UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

AN ASSESSMENT OF RISK MANAGEMENT PRACTICES OF GOVERNMENT FUNDED AFFORDABLE HOUSING PROJECTS IN GHANA

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JANUARY, 2019

DECLARATION

STUDENT'S DECLARATION

I, GHAPSON BUABENG, declare that this Dissertation with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE: ……..

DATE: ……

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidance for supervision of Dissertation as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: NONGIBA ALKANAM KHENI (PhD)

SIGNATURE: …….....

DATE: ….....

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DEDICATION

I dedicate this work to my children; Oheneba K. Buabeng, Ewuradwoa Buabeng and Efuanhyira Buabeng

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ABSTRACT

Construction projects are initiated in complex and dynamic environments resulting in circumstances of high uncertainty and risk, which are compounded by demanding time constraints. The government funded affordable housing projects in Ghana have been abandoned or are being worked on at a snail's pace. Based on this, the study aimed at assessing risk management practices in construction projects focusing on government funded affordable housing projects in Ghana. Descriptive research design was employed for this study. The study involved the Borteyman, Koforidua and Kumasi government funded affordable housing projects, which included a total of 159 site managers. A census survey was adopted to sample all the 159 site managers on the Borteyman, Koforidua and Kumasi government funded affordable housing projects were included in the study. The study found that design variations, tight project schedule, bureaucracy of government, delays in payments, changes necessitated as a result of government policy, excessive approval procedures in administrative government departments, and high performance or quality expectations are the particular risk associated with the affordable housing projects in Ghana. It appeared from the study that delays in payments, under-budgeting contingency costs, changes in design scope, risk of rework, and tight project schedule can be reduced by the stakeholders. The study concluded that the proposed framework for the government funded affordable housing projects in Ghana is appropriate for analysis but it might be modified in the future as the project develops incorporating the project-related risks which may appear during project execution. The study recommended that risk management technique (BBN) should be applied into any construction project at the initial stage of the project to get maximum benefit of the technique.

Keywords: Risk Management, Projects, Government Funded, Affordable Housing

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Construction industry comprises a wide range of activities involving construction, alteration, and/or repair residential construction, bridge erection, roadway paving, excavations, demolitions, and large-scale painting jobs (Behm, 2008). A major success factor in the construction industry is the issue of effective project management (Zhi, 1995). According to Shen, Wu and Zhang (2011), project management is concerned with the time, quality, scope, costs, safety, environmental sustainability, and how they are integrated to achieve objectives associated with obtaining the right quality or results, on the defined scope or scale of operation, within the estimated costs, forecasted time, safety measures and environmental soundness.

Project management is therefore the planning, organization, motivation, and control of resources, procedures and protocols to achieve specific targets (Tam, Shen, & Kong, 2011). In the construction industry, the importance of effective project management cannot be underestimated given that construction projects consist of different facets, namely design, external, internal and finishing facets, which must be synthesised either simultaneously or sequentially towards a central goal (Zou, Chen, & Chan, 2010). Each facet has several sub-categories, which in themselves, must be coordinated successfully for further integration into the broader project and each sub-category must be of the right quality, within the estimated budget, and also on time. In this respect, Wang and Yuan (2010) indicated that a single construction project can

be complex and uncertainties at each facet can retard the achievement of the project's objectives.

According to Crockford (1986), uncertainties in projects engender a risk situation, but the two terms are not the same. Uncertainty, according to Flyvberg (2003), refers to the occurrence of an event about which little is known, whereas a risk is the outcome of an event, which is predicted on the basis of statistical probability. Dorman (2007) further explains that uncertainty exists when there is more than one possible outcome and risk exists when a decision is expressed in terms of a range of possible outcomes. Moreover, whereas uncertainties may yield either favourable or negative consequences, risks are seen as threats, which impact negatively on project performance. Risks and uncertainties, in Zou et al. (2010) opinion, are more inherent in the construction industry than other industries. They explain that the complexity and dynamism in construction projects makes the industry highly prone to several risks. The dimensions of risks in the construction industry, to that effect, are broadly categorised into external and internal risks. Laryea (2008) also affirmed that the construction industry is often considered as a risky business due to its complexity and strategic nature. It incurs a numerous project stakeholder, internal and external factors which will lead to enormous risks. Unfortunately, the construction industry has a poor reputation in risk analysis when compared to other industries (Laryea, 2008).

Risk management in construction is therefore concerned with project activities aimed at minimising the effects of risks, which arise from project uncertainties (Zou et al., 2010). The strategies to manage threats typically include transferring the threat to another party, avoiding the threat, reducing the negative effect or probability of the threat, or even accepting some or all of the potential or actual consequences of a

particular threat. Osipova (2008), however, indicate that the specific strategies and methods of risk management are, however, defined the context of management, security, engineering, industrial process, financial portfolios, actuarial assessments, or health and safety targets of projects.

In theory, the risk management approaches is seen as a decision making process which is led by different levels of risk aversion or risk addiction attitudes. Therefore, risk management can be nested in block-maxima (extreme value theory) and peak-over-threshold (POT) models. The block maxima model support avoiding risks that may be incurred (McNeil, 1998), whereas the peak-over-threshold model aims to keep risks under a threshold, beyond which they are classified as high and unsustainable (McNeil, 1999; Coales, 2001). Several studies indicate that construction risks are constantly changing, which necessitates the involvement of the all stakeholders in construction projects in the strategic risk management at the portfolio and the project level (Adams, 2008). Banaitiene and Banaitis (2012) also established that the type of project, whether government or private, also determines the approach to risk management to be taken. Hardy (2010) also established that delivery of projects in the public sector is often nuanced. In Europe, Middle East, India and Africa context, the tendering processes and contractor selection may be liaised with cronyism and unfairness within the political arena, bribery and corruption, and politicisation of the tendering process (Ernest & Young, 2012). According to Hastings, Takala and