could be in the form of descriptive statistics, Normality test, Outlier test, Reliability test and finally Hypothesis testing-Using correlation analysis and Chi-Square test and Multi Regression analysis. In this research the data analysis will be based on Hypothesis testing since it is a deductive approach.

3.5 Research questions and conceptual framework

According to literature review, this research had identified the gap of project risk management implementation critical success factors relationship and project success in construction projects in UAE. Hence the aim of this research to fill this gap and achieve research objectives, the following research questions and framework will be utilized.

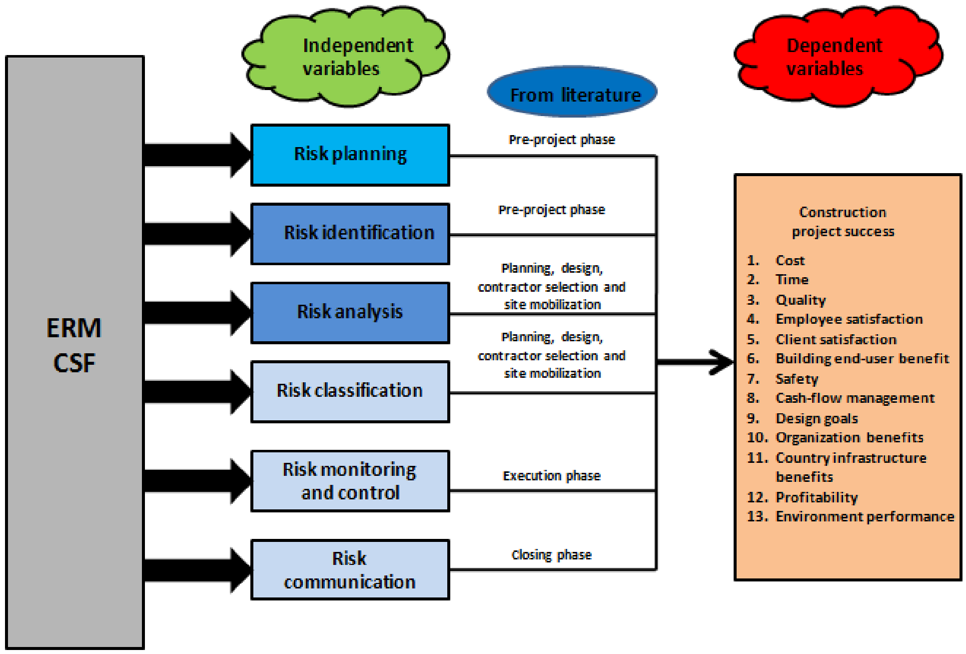

Figure 14: Conceptual framework

Source: Author

In the light of research objectives, Creswell (2013) stated that hypothesis emphasize and help in finding relationships between variables in which purpose of the study can be achieved. In order to clarify the relationships between research objectives the following research questions established with their hypothesis:-

RQ1:- What are the effects of Enterprise risk management critical success factors implementation in project risk management processes along project lifecycle?

H0: There is no positive correlation of Enterprise Risk management critical success factors on establishing of risk plan in pre-project phase

H1: There is no positive correlation of Enterprise Risk management critical success factors on risk identification in pre-project phase

H2: There is no positive correlation of Enterprise Risk management critical success factors on risk analysis in planning and design phase and contractor selection and site mobilization phases

H3: There is no positive correlation of Enterprise Risk management critical success factors on risk classification in planning and design phase and contractor selection and site mobilization phases

H4: There is no positive correlation of Enterprise Risk management critical success factors on risk monitoring in execution phase

H5: There is no positive correlation of Enterprise Risk management critical success factors on risk controlling in execution phase

H6: There is no positive correlation of Enterprise Risk management critical success factors on risk communication in closing phase

RQ2: What are the impacts of project risk management processes on construction project success criteria? The following hypothesis drawn to find out the relationships between project risk management processes and construction project success criteria:

H0: There is no positive correlation of project risk management processes on construction project success

Chapter Four: Data collection and analysis

4.0 Introduction

The collection, presentation and addressing data is highly essential part in a research where it constitute a fundamental outcome of the research and helps in clarifying and explaining the research topic. Collection of data is highly vital to the process of the research where it consist of two types of data sources and these are primary and secondary data sources.

4.1 Primary Data

Primary data in this research described as data obtained from its original state and derived by the researcher. Therefore, it means that this type of data was not available or exist where efforts by the researcher spent to generate this data. Several methods for collecting primary data, according to Singh and Mangat (2013) stated that methods employed to collect primary data include case studies, surveys, observations, questionnaires and interviews. This research utilized questionnaires and distributed to construction project managers and other professionals in UAE to collect primary data on actual project risk management practices. Hence primary data helps in accumulating quantitative data in which it provide answers to research questions as pointed out by Freise (2012).

Describing the questionnaire built and used in this study, it consist of three sections. The first section attempt to collect data on general information of respondents such as age, time spent on projects, duration of projects and gender. The second section of the questionnaire attempt to collect data to rank the importance of project risk management implementation critical success factors along construction project lifecycle and its stages. The third section of the questionnaire attempt to find the correlation between project risk management processes and construction project success.

4.2 Secondary Data

Secondary data described in this research as those data collected from other researchers works as pointed out by Gufrery and Loewy (2010). Data collected through secondary resources could in the form of journals, internet sources, literatures, magazines, bibliography ,social networks and blogs as stated by Saunders et al.,(2009).

Describing the secondary data used in this research, literature review and several thesis of other researchers about Enterprise risk management, project risk management, critical success factors and practices had been reviewed to build the conceptual framework of this study that serve as the basis of research topic and questions and hypothesis to examine the correlation of project risk management implementation critical success factors on construction project success.

4.3 Data analysis

One of the most critical and important phases of research is the data analysis where it access primary and secondary data collected that aide the researcher to generate some effective results as pointed out by Gast and Ledford (2009).

Since Myer (2009) and Silverman (2005) stated that there is no particular data analysis method and approach is better than the other especially when it comes to select a computer aided software to analyze data. Social Science Software (SPSS) was utilized in this research through illative statistics such as (T-test, Pearson correlation and ANOVA). The reason behind using this software thus it helps in presenting different outputs through same data where it is possible to carry out different tests on the same data and compare results that help guarantee the reliability and generalize the research.

Below a description of steps conducted in this research to analyze data through using SPSS.

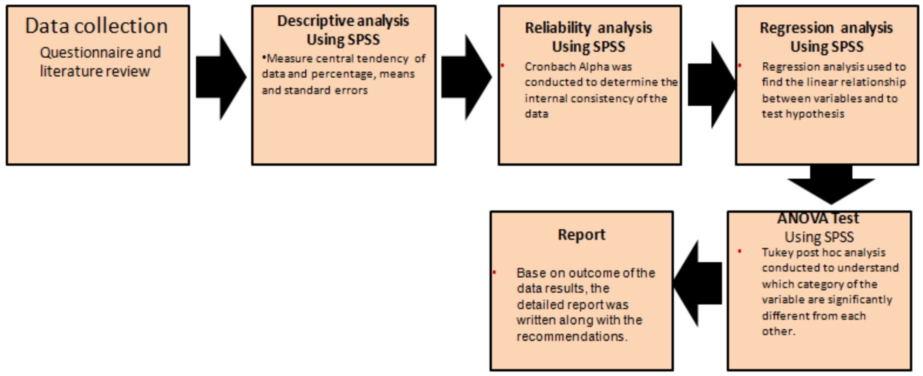

Figure 15: Analysis steps description

Source: Author

4.4 Descriptive analysis

Through conducting the descriptive analysis through using SPSS, a number of results generated according to respondents general information. Below results presented with some information generated to describe the nature of respondents.

Statistics

		Age	Gender	ProjectDuration	Experience	ProjectPercent
N	Valid	39	39	39	39	39
	Missing	0	0	0	0	0

Table 4: Number of respondents
Source: SPSS

From this table, the total number of respondents are 39 personal where mainly 20 respondent where construction project managers and the rest construction team leaders.

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25-34	6	15.4	15.4	15.4
	35-44	17	43.6	43.6	59.0
	45-54	12	30.8	30.8	89.7
	above 54	4	10.3	10.3	100.0
	Total	39	100.0	100.0	

Table 5: Age of respondents

Source: SPSS

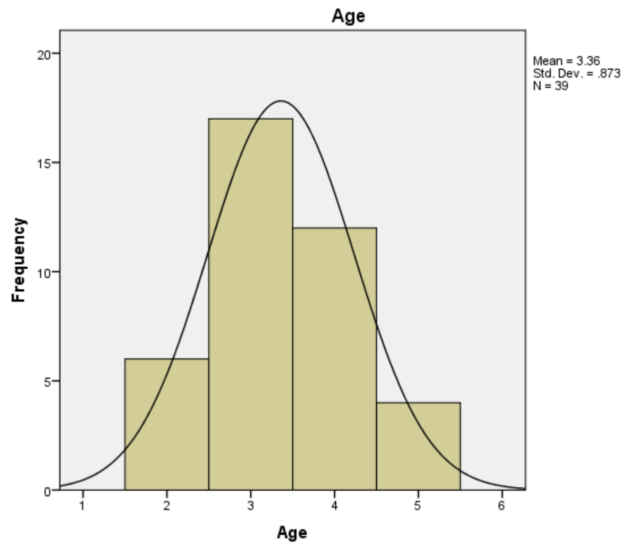

Figure 16: Age of respondents
Source: SPSS

From the table above, we can conclude that the majority of respondents where between 35 and 44 years old then second ranked age from 45 to54. Least ranked category of respondent where 55 years or older.

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	30	76.9	76.9	76.9
	female	9	23.1	23.1	100.0
	Total	39	100.0	100.0	

Table 6: Gender of respondent

Source: SPSS

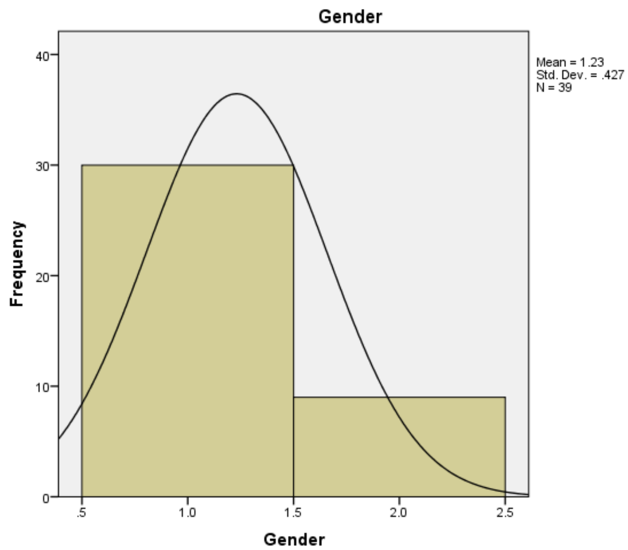

Figure 17: Gender of respondent
Source: SPSS

From the above table, it can be concluded that majority of gender type working in construction projects in UAE are males, mainly construction project managers where 30 project managers where males and 9 project managers where female mainly working in fit-out projects.

ProjectDuration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 2 years	12	30.8	30.8	30.8
	2 to 5 years	24	61.5	61.5	92.3
	above 5 years	3	7.7	7.7	100.0
	Total	39	100.0	100.0	

Table 7: Project duration

Source: SPSS

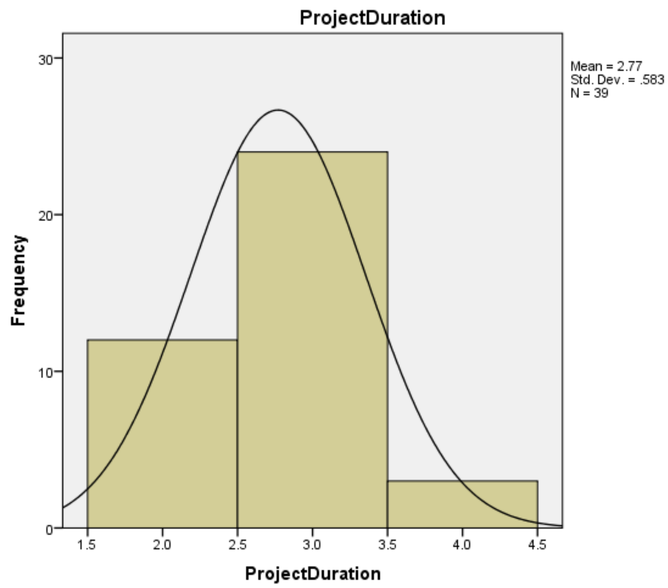

Figure 18: Project duration
Source: SPSS

According to respondents, the majority of construction projects in UAE time span from 2 to 5 years where secondly ranked from 1 to 2 years.

Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	project manager	20	51.3	51.3	51.3
	team lead	14	35.9	35.9	87.2
	team member	5	12.8	12.8	100.0
	Total	39	100.0	100.0	

Table 8: Roles and experience of respondents

Source: SPSS

Figure 19: Roles and experience of respondents

Source: SPSS

From the above table and figure, it state that 20 respondents where construction project managers where directors are included as project managers in some construction projects while the rest 19 respondents where team leaders that include construction managers and project engineers while 5 respondents where team members such as procurement officers, HR officers, site supervisors and site engineers.

ProjectPercent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 25 percent	2	5.1	5.1	5.1
	25 to 50 percent	6	15.4	15.4	20.5
	50 to 75 percent	6	15.4	15.4	35.9
	above 75 percent	25	64.1	64.1	100.0
	Total	39	100.0	100.0	

Table 9: Time spent on projects
Source: SPSS

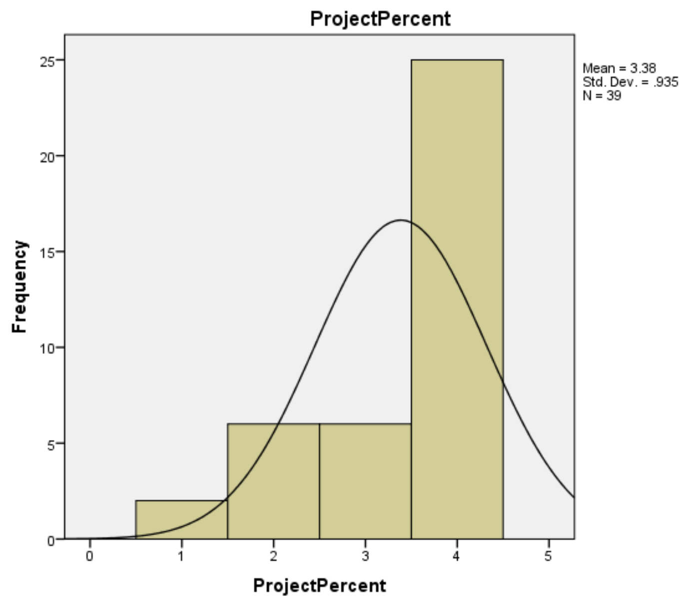

Figure 20: Time spent on projects
Source: SPSS

From the above table and figure, 25 respondents where spending more than 75 percent of their time on projects they work in 6 respondents used manage more than one project mainly project directors where they used to spend 50 to 75 percent of their time. Also, results reveal that 6 respondents used to work in different projects and spend 25 to 50 percent of their time where they are procurement and HR officers mainly they are team members.

4.5 Reliability analysis

Through using SPSS software, the internal consistency of questions in a questionnaire had been tested through reliability T-test analysis where Cronbach alpha shows a marginal rating of consistency between 0.675 and 0.730 which is highly efficient for each question in the questionnaire. Below are results presented for internal consistency for each set of questions for Independent variables.

The below tables for ranking CSF in risk identification process for pre-project phase:

Reliability Statistics

Cronbach's Alpha	N of Items
.675	9

Item Statistics

	Mean	Std. Deviation	N
Identification_PrePhase1	4.74	.442	39
Identification_PrePhase2	4.31	.614	39
Identification_PrePhase3	4.21	.656	39
Identification_PrePhase4	3.56	.821	39
Identification_PrePhase5	3.26	1.141	39
Identification_PrePhase6	3.18	1.167	39
Identification_PrePhase7	3.38	1.350	39
Identification_PrePhase8	3.44	1.046	39
Identification_PrePhase9	3.46	1.253	39

Table 10: T-test for Pre Project phase questions reliability

Source : SPSS

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Identification_PrePhase1	28.79	22.273	-.101	.700
Identification_PrePhase2	29.23	22.761	-.187	.719
Identification_PrePhase3	29.33	19.965	.281	.662
Identification_PrePhase4	29.97	17.920	.497	.623
Identification_PrePhase5	30.28	17.629	.325	.655
Identification_PrePhase6	30.36	14.868	.646	.569
Identification_PrePhase7	30.15	14.923	.508	.606
Identification_PrePhase8	30.10	17.673	.373	.643
Identification_PrePhase9	30.08	15.126	.549	.595

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
33.54	22.045	4.695	9

The below tables for ranking CSF in risk planning process for pre-project phase:

Reliability Statistics

Cronbach's Alpha	N of Items
.542	9

Item Statistics

	Mean	Std. Deviation	N
Planning_PrePhase1	4.44	.718	39
Planning_PrePhase2	4.26	.880	39
Planning_PrePhase3	3.87	.951	39
Planning_PrePhase4	3.67	.955	39
Planning_PrePhase5	3.46	1.144	39
Planning_PrePhase6	3.26	1.229	39
Planning_PrePhase7	3.26	1.352	39
Planning_PrePhase8	3.54	.913	39
Planning_PrePhase9	3.44	1.165	39

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Planning_PrePhase1	28.74	19.248	-.089	.583
Planning_PrePhase2	28.92	17.757	.091	.553
Planning_PrePhase3	29.31	18.219	.010	.576
Planning_PrePhase4	29.51	15.046	.438	.457
Planning_PrePhase5	29.72	13.629	.505	.419
Planning_PrePhase6	29.92	15.810	.193	.533
Planning_PrePhase7	29.92	14.704	.258	.512
Planning_PrePhase8	29.64	15.815	.352	.484
Planning_PrePhase9	29.74	14.143	.423	.449

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
33.18	19.204	4.382	9

Table 11: T-test for Pre Project phase questions reliability

Source : SPSS

The below tables for ranking CSF in risk analysis process for planning, design, contractor selection and site mobilization phases:

Reliability Statistics

Cronbach's Alpha	N of Items
.730	9

Item Statistics

	Mean	Std. Deviation	N
Analysis_PDS1	4.03	1.088	39
Analysis_PDS2	3.67	1.108	39
Analysis_PDS3	3.59	.751	39
Analysis_PDS4	3.85	.904	39
Analysis_PDS5	3.95	1.050	39
Analysis_PDS6	3.36	1.328	39
Analysis_PDS7	3.69	1.151	39
Analysis_PDS8	3.15	1.040	39
Analysis_PDS9	3.44	1.334	39

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Analysis_PDS1	28.69	27.219	.219	.737
Analysis_PDS2	29.05	26.892	.241	.734
Analysis_PDS3	29.13	26.799	.454	.705
Analysis_PDS4	28.87	26.220	.416	.706
Analysis_PDS5	28.77	25.866	.367	.713
Analysis_PDS6	29.36	23.026	.479	.692
Analysis_PDS7	29.03	23.289	.565	.676
Analysis_PDS8	29.56	25.094	.453	.698
Analysis_PDS9	29.28	22.682	.506	.686

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
32.72	30.892	5.558	9

Table 12: T-test for Planning to site mobilization phases questions reliability

Source : SPSS

The below tables for ranking CSF in risk classification process for planning, design, contractor selection and site mobilization phases:

Reliability Statistics

Cronbach's Alpha	N of Items
.655	9

Item Statistics

	Mean	Std. Deviation	N
Classification_PDS1	4.08	.957	39
Classification_PDS2	3.54	1.120	39
Classification_PDS3	3.72	1.075	39
Classification_PDS4	3.72	1.213	39
Classification_PDS5	3.62	1.330	39
Classification_PDS6	3.62	1.115	39
Classification_PDS7	4.05	1.050	39
Classification_PDS8	3.67	.838	39
Classification_PDS9	3.54	1.211	39

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Classification_PDS1	29.46	22.887	.297	.635
Classification_PDS2	30.00	19.895	.537	.579
Classification_PDS3	29.82	21.362	.403	.612
Classification_PDS4	29.82	20.099	.455	.597
Classification_PDS5	29.92	19.915	.407	.609
Classification_PDS6	29.92	23.231	.190	.659
Classification_PDS7	29.49	24.730	.066	.682
Classification_PDS8	29.87	24.588	.148	.661
Classification_PDS9	30.00	20.000	.467	.594

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
33.54	26.518	5.150	9

Table 13: T-test for Planning to site mobilization phases questions reliability

Source : SPSS

The below tables for ranking CSF in risk monitoring process for execution phase:

Reliability Statistics

Cronbach's Alpha	N of Items
.667	9

Item Statistics

	Mean	Std. Deviation	N
Monitoring_Execution1	3.92	1.222	39
Monitoring_Execution2	3.51	1.315	39
Monitoring_Execution3	3.46	1.047	39
Monitoring_Execution4	3.87	1.281	39
Monitoring_Execution5	3.44	1.373	39
Monitoring_Execution6	3.62	1.330	39
Monitoring_Execution7	3.56	1.188	39
Monitoring_Execution8	3.51	1.048	39
Monitoring_Execution9	3.51	1.254	39

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Monitoring_Execution1	28.49	29.362	.208	.668
Monitoring_Execution2	28.90	25.463	.484	.606
Monitoring_Execution3	28.95	27.313	.476	.616
Monitoring_Execution4	28.54	30.360	.114	.689
Monitoring_Execution5	28.97	26.552	.366	.634
Monitoring_Execution6	28.79	26.904	.358	.636
Monitoring_Execution7	28.85	26.660	.452	.616
Monitoring_Execution8	28.90	28.779	.333	.643
Monitoring_Execution9	28.90	27.621	.336	.641

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
32.41	33.617	5.798	9

Table 14: T-test for execution phase questions reliability
Source : SPSS

The below tables for ranking CSF in risk controlling process for execution phase:

Reliability Statistics

Cronbach's Alpha	N of Items
.770	9

Item Statistics

	Mean	Std. Deviation	N
Controlling_Execution1	3.77	1.266	39
Controlling_Execution2	3.36	1.181	39
Controlling_Execution3	3.51	1.167	39
Controlling_Execution4	3.92	.900	39
Controlling_Execution5	3.95	1.123	39
Controlling_Execution6	3.79	1.031	39
Controlling_Execution7	3.67	1.243	39
Controlling_Execution8	3.31	1.239	39
Controlling_Execution9	3.31	1.301	39

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Controlling_Execution1	28.82	29.099	.595	.724
Controlling_Execution2	29.23	31.393	.457	.747
Controlling_Execution3	29.08	31.810	.430	.751
Controlling_Execution4	28.67	35.123	.271	.770
Controlling_Execution5	28.64	32.131	.427	.752
Controlling_Execution6	28.79	33.325	.373	.759
Controlling_Execution7	28.92	29.126	.608	.722
Controlling_Execution8	29.28	30.945	.461	.747
Controlling_Execution9	29.28	31.103	.416	.754

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
32.59	38.827	6.231	9

Table 15: T-test for execution phase questions reliability
Source : SPSS

The below tables for ranking CSF in risk communication process for closing phase:

Reliability Statistics

Cronbach's Alpha	N of Items
.748	9

Item Statistics

	Mean	Std. Deviation	N
Communication_Closing1	3.28	1.486	39
Communication_Closing2	3.21	1.196	39
Communication_Closing3	3.15	1.040	39
Communication_Closing4	3.77	.959	39
Communication_Closing5	4.15	.844	39
Communication_Closing6	3.54	1.120	39
Communication_Closing7	3.74	1.251	39
Communication_Closing8	3.51	1.254	39
Communication_Closing9	3.41	1.371	39

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Communication_Closing1	28.49	28.256	.455	.722
Communication_Closing2	28.56	29.252	.539	.706
Communication_Closing3	28.62	32.243	.367	.734
Communication_Closing4	28.00	36.105	.055	.772
Communication_Closing5	27.62	33.243	.380	.733
Communication_Closing6	28.23	31.130	.422	.726
Communication_Closing7	28.03	31.184	.351	.738
Communication_Closing8	28.26	28.038	.606	.692
Communication_Closing9	28.36	26.762	.635	.684

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
31.77	37.656	6.136	9

Table 16: T-test for closing phase questions reliability
Source : SPSS

The below tables reveal that there was a strong internal consistency for the set of questions for the dependent variables where consistency ranked to be 0.751 for all the questions.

Reliability Statistics

Cronbach's Alpha	N of Items
.751	13

Item Statistics

	Mean	Std. Deviation	N
PRM_CostSuccess	4.33	.838	39
PRM_TimeSuccess	4.08	.900	39
PRM_QualitySuccess	3.56	1.142	39
PRM_ClientSatSuccess	3.46	.996	39
PRM_EmployeeSatSuccess	3.08	.957	39
PRM_EndUserSatSuccess	3.15	1.040	39
PRM_SafetySuccess	3.51	1.189	39
PRM_CashMgtSuccess	3.33	.838	39
PRM_DesignSuccess	3.82	.854	39
PRM_OrgBenifitSuccess	3.41	1.044	39
PRM_CtryInfrasSuccess	3.23	1.245	39
PRM_ProfitSuccess	3.28	.999	39
PRM_EnvionmentSuccess	3.72	.944	39

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PRM_CostSuccess	41.64	40.499	.171	.755
PRM_TimeSuccess	41.90	38.884	.297	.744
PRM_QualitySuccess	42.41	34.722	.520	.718
PRM_ClientSatSuccess	42.51	35.993	.505	.721
PRM_EmployeeSatSuccess	42.90	36.516	.484	.724
PRM_EndUserSatSuccess	42.82	36.572	.427	.730
PRM_SafetySuccess	42.46	35.887	.402	.733
PRM_CashMgtSuccess	42.64	38.973	.320	.742
PRM_DesignSuccess	42.15	37.397	.469	.728
PRM_OrgBenifitSuccess	42.56	37.884	.315	.743
PRM_CtryInfrasSuccess	42.74	35.406	.410	.733

PRM_ProfitSuccess	42.69	39.534	.199	.755
PRM_EnvionmentSuccess	42.26	38.196	.337	.740

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
45.97	43.026	6.559	13

Table 17: T-test for PRM Process and construction project success
Source : SPSS

4.6 Regression analysis

The purpose of the regression analysis is to find out the nature of the relationship between the variables and to test the hypothesis. The analysis is split into two parts where the first one is the test of the independent variables through ranking PRM CSF along the construction project lifecycle. The second regression analysis will test the hypothesis drawn to find out the correlation between the implementation project risk management and construction project success where they are grouped as the dependent variables.

4.6.1 Independent variables regression analysis

After conducting the regression analysis using SPSS, R 0.92 square values state that there is a strong linear relationship between the global independent variables and global dependent variables. Below results of the regression analysis between independent variables and dependent variables.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.341[a]	.116	.092	6.24894

a. Predictors: (Constant), Global_IV

Table 18: Summary of global independent variable regression analysis
Source: SPSS

4.6.2 Correlation test analysis for independent variables

As ranking of PRM CSFs highly important along construction project lifecycle, correlation test analysis is a significant tool where this tool designed to measure the strength between variables. The results of this analysis by using SPSS software presented in the following tables.

Correlations

		IdentificationFactor	PlanningFactor	AnalysisFactor	ClassificationFactor	MonitoringFactor	ControllingFactor	CommunicationFactor	Global_DV
IdentificationFactor	Pearson Correlation	1	.654**	.561**	.460**	.415**	.601**	.468**	.253
	Sig. (2-tailed)		.000	.000	.003	.009	.000	.003	.120
	N	39	39	39	39	39	39	39	39
PlanningFactor	Pearson Correlation	.654**	1	.554**	.400*	.558**	.587**	.237	.183
	Sig. (2-tailed)	.000		.000	.012	.000	.000	.146	.264
	N	39	39	39	39	39	39	39	39
AnalysisFactor	Pearson Correlation	.561**	.554**	1	.498**	.512**	.664**	.532**	.352*
	Sig. (2-tailed)	.000	.000		.001	.001	.000	.000	.028
	N	39	39	39	39	39	39	39	39
ClassificationFactor	Pearson Correlation	.460**	.400*	.498**	1	.575**	.752**	.460**	.365*
	Sig. (2-tailed)	.003	.012	.001		.000	.000	.003	.022

	N	39	39	39	39	39	39	39	39
MonitoringFactor	Pearson Correlation	.415**	.558**	.512**	.575**	1	.728**	.455**	.231
	Sig. (2-tailed)	.009	.000	.001	.000		.000	.004	.156
	N	39	39	39	39	39	39	39	39
ControllingFactor	Pearson Correlation	.601**	.587**	.664**	.752**	.728**	1	.656**	.200
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.222
	N	39	39	39	39	39	39	39	39
CommunicationFactor	Pearson Correlation	.468**	.237	.532**	.460**	.455**	.656**	1	.278
	Sig. (2-tailed)	.003	.146	.000	.003	.004	.000		.087
	N	39	39	39	39	39	39	39	39
Global_DV	Pearson Correlation	.253	.183	.352*	.365*	.231	.200	.278	1
	Sig. (2-tailed)	.120	.264	.028	.022	.156	.222	.087	
	N	39	39	39	39	39	39	39	39

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

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

Correlations

Control Variables			Planning_PrePhase1	Planning_PrePhase2	Planning_PrePhase3	Planning_PrePhase4	Planning_PrePhase5	Planning_PrePhase6	Planning_PrePhase7	Planning_PrePhase8	Planning_PrePhase9
PlanningFactor	Planning_PrePhase1	Correlation	1.000	.049	.029	-.363	-.241	-.118	.070	.088	-.361
		Significance (2-tailed)	.	.770	.861	.025	.145	.482	.678	.598	.026
		df	0	36	36	36	36	36	36	36	36
	Planning_PrePhase2	Correlation	.049	1.000	.209	-.092	-.195	-.170	-.479	.442	-.497
		Significance (2-tailed)	.770	.	.207	.583	.242	.308	.002	.005	.002
		df	36	0	36	36	36	36	36	36	36
	Planning_PrePhase3	Correlation	.029	.209	1.000	.060	-.175	-.475	-.339	-.266	.100
		Significance (2-tailed)	.861	.207	.	.722	.293	.003	.037	.107	.551
		df	36	36	0	36	36	36	36	36	36

Planning_PrePhase4	Correlation	-.363	-.092	.060	1.000	.114	-.189	-.319	-.116	.098
	Significance (2-tailed)	.025	.583	.722	.	.496	.256	.051	.489	.558
	df	36	36	36	0	36	36	36	36	36
Planning_PrePhase5	Correlation	-.241	-.195	-.175	.114	1.000	-.038	-.087	-.452	.080
	Significance (2-tailed)	.145	.242	.293	.496	.	.820	.602	.004	.631
	df	36	36	36	36	0	36	36	36	36
Planning_PrePhase6	Correlation	-.118	-.170	-.475	-.189	-.038	1.000	-.040	.073	-.290
	Significance (2-tailed)	.482	.308	.003	.256	.820	.	.810	.662	.077
	df	36	36	36	36	36	0	36	36	36
Planning_PrePhase7	Correlation	.070	-.479	-.339	-.319	-.087	-.040	1.000	-.255	.090
	Significance (2-tailed)	.678	.002	.037	.051	.602	.810	.	.122	.590

	df	36	36	36	36	36	36	0	36	36
Planning_PrePhase8	Correlation	.088	.442	-.266	-.116	-.452	.073	-.255	1.000	-.320
	Significance (2-tailed)	.598	.005	.107	.489	.004	.662	.122	.	.050
	df	36	36	36	36	36	36	36	0	36
Planning_PrePhase9	Correlation	-.361	-.497	.100	.098	.080	-.290	.090	-.320	1.000
	Significance (2-tailed)	.026	.002	.551	.558	.631	.077	.590	.050	.
	df	36	36	36	36	36	36	36	36	0

Correlations

Control Variables			Analysis_PDS1	Analysis_PDS2	Analysis_PDS3	Analysis_PDS4	Analysis_PDS5	Analysis_PDS6	Analysis_PDS7	Analysis_PDS8	Analysis_PDS9
AnalysisFactor	Analysis_PDS1	Correlation	1.000	.145	-.066	-.002	-.210	-.229	-.161	-.203	-.385
		Significance (2-tailed)	.	.384	.696	.992	.206	.166	.334	.221	.017
		df	0	36	36	36	36	36	36	36	36
	Analysis_PDS	Correlation	.145	1.000	.008	-.202	-.309	-.282	.021	-.410	-.117

2	Significance (2-tailed)	.384	.	.964	.225	.059	.086	.902	.011	.485
	df	36	0	36	36	36	36	36	36	36
Analysis_PDS 3	Correlation	-.066	.008	1.000	.038	-.548	-.128	-.292	.283	.029
	Significance (2-tailed)	.696	.964	.	.822	.000	.444	.075	.085	.865
	df	36	36	0	36	36	36	36	36	36
Analysis_PDS 4	Correlation	-.002	-.202	.038	1.000	-.025	-.142	-.334	-.237	.062
	Significance (2-tailed)	.992	.225	.822	.	.880	.396	.041	.153	.713
	df	36	36	36	0	36	36	36	36	36
Analysis_PDS 5	Correlation	-.210	-.309	-.548	-.025	1.000	.163	.056	.012	-.238
	Significance (2-tailed)	.206	.059	.000	.880	.	.328	.739	.942	.151
	df	36	36	36	36	0	36	36	36	36
Analysis_PDS 6	Correlation	-.229	-.282	-.128	-.142	.163	1.000	-.068	-.267	-.177
	Significance (2-tailed)	.166	.086	.444	.396	.328	.	.687	.105	.287
	df	36	36	36	36	36	0	36	36	36
Analysis_PDS	Correlation	-.161	.021	-.292	-.334	.056	-.068	1.000	-.001	-.233

	7	Significance (2-tailed)	.334	.902	.075	.041	.739	.687	.	.993	.159
		df	36	36	36	36	36	36	0	36	36
	Analysis_PDS8	Correlation	-.203	-.410	.283	-.237	.012	-.267	-.001	1.000	.040
		Significance (2-tailed)	.221	.011	.085	.153	.942	.105	.993	.	.811
		df	36	36	36	36	36	36	36	0	36
	Analysis_PDS9	Correlation	-.385	-.117	.029	.062	-.238	-.177	-.233	.040	1.000
		Significance (2-tailed)	.017	.485	.865	.713	.151	.287	.159	.811	.
		df	36	36	36	36	36	36	36	36	0

Correlations

Control Variables			Classification_PDS1	Classification_PDS2	Classification_PDS3	Classification_PDS4	Classification_PDS5	Classification_PDS6	Classification_PDS7	Classification_PDS8	Classification_PDS9
ClassificationFactor	Classification_PDS1	Correlation	1.000	.286	.020	-.198	-.044	.054	-.394	-.283	-.321
		Significance (2-tailed)	.	.082	.906	.233	.795	.749	.014	.085	.050
		df	0	36	36	36	36	36	36	36	36
	Classification_PDS2	Correlation	.286	1.000	-.178	-.388	.075	-.211	-.516	.023	.109

	Significance (2-tailed)	.082	.	.285	.016	.656	.204	.001	.891	.514
	df	36	0	36	36	36	36	36	36	36
Classification_PDS3	Correlation	.020	-.178	1.000	.192	-.373	-.072	-.117	.052	-.421
	Significance (2-tailed)	.906	.285	.	.248	.021	.668	.484	.758	.009
	df	36	36	0	36	36	36	36	36	36
Classification_PDS4	Correlation	-.198	-.388	.192	1.000	.056	-.274	-.155	-.179	-.110
	Significance (2-tailed)	.233	.016	.248	.	.739	.096	.352	.282	.512
	df	36	36	36	0	36	36	36	36	36
Classification_PDS5	Correlation	-.044	.075	-.373	.056	1.000	-.302	-.195	-.185	-.158
	Significance (2-tailed)	.795	.656	.021	.739	.	.066	.240	.267	.344
	df	36	36	36	36	0	36	36	36	36

Classification_PDS6	Correlation	.054	-.211	-.072	-.274	-.302	1.000	.180	-.427	-.107
	Significance (2-tailed)	.749	.204	.668	.096	.066	.	.280	.007	.522
	df	36	36	36	36	36	0	36	36	36
Classification_PDS7	Correlation	-.394	-.516	-.117	-.155	-.195	.180	1.000	.096	-.066
	Significance (2-tailed)	.014	.001	.484	.352	.240	.280	.	.567	.696
	df	36	36	36	36	36	36	0	36	36
Classification_PDS8	Correlation	-.283	.023	.052	-.179	-.185	-.427	.096	1.000	.088
	Significance (2-tailed)	.085	.891	.758	.282	.267	.007	.567	.	.600
	df	36	36	36	36	36	36	36	0	36
Classification_PDS9	Correlation	-.321	.109	-.421	-.110	-.158	-.107	-.066	.088	1.000
	Significance (2-tailed)	.050	.514	.009	.512	.344	.522	.696	.600	.

		df	36	36	36	36	36	36	36	36	0

Correlations

Control Variables			Monitoring_Execution1	Monitoring_Execution2	Monitoring_Execution3	Monitoring_Execution4	Monitoring_Execution5	Monitoring_Execution6	Monitoring_Execution7	Monitoring_Execution8	Monitoring_Execution9
Monitoring Factor	Monitoring_Execution1	Correlation	1.000	.505	.039	-.260	-.378	-.380	-.272	-.312	.049
		Significance (2-tailed)	.	.001	.818	.115	.019	.019	.098	.057	.769
		df	0	36	36	36	36	36	36	36	36
	Monitoring_Execution2	Correlation	.505	1.000	.003	-.263	-.317	-.426	-.157	-.455	.138
		Significance (2-tailed)	.001	.	.985	.110	.052	.008	.345	.004	.410
		df	36	0	36	36	36	36	36	36	36
	Monitoring_Execution3	Correlation	.039	.003	1.000	.133	-.127	-.251	-.358	-.092	-.179

	Significance (2-tailed)	.818	.985	.	.427	.446	.128	.027	.584	.281
	df	36	36	0	36	36	36	36	36	36
Monitoring_Execution4	Correlation	-.260	-.263	.133	1.000	.226	-.150	-.340	-.182	-.344
	Significance (2-tailed)	.115	.110	.427	.	.172	.369	.036	.274	.035
	df	36	36	36	0	36	36	36	36	36
Monitoring_Execution5	Correlation	-.378	-.317	-.127	.226	1.000	-.082	.031	-.069	-.408
	Significance (2-tailed)	.019	.052	.446	.172	.	.626	.855	.680	.011
	df	36	36	36	36	0	36	36	36	36
Monitoring_Execution6	Correlation	-.380	-.426	-.251	-.150	-.082	1.000	.462	.116	-.298

	Significance (2-tailed)	.019	.008	.128	.369	.626	.	.003	.490	.070
	df	36	36	36	36	36	0	36	36	36
Monitoring_Execution7	Correlation	-.272	-.157	-.358	-.340	.031	.462	1.000	-.162	-.161
	Significance (2-tailed)	.098	.345	.027	.036	.855	.003	.	.330	.334
	df	36	36	36	36	36	36	0	36	36
Monitoring_Execution8	Correlation	-.312	-.455	-.092	-.182	-.069	.116	-.162	1.000	.270
	Significance (2-tailed)	.057	.004	.584	.274	.680	.490	.330	.	.101
	df	36	36	36	36	36	36	36	0	36
Monitoring_Execution9	Correlation	.049	.138	-.179	-.344	-.408	-.298	-.161	.270	1.000

		Significance (2-tailed)	.769	.410	.281	.035	.011	.070	.334	.101	.
		df	36	36	36	36	36	36	36	36	0

Correlations

Control Variables			Controlling_Execution1	Controlling_Execution2	Controlling_Execution3	Controlling_Execution4	Controlling_Execution5	Controlling_Execution6	Controlling_Execution7	Controlling_Execution8	Controlling_Execution9
Controlling Factor	Controlling_Execution1	Correlation	1.000	-.071	-.019	-.298	-.211	-.035	-.076	-.010	-.235
		Significance (2-tailed)	.	.672	.908	.070	.204	.834	.649	.951	.155
		df	0	36	36	36	36	36	36	36	36
	Controlling_Execution2	Correlation	-.071	1.000	.284	-.293	-.225	.242	-.281	-.387	-.280
		Significance (2-tailed)	.672	.	.084	.074	.174	.143	.087	.016	.088
		df	36	0	36	36	36	36	36	36	36

Controlling_Execution3	Correlation	-.019	.284	1.000	-.024	-.218	-.167	-.109	-.294	-.429
	Significance (2-tailed)	.908	.084	.	.886	.189	.317	.513	.073	.007
	df	36	36	0	36	36	36	36	36	36
Controlling_Execution4	Correlation	-.298	-.293	-.024	1.000	.417	-.212	-.091	-.308	-.075
	Significance (2-tailed)	.070	.074	.886	.	.009	.202	.589	.060	.656
	df	36	36	36	0	36	36	36	36	36
Controlling_Execution5	Correlation	-.211	-.225	-.218	.417	1.000	.026	-.419	-.166	-.154
	Significance (2-tailed)	.204	.174	.189	.009	.	.876	.009	.319	.356
	df	36	36	36	36	0	36	36	36	36
Controlling_Execution6	Correlation	-.035	.242	-.167	-.212	.026	1.000	.044	-.474	-.327

	Significance (2-tailed)	.834	.143	.317	.202	.876	.	.792	.003	.045
	df	36	36	36	36	36	0	36	36	36
Controlling_Execution7	Correlation	-.076	-.281	-.109	-.091	-.419	.044	1.000	.097	-.085
	Significance (2-tailed)	.649	.087	.513	.589	.009	.792	.	.563	.613
	df	36	36	36	36	36	36	0	36	36
Controlling_Execution8	Correlation	-.010	-.387	-.294	-.308	-.166	-.474	.097	1.000	.395
	Significance (2-tailed)	.951	.016	.073	.060	.319	.003	.563	.	.014
	df	36	36	36	36	36	36	36	0	36
Controlling_Execution9	Correlation	-.235	-.280	-.429	-.075	-.154	-.327	-.085	.395	1.000

Significance (2-tailed)	.155	.088	.007	.656	.356	.045	.613	.014	.
df	36	36	36	36	36	36	36	36	0

Correlations

Control Variables			Communication_Closing1	Communication_Closing2	Communication_Closing3	Communication_Closing4	Communication_Closing5	Communication_Closing6	Communication_Closing7	Communication_Closing8	Communication_Closing9
CommunicationFactor	Communication_Closing1	Correlation	1.000	.335	.161	-.188	-.491	-.490	-.425	-.278	.105
		Significance (2-tailed)	.	.040	.333	.257	.002	.002	.008	.091	.530
		df	0	36	36	36	36	36	36	36	36
	Communication_Closing2	Correlation	.335	1.000	-.011	-.009	-.321	-.308	-.247	-.512	-.032

	Significance (2-tailed)	.040	.	.946	.958	.049	.060	.135	.001	.847
	df	36	0	36	36	36	36	36	36	36
Communication_Closing3	Correlation	.161	-.011	1.000	-.083	-.173	-.413	-.293	-.116	-.079
	Significance (2-tailed)	.333	.946	.	.618	.298	.010	.074	.486	.639
	df	36	36	0	36	36	36	36	36	36
Communication_Closing4	Correlation	-.188	-.009	-.083	1.000	.160	-.304	-.219	-.044	-.229
	Significance (2-tailed)	.257	.958	.618	.	.336	.063	.186	.792	.168
	df	36	36	36	0	36	36	36	36	36
Communication_Closing5	Correlation	-.491	-.321	-.173	.160	1.000	.066	.005	.602	-.522

	Significance (2-tailed)	.002	.049	.298	.336	.	.692	.977	.000	.001
	df	36	36	36	36	0	36	36	36	36
Communication_Closing6	Correlation	-.490	-.308	-.413	-.304	.066	1.000	.498	-.058	.042
	Significance (2-tailed)	.002	.060	.010	.063	.692	.	.001	.732	.803
	df	36	36	36	36	36	0	36	36	36
Communication_Closing7	Correlation	-.425	-.247	-.293	-.219	.005	.498	1.000	-.188	-.216
	Significance (2-tailed)	.008	.135	.074	.186	.977	.001	.	.258	.193
	df	36	36	36	36	36	36	0	36	36
Communication_Closing8	Correlation	-.278	-.512	-.116	-.044	.602	-.058	-.188	1.000	-.146

	Significance (2-tailed)	.091	.001	.486	.792	.000	.732	.258	.	.381
	df	36	36	36	36	36	36	36	0	36
Communication_Closing9	Correlation	.105	-.032	-.079	-.229	-.522	.042	-.216	-.146	1.000
	Significance (2-tailed)	.530	.847	.639	.168	.001	.803	.193	.381	.
	df	36	36	36	36	36	36	36	36	0

Table 19: Correlation test analysis for PRM CSF ranking over PLC
Source: SPSS

4.6.3 Regression analysis for Global dependent variables

A regression analysis conducted to test the effects of independent variables which they form the whole project risk management process on the dependent variables where they form the criteria of construction projects success. The R square value is strong 1.00 in which it states that the linear relationship is too high.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000[a]	1.000	1.000	.00000

a. Predictors: (Constant), CommunicationFactor, PlanningFactor, ClassificationFactor, MonitoringFactor, AnalysisFactor, IdentificationFactor, ControllingFactor

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33469.436	7	4781.348	.	.[b]
	Residual	.000	31	.000		
	Total	33469.436	38			

a. Dependent Variable: Global_IV

b. Predictors: (Constant), CommunicationFactor, PlanningFactor, ClassificationFactor, MonitoringFactor, AnalysisFactor, IdentificationFactor, ControllingFactor

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-9.948E-14	.000		.000	1.000
	IdentificationFactor	1.000	.000	.158	156391657.002	.000
	PlanningFactor	1.000	.000	.148	136906333.067	.000
	AnalysisFactor	1.000	.000	.187	193557572.237	.000
	ClassificationFactor	1.000	.000	.174	168230109.380	.000
	MonitoringFactor	1.000	.000	.195	190093997.170	.000
	ControllingFactor	1.000	.000	.210	137375475.237	.000
	CommunicationFactor	1.000	.000	.207	210459406.322	.000

a. Dependent Variable: Global_IV

Table 20: Regression analysis for dependent variables for Construction project success

Chapter Five: Discussion and Recommendation

5.0 Introduction

In this dissertation, the overall aim purpose of this work to explore and determine the relationship between project risk management implementation critical success factors and construction project success. It has shown that there is a strong relationship between critical success factors implementation of Enterprise Risk Management utilized in project risk management and enhancement of achieving construction project success criteria and objectives. Furthermore, the work shown the achievement of each objective had supported the aim of the research and the analysis of surveys and questionnaires had complemented the previous findings in academic literature reviews.

In this chapter, it will present a justification through discussion of the research findings from the previous chapters where a summarize of each chapter and provide a detailed insight into the topic area. Furthermore, a research limitations and recommendations for future research will be suggested.

5.1 A Review of research objectives

In order to achieve research aim and objectives, the literature review had been divided into six main sections. First section had explored the definitions of project issue, risk and uncertainty and risk management. The second section, had explored the concept of risk management process and its different types of the processes. The third section was exploring the implementation of project risk management over the construction project lifecycle where the importance of each step in the risk management described in each phase. The fourth section, describe the project lifecycle phases and its main activities and particularly the construction project lifecycle which is denoted by Bennet (2003) as special and highly fit for the construction projects. The fifth section was exploring the critical success factors of enterprise risk management and its ability to be implemented to project risk management. The sixth and the final section in literature review was exploring the project success and particularly the construction project success and its relation to project risk management.

5.1.1 Objective 1

As the first objective was 'exploring the terms of risk, risk management and project risk management critical success factors' it was reviewed in chapter 2.

Several studies had not agreed on one specific term to define risk as pointed out by Aven and Renn(2009). Hence some researchers such as Hopkin (2008, p.11) had pointed out that this context refers to negative consequence. Moreover, Hopkin (2008, p.11) stressed the notion of risk can be a positive consequence or risk being related to uncertainty of an outcome.In project management context , PMI(2000) defined risk to be an uncertain event or condition that if it occur it may have positive or negative effects on project objective. While uncertainty described by Merna and Al-Thaniy(2008, P.7) as a prophecy where it cannot be predicted since it does not depends on past data or experience.Merna and Al-Thaniy, they defined uncertainty as the inability to attach the probability to likehood of an event to occur. Project issue on another hand defined by M. NextGen (2015) as the state of being highly predictable on event and outcome occurrence and no action taken to mitigate.

Understanding risk management in project context, according to PMI (2008) it is the process of risk identification, qualitative, quantitative analysis and response.Despite the extensive literature in project risk management practices, the area of study that cover critical success factors (CSF) identification and body of knowledge not sufficiently developed as concluded by Yaraghi (2011). Hosseini et al. (2016) starts by identifying the critical success factors for that system.Shehu and Akintoye (2011) and Ranong and Phuenngam (2009) stated that based on Rockart (1982) who first developed the critical success concept to discuss risks and prerequisite to achieve project success.

5.1.2 Objective 2

The second objective was 'Exploring the terms of project lifecycle and construction projects success criteria' reviewed in section 2.4 and 2.6.

Where project lifecycle defined as a business it have a beginning and end that include many activities where they described project lifecycle as a tool to improve project performance as pointed out by Gajewska and Ropel(2011). Through literature, there was an argument on deciding the number of project lifecycle phases that fit construction since same size fit all cannot be effective in construction projects. Smith et al. (2006) argued that best project lifecycle phases could be divided into eight succeeding phases and these are Pre-feasibility, feasibility, contract/ procurement, implementation, commissioning, hand-over and operations. In contrast, Westland(2006) stated that project lifecycle consist initiation, planning, execution and closure phase based on early Pinto and Prescott (1988) study.Bennet(2003) posits a typical project lifecycle framework that goes in line with project complexity where it consist of six phases and these are pre-project phase, planning and design phase, contractor selection phase, contractor mobilization phase, project operation phase and project termination phase. He supported that notion since construction projects highly complex in nature and require a special project lifecycle framework.

As in literature reviewed, the argument on defining construction project success criteria had no agreement between researchers as stated bySilva et al.(2016) and Elattar (2009) hence construction project success criteria defined as 'The perceived degree of achievement of predetermined performance objectives and participants'. From this notion they stated that construction project success may go beyond Iron triangle (Cost, time and Quality). According to Silva et al.(2016) study, construction project success may include client satisfaction, end user of premise, employee satisfaction, effective cash-flow management, enhancing commitment safety, environment performance, increasing profit margin, organization benefits and country benefit where they can be categorized under project success and project management success as concluded by Radujković and Sjekavica (2017).

5.1.3 Objective 3

The third objective of the research is to investigate the extent of effects of critical success factors on project risk management processes to answer the research question, What are the correlation effects of Enterprise risk management critical success factors implementation in project risk management processes along project lifecycle?

To answer this question,Yaraghi (2011) stated that there is no accepted global standard and guidelines to design and implement an effective risk management system. ThroughYaraghi (2011) study conclusion on critical success factors (CSF), testing established null hypothesis revealed that there is a difference on level of importance of (CSF) along construction project lifecycle. According to H0, the Pearson Correlation values stated that there is a positive correlation since top management support, setting objectives and corporate risk culture had the highest values in the pre-project phase during risk identification process. The values are 1.0 for top management, 0.96 for setting of objectives and corporate risk culture 0.71. These values would reject the null hypothesis. In addition, these three (CSF) need to be considered during business opportunity evaluation, choosing delivery method and choosing contract type. H1 null hypothesis, testing the most important (CSF) during the pre-project phase during risk planning. Through Pearson correlation, the most important (CSF) are top management support and risk appetite during the planning for risk while evaluating business opportunity, selecting project delivery method and choosing contract. Thus the values are 1.0 for top management and 0.64 which is moderate. These values would reject the null hypothesis. H2 null hypothesis test the most important (CSF) when conducting risk analysis during planning and design, contractor selection and site mobilization phases. Allocation of sufficient resources and establishing means of risk identification, analysis and response where most important (CSF) during risk analysis where it had a value of 0.88 and 0.977 thus they are important when establishing project objectives, designing, tendering and preparation for construction phase. Moreover H2 null hypothesis rejected. H3 null hypothesis test the most important (CSF) when classifying of risk during the planning and design, contractor selection and site mobilization phases. The most important (CSF) are risk ownership and communication of risk with values of 0.950 and 0.862. These (CSF) are important when classifying risks during establishing project objectives, designing, tendering and preparation for construction phase. Its concluded that H3 null hypothesis can be rejected.

H4 null hypothesis tests the monitoring of risks during the execution phase. The most important (CSF) during monitoring of risks are top management support, defining risk appetite and risk communication with the values 1.0, 0.756 and 0.757 while monitoring the resource management during the execution phase of the construction works. Thus, H4 null hypothesis rejected.

H5 null hypothesis tests the controlling of risks during the execution phase. The most important (CSF) during the control of risks when managing the resources of the construction project are top management support, means of risk communication and conducting training programs and these values are 0.838, 0.931 and 0.787. H5 null hypothesis rejected.

H6 null hypothesis tests the communication of risks during the closing phase of the construction project. The most important (CSF) during the closing phase while communicating of risk are allocation of sufficient resources and corporate risk culture with Pearson correlation values 1.0 and 0.847. H6 null hypothesis rejected.

5.1.4 Objective 4

The fourth objective is about 'Investigating the relationship between project risk management implementation and construction project success criteria. ' to answer this question, a research question established, What are the impacts of project risk management processes on construction project success?

As Rodrigues-da-Silva and Crispim (2014), stated that project risk management is a process consist of chain decision agents practices in which these decisions ensure project is operated within certain conditions such as time, cost, quality and other parameters etc.).Aglobal null hypothesis drawn to test the relationship between the project risk management processes and its decisions taken to ensure achievement of construction project success objectives. According to R2 value which 1.0, it stated that there is a strong relationship between project risk management processes and construction project success. This value confirm Alshibly et al. (2015) conclusion where construction project risk management can be a tool to enhance project success. Thus global H0 hypothesis rejected.

5.2 Research Limitation

The findings of the research somewhat limited due to time constraint, availability of information, lack of existence of a risk management department in several different types of construction projects visitedin UAE to conduct the surveys through distribution of questionnaires to construction project managers and professionals.

The constraint of time and availability of information on risk and risk management by respondents could be effected with bias that affect the secondary data while filling the questionnaire. Since the results obtained from UAE construction projects, readers may won't be able to generalize these results in other construction projects in different countries.

5.3 Recommendations for future study and professionals use

Many questions on importance of critical success factors of implementation of project risk management remain unanswered along the construction project lifecycle phases, where number of phases would vary from one project to another. Moreover, through conducting surveys, lack of risk management department or offices in UAE construction contractors observed.

Therefore, future researchers should undertake investigations on ranking project risk management implementation critical success factors on different construction project lifecycles which depend on type of construction projects. Hence, a stronger relationship would be enhanced between project risk management critical success factors and construction project lifecycle to ensure success of projects. Moreover, researchers in risk management field in UAE construction industry would investigate the establishment of risk management office in construction contractors to enhance good practices of project risk management implementation through ranking those critical success factors derived from COSO (2004) Enterprise risk management frameworks.

The dissertation would contribute to construction project risk management and project management topics. Understanding means of ranking project risk management critical success factors and establishment of risk management officewould support construction project managers and other construction professionals to enhance project success. In addition, academic scholars can benefit from this study whenever project risk management construction risk are their topic of interest.

Chapter Six: Conclusion

The current study had tested and confirmed 9 Enterprise risk management critical success factors that can be utilized to enhance the implementation of project risk management in UAE construction industry. The 9 Enterprise risk management critical success factors selected and confirmed in this study where 'top management support', 'objective settings', ' risk ownership', 'corporate risk culture', 'risk appetite', 'means of risk communication', 'conducting training programs', 'allocation of sufficient resources' and 'establishing means of risk identification, analysis and response'. The study found that all these critical success factors are correlated to the success of project risk management implementation and construction project success.

In addition, through ranking the importance of these critical success factors it would be able to establish project risk management office within construction contractors where elements needed to establish the department can be easily managed through understanding the critical success factors by the organization owner and the top management and every employee in the organization.

References

Ehi-uujamhan (2015),The complements towards developing a new risk management framework and its applicability to the Nigerian power sector

Rahman, A. Varuttamasenia, A., Kintner-Meyerb, M. and Lee, C. J., (2013).Application of fault tree analysis for customer reliability assessment of adistribution power system. Reliability Engineering and System Safety. 111,
76-85.

Khatta, S. R. (2008). Risk Management. Global India Publications Pvt Ltd. New
Delhi

Munns, A.K. and Bjeirmi, B.F. (1996), "The role of project management in achieving project success", *International Journal of Project Management*, Vol. 14, No. 2, pp. 81-87.

Turner J R, The handbook of the project based management: Improving the processes for achieving your strategic objectives McGraw-Hill (1992)

Kwak, Y.H., (2003). Brief history of project management. Chapter 2. In: Carayannis, Kwak, Anbari (Eds.), The Story of Managing Projects: an Interdisciplinary Approach. Quorum Books, Westport, Connecticut.

PMI, (2013). A Guide to the Project Management Body of Knowledge: (PMBOK® Guide). fifth ed. PMI, Project Management Institute, Newtown Square, PA.

Flanagan, R, Norman, G. (1993). Risk management and construction. Blackwell Science Pty Ltd, Victoria, Australia.

Serpella, A. F., Ferrada, X., Howard, R., & Rubio, L. (2014). Risk management inconstruction projects: A knowledge-based approach. *Procedia-Social andBehavioral Sciences, 119*, 653-662. doi:10.1016/j.sbspro.2014.03.073

Pinto,J. K. and Prescott, J. E.(1988).Variationsin Critical Success Factors Over theStages in the Project Life Cycle. Journal of Management.14(1), 5-18.

Westland, J., (2006). Project Management Life Cycle: A Complete Step-by-stepMethodology for Initiating Planning Executing and Closing the Project. Kogan:Page Limited. Pentonville, United Kingdom.

Gajewska and Ropel (2011), Risk management practices in construction projects-case study, Department of Civil and Environmental Engineering *Division of Construction Management* CHALMERS UNIVERSITY OF TECHNOLOGY Göteborg, Sweden 2011 Master"s Thesis 2011:47

Osipova(2008), Risk management in construction projects: a comparative study of the different procurement options in Sweden, Luleå University of Technology Department of Civil, Mining and Environmental Engineering Division of Architecture and Infrastructure Construction Management Research Group

Pinto, J.K. and Slevin, D.P. (1988), "Project success: definitions and measurement techniques", *Project Management Institute.*

Baloi, D., & Price, A. D. (2003). Modelling global risk factors affecting construction cost performance. *International Journal of Project Management*, *21*(4), 261–269.

PMBOK. (2000). *A guide to the project management body of knowledge*. Project Management Institute.

Smith, N. J., Merna, T., and Jobling, P. (2006). Managing risk in constructionprojects. 2nd ed. Oxford: Blackwell Publishing.

Bennett, F. L. (2003) . The Management of Construction: A Project LifecycleApproach, London, UK: Butterworth Heinemenn.

Committee of Sponsoring Organizations of the Treadway Commission (2004) Enterprise Risk Management: IntegratedFramework: Executive Summary & Framework, COSO, Jersey City, NJ.

Wateridge, J. (1995). IT projects: a basis for success. *International Journal of Project Management, 13*(3), 169-172.

Jugdev, K., & Müller, R. (2005). A RETROSPECTIVE LOOK AT OUR EVOLVING UNDERSTANDING OF PROJECT SUCCESS. *ProjectManagement Journal*, *36*(4), 19.

Barber, R. B. (2005), Understanding internally generated risks in projects. *International Journal of Project Management*, 23(8), 584-590.

PMI, Standard Committee. (2000), *A guide to the project management body of knowledge*, Newton Square, PA.

Milosevic, D., Patanakul, P., (2005). Standardized project management mayincrease development projects success. Int. J. Proj. Manag. 23 (3), 181–192.

Wang, S. Q., Tiong, R. L., Ting, S. K., and Ashley, D. (2000). Evaluation andmanagement of political risks in China's BOT projects. Journal of constructionengineering and management, 126(3), 242-250.

M. NextGen, Project Management Handbook, University ofMichigan, Michigan Program: accessed Mar. 2015.

Artto, K., Ahola, T., &Vartiainen, V. (2016). From the front end of projects to the back end of operations: Managing projects for value creation throughout the system lifecycle. *International Journal of Project Management, 34*, 258-270. doi:10.1016/j.ijproman.2015.05.003

Abdali, S., Hourani, M. A., Abuerrub, A., &Shambour, Q. (2013). Toward a conceptual framework for integrating enterprises performance and risk management. *Journal of Management Research, 5*, 145-166. doi:10.5296/jmr.v5i4.4395

Edkins, A., Geraldi, J., Morris, P., & Smith, A. (2013). Exploring the front-end of project management. *Engineering Project Organization Journal, 3*, 71-85. doi:10.1080/21573727.2013.775942

Zhao, X., Hwang, B. G., Pheng Low, S., & Wu, P. (2014). Reducing hindrances to enterprise risk management implementation in construction firms. *Journal of Construction Engineering and Management*, *141*, 04014083-1-04014083-10. doi:10.1061/(ASCE)CO.1943-7862.0000945

Zhao, X., Hwang, B. G., &Pheng Low, S. (2014). Enterprise risk management implementation in construction firms: An organizational change perspective. *Management Decision, 52*, 814-833. doi:10.1061/(ASCE)CO.1943-7862.0000873

Yaraghi, N., & Langhe, R. G. (2011). Critical success factors for risk management systems. *Journal of Risk Research, 14*, 551-581. doi:10.1080/13669877.2010.547253

Thamhain, H. (2013). Managing risks in complex projects. *Project Management Journal, 44*(2), 20-35. doi:10.1002/pmj.21325

Allan, N., & Yin, Y. (2010). Development of a methodology for understanding the potency of risk connectivity. *Journal of Management in Engineering, 27*, 75-79. doi:10.1061/(ASCE)ME.1943-5479.0000036

Choudhry, R. M., & Iqbal, K. (2013). Identification of risk management system in construction industry in Pakistan. *Journal of Management in Engineering, 29*, 42-49. doi:10.1061/(ASCE)ME.1943-5479.0000122

James T. Wallace Jr.(2016) RISK SYSTEM INTERRELATIONSHIPS OVER A CONSTRUCTION PROJECT'S LIFE CYCLE: A CORRELATIONAL STUDY,

Baccarini, D. (1999). The logical framework method for defining project success. *Project*

Management Journal, 30(1), 25-32.

Hussein, B. A., Ahmad, S. B., &Zidane, Y. J. (2015). Problems associated with defining project success. *Procedia Computer Science, 64,* 940-947. doi:10.1016/j.procs.2015.08.611

Bowen, P. A., Cattel, K. S., Hall, K. A., Edwards, P. J., & Pearl, R. G. (2002). Perceptions of time, cost and quality management on building projects. *Construction Economics and Building, 2*(2), 48-56. doi:10.5130/ajceb.v2i2.2900

Ika, L. A. (2009). Project success as a topic in project management journals. *Project Management Journal, 40*(4), 6-19. doi:10.1002/pmj.20137

San Cristóbal, J. R. (2009). Time, cost, and quality in a road building project. *Journal of Construction Engineering & Management, 135*, 1271-1274.

De Wit, A. (1988). Measurement of project success. *International Journal of Project Management, 6*(3), 164-170.

Cooke-Davies, T. (2002), "The real success factors on projects", *International Journal of Project Management*, Vol. 20, No. 3, pp. 185-190.

Lim, C.S. and Mohamed, M.Z. (1999), "Criteria of project success: an exploratory re-examination", *International Journal of Project Management*, Vol. 17, No. 4, pp. 243-248.

Silva(2016), Criteria for Construction Project Success: A Literature Review, 13th International Conference on Business Management 2016

Rockart, JF. The changing role of theinformation systems executive: acritical success factors perspective.Sloan Management Review. 1982;24(1): 3–13.

Coccia R. Communication key tosuccess in enterprise riskmanagement. Business Insurance . May 09, 2005;39(19):18.

Eccles R. G., Ioannou, I., and Serafeim., G (2012). The impact of corporate culture of sustainability on corporate behavior and performance. (No. W17950). National bureau of economic Chicago .

Dowling , G.R.(2006), Communicating corporate reputation through stories. California Management Review, 49(1), 82.

Bertels. S., Papania, L. Papania, D.(2010). Embedding sustainability in organizational culture. A systematic review of the body of knowledge. London, Canada : Network for business sustainability.

Banks E., (2012). Risk culture: a practical guide to building and strengthen the fabric of risk management . London: Palgrave Macmillan.

Segal S.,(2011). Corporate value of enterprise risk management : the next step in business management (Vol.3). John Wiley and sons.

Duckert, G.H. (2011) Practical Enterprise Risk Management: ABusiness Process Approach, John Wiley & Sons, Hoboken, NJ.

Economist Intelligence Unit (2007) Best Practice in Risk Management,EIU, London.

Espersen, D. (2007) The language of risk. Internal Auditor, 64(3), 69–73.

Zhao, X., Hwang, B.G. and Low, S.P. (2013) Developingfuzzy enterprise risk management maturity model for constructionfirms. Journal of Construction Engineering andManagement, 139(9), 1179–89.

Banham, R. (2004) Enterprising views of risk management.Journal of Accountancy, 197(6), 65 71.

MarchettiA.M.(2011). Enterprise risk management best practice: From assessment to ongoing compliance.

Gates, S. (2006) Incorporating strategic risk into enterpriserisk management: a survey of current corporate practice.Journal of Applied Corporate Finance, 18(4), 81–90.

Muralidhar, K. (2010) Enterprise risk management in theMiddle East oil industry: an empirical investigation acrossGCC countries. International Journal of Energy Sector Management, 4(1), 59–86.

Hopkinson, M. (2011) The Project Risk Maturity Model: Measuringand Improving Risk Management Capability, Gower,Burlington, VT.

Wood, P. 2005. Risk management off the shelf and into practice. *Manager: British Journal of Administrative Management* 45: 26–7.

Lemos, T., M. Betts, D. Eaton, and L. Almeida. 2001. Model for management of whole life cycle risk uncertainty in the private finance initiative (PFI). *Journal of Project Finance* 6, no. 4: 68.

McDonald, C. 2004. ERM success checklist. *National Underwriter/Property & Casualty Risk & Benefits Management* 108, no. 10: 26.

Roth, J., and D. Espersen (2004). Risk reflections. *Internal Auditor* 61, no. 5: 75–9.

Ward and Chapman (1995). Risk management perspective on the project lifecycle. International Journal of project management Vol 13 No.3, pp145-149.

Ward, S.C. and Chapman, C.B., 1995. *Risk-management perspective on the project life cycle, International Journal of Project Management*, Vol. 13, No. 3, pp. 145-149

Lemaitre, N and Steiner B., “simulating innovation in large companies: observations and recommendations from Belgium” R&D management 1988 18(2) 141-158.

Lyles M.A. ‘Formulating strategic problem: empirical analysis and model development’ strategic management J 1981 2 61-75.

Korczynski, M., (1996). The low-trust route to economic development: Inter-firm relations in the UKengineering construction industry in the 1980s and 1990s. *Journal of Management Studies*, *33*(6), 787–808.

Sullivan, K. (2011). Quality management programs in the construction industry: Pre-contract planningcompared with other methodologies. *ASCE Journal of Management in Engineering*, *27*(4),210–218.

Ruuska, I., Artto, K., Aaltonen, K., &Lehtonen, P., 2009. Dimensions of distance in a project network: Exploring Olkiluoto 3 nuclear power plant project. *International Journal of Project Management*, *27*(2), 142–153.

Albert P.C. Chan, Ada P.L. Chan, (2004) "Key performance indicators for measuring constructionsuccess", Benchmarking: An International Journal, Vol. 11 Issue: 2, pp.203-221,

Ziyu Wu, Tahir Nisar, DharmKapletia, Guru Prabhakar, (2017) "Risk factors for project success in theChinese construction industry", Journal of Manufacturing Technology Management, Vol. 28 Issue: 7,pp.850-866,

Davies, A. and Hobday, M. (2005), The Business of Projects: Managing Innovation in Complex Productsand Systems, Cambridge University Press, Cambridge.

Chapman, C. (1997), “Project risk analysis and management – PRAM the generic process”, International Journal of Project Management, Vol. 15 No. 5, pp. 273-281

Williams, T.M. (2005), “Assessing and moving on from the dominant project management discourse inthe light of project overruns”, IEEE Transactions on Engineering Management, Vol. 52 No. 4,pp. 497-508.

Anantatmula, V. and Fan, Y. (2013), “Risk management instruments, strategies and their impact on projectsuccess”, International Journal of Risk and Contingency Management, Vol. 2 No. 2, pp. 27-41.

Teller, J., Kock, A. and Gemünden, H.G. (2014), “Risk management in project portfolios is more thanmanaging project risks: a contingency perspective on risk management”, Project ManagementJournal, Vol. 45 No. 4, pp. 67-80.

Sanvido V, Grobler F, Parfitt K, Guvenis M, Coyle M (1992)Critical success factors for construction projects. J ConstrEngManage 118:94–111. doi:10.1061/(ASCE)0733-9364

Steiner, G. A. (1969). Top management planning. New York: Macmillan.

Tah, J. H. M., &Carr, V. (2001). Towards a framework for project risk knowledgemanagement in the construction supply chain. Advanced in EngineeringSoftware, 32, 835–846.

Elkington, P., &Smallman, C. (2002). Managing project risks: A case study from theutilities sector. International Journal of Project Management, 20, 49–57.

Teneyuca, D. (2001). Organizational leader’s use of risk management forinformation technology. Information Security Technical Report, 6(3), 54–59.

Royal Commission (1992), Royal Commission into productivity in the building industry in New South Wales, New South Wales Government , Sydney.

Latham M. Sir (1994), Constructing the team. Joint Review of procurement and contractual arrangement in the United Kingdom construction Industry, HSMO London.

Department of Industry, Science and Tourism (DIST) (1998), Building for Growth . A Draft Strategy for the building industry and Construction industry.

Ehsan A., Anjelo, F. D., Kujur, F. E., &Chaudhary, M. (2014). Risk management strategies for accidental riskoccurrence on construction sites: A case study of Allahabad. *Journal of Academia and Industrial Research, 3*(2), 89-91.

Smith, N. J. (2003). *Appraisal, risk and uncertainty.* London: Thomas Telford Ltd.

Teale, D. (2003), Successful Project Risk Assessment in a Week, Hodder & Stoughton, London.

Anantatmula, V. and Fan, Y. (2013), “Risk management instruments, strategies and their impact on projectsuccess”, International Journal of Risk and Contingency Management, Vol. 2 No. 2, pp. 27-41.

Hopkin, P. (2012). *Fundamentals of risk management* (2nd ed.). London: Kogan-Page.

Popova-Clark, J. (2011). *Risk management: Better, but still not there yet.* Retrieved on February 15, 2014 from http://www.dataanalytics.com/pdf/BetterRiskMgt.pdf

Flanagan, R., & Norman, G. (1993).Risk management and construction. London: Blackwell Science Ltd.

Project Management Institute (PMI). (2004). *Project management body of knowledge* (3rd ed.). New York: Project Management Institute, Inc.

EdmundasKazimierasZavadskas ,Zenonas ,Turskis&JolantaTamošaitiene (2010) Risk assessment of construction projects, Journal of Civil Engineering and Management, 16:1, 33-46

Hillson, D., & Murray-Webster, R. (2004).*Understanding and managing risk attitude*. Accessed on September 16, 2014 from

Smith, G., & Bohn, C. (1999).Small to medium contractor contingency and assumption of risk.*ConstructionEngineering and Management, 125*(2), 101-108.

Smallman, C. (1999). Risk and organizational behavior: A research model. *Disaster Prevention and Management, 5*(2), 12-26.

Ghahramanzadeh, M. (2013). Managing risk of construction project a case study of Iran. Retrieved on October 20, 2014

Pawel Szymanski (2017). Risk management in construction projects. Procedia Engineering 208 (2017) 174-182.

Girmscheid, G. (2013), “Risk allocation model (RA model) – the critical success factor for public-privatepartnerships”, in De vries, P. and Yehoue, E.B. (Eds), *The Routledge Companion to Public-PrivatePartnerships*, Routledge, Abingdon, pp. 249-300.

Rutkauskas, A. V. 2008. On the sustainability of regional competitiveness development considering risk, Technological and Economic Development of Economy 14(1): 89–99. doi:10.3846/2029-0187.2008.14.89-99

Zayed, T.; Amer, M.; Pan, J. 2008. Assessing risk and uncertainty inherent in Chinese highway projects using AHP, International Journal of Project Management 26(4): 408– 419. doi:10.1016/j.ijproman.2007.05.012

Akintoye, A.S. and MacLeod, M.J. (1997), “Risk analysis and management in construction”, International Journal of Project Management, Vol. 15 No. 1, pp. 31-38.

David Hillson, (2003) "Using a Risk Breakdown Structure in project management", Journal of FacilitiesManagement, Vol. 2 Issue: 1, pp.85-97, Shenkir, W.G., Barton, T.L. and Walker, P.L. (2010), “Enterprise risk management: lessons from the field”, in Fraser, J. and Simkins, B.J. (Eds), Enterprise Risk Management: Today’s Leading Research and Best Practices for Tomorrow’s Executives, John Wiley & Sons, Hoboken, NJ, pp. 441-63.

Stroh, P.J. (2005), “Enterprise risk management at UnitedHealth Group”, Strategic Finance, July, available at: www.imanet.org/resources_and_publications/strategic_finance_magazine/ issues/July_2005.aspx (accessed 21 February 2011).

Fraser, J.R.S. (2010), “How to prepare a risk profile”, in Fraser, J. and Simkins, B.J. (Eds), Enterprise Risk Management: Today’s Leading Research and Best Practices forTomorrow’s Executives, John Wiley & Sons, Hoboken, NJ, pp. 171-88.

Crouhy, M., Galai, D. and Mark, R. (2006), The Essentials of Risk Management, McGraw-Hill, New York, NY.

Branson, B., Concessi, P., Fraser, J., Hofmann, M., Kolb, R., Perkins, T., Rizzi, J. and Simkins, B.J.(2008), “Enterprise risk management: current initiatives and issues”, Journal of Applied Finance, Vol. 18 No. 1, pp. 115-32.

Hillson, D. (2007), “Understanding risk exposure using multiple hierarchies”, paper presented at 2007 Project Management Institute Global Congress EMEA, 14-16 May 2007, Budapest, Hungary, available at: www.risk-doctor.com/pdf-files/ADV05.pdf (accessed 1 February 2010).

ISO/IEC 31010:2009 (2009), Risk Management – Risk Assessment Techniques, International Organization for Standardization, Geneva.

Linstone, H. &Turloff, M. (1975). *The Delphi method: Techniques and applications.* London, UK: Addison-Wesley

Adler, M. &Ziglio. E. (1996). *Gazing into the oracle: The Delphi Method and its application to socialpolicy and public health*. London: Jessica Kingsley Publishers.

Delbeq, A., Van de Ven, A., & Gustafson, D. H. (1975). *Group techniques for program planning: A guideto nominal group and Delphi processes*. Glenview, USA: Scott, Foresman and Company.

Czinkota, M. &Ronkainen (1997). International business and trade in the next decade: Report from a Delphistudy. *Journal of International Business Studies, 28*(4), 827 - 844.

Skulmoski, G. & Hartman, F. (2002). The Delphi method: Researching what does not exist (yet). Proceedings
of the *International Research Network on Organization by Projects, IRNOP V Conference*, Renesse,The Netherlands.

Aven, T. ,&Renn, O. (2015). An evaluation of the treatment of risk and uncertain- ties in the IPCC reports on climate change. *Risk Analysis*, *35* (4), 701–712 open access).

Baraldi, P. ,Zio, E. , & Compare, M. (2009). A method for ranking components im- portance in presence of epistemic uncertainties. *Journal of Loss Prevention in the Process Industries, 22* , 582–592 .

Flage, R. ,Aven, T. , Baraldi, P. , &Zio, E. (2014). Concerns, challenges and directions of development for the issue of representing uncertainty in risk assessment. *Risk Analysis*, *34* (7), 1196–1207 .

Ahmed, A., Kayis, B. and Amornsawadwatana, S. (2007), "A review of techniques for risk managementin projects", An International Journal, Vol. 14 No. 1, pp. 22-36.

Charles TeyeAmoatey, Samuel Famiyeh, Peter Andoh, (2017) "Risk assessment of mining projectsin Ghana", Journal of Quality in Maintenance Engineering, Vol. 23 Issue: 1, pp.22-38,

AS/NZS 5050 (2010), "Business continuity –managing disruption-related risks", Standards Association of Australia, Sydney.

Pyra, J. and Trask, J. (2002), "Risk management post analysis: gauging the success of a simple strategyin a complex project", Project Management Journal, Vol. 33 No. 2, pp. 41-48.

Chapman, C.B. and Ward, S.C. (1997), Project Risk Management: Processes, Techniques and Insights,Wiley, Chichester.

Crockford, N. (1986), An Introduction to Risk Management, 2nd ed., Woodhead-Faulkner.

Hill, R. et al. 2010.Guide to Cloud Computing. Principles and Practice. Springer-Verlag. London.

Charvat, J. 2003. Project Management Methodologies. Selecting, Implementing, and Supporting Methodologies and Processes for Projects. John Wiley & Sons, Inc. New Jersey.

Saunders, M., Lewis, P. &Thornhill, A. (2009) *Research methods for business students, 5th ed.,* Harlow, Pearson Education.

Creswell, J.W., Research Design: Qualitative & Quantitative Approaches, London: SAGE Publications, 1994.

Judith Ann Tate, & Mary Beth Happ,(2017), Qualitative SecondaryAnalysis: A Case Exemplar

Bryman, A. (2006). Integrating quantitative and qualitative research: How is it done? Qualitative Research, 6, 97e113.

Greene, J. C., Caracelli, V. J., &Graham,W. F. (1989). Toward a conceptual frameworkfor mixed-method evaluation designs. Educational Evaluation & Policy Analysis, 11, 255e274.

Joop J. Hox and Hennei R. Boeiji (2005), Data collection, Primary vs Secondary, Encyclopedia of social Measurement, Volume 1 p 593-599.

Singh, R., and Mangat, N. S. (2013). Elements of survey sampling, Springer Science and Business Media, 15.

Creswell, J. W., (2013). Qualitative, Quantitative, and Mixed Methods Aroaches.4th ed. London: SAGE Publications, Inc.

Gast, L. D. and Ledford, J., (2009). Single Subject Research Methodology in Behavioral Sciences. Routledge. Taylor & Francis Group. New York and London.

Myers, M. D. (2009). Qualitative Research in Business & Management, California: Sage Publications Inc.

Appendix

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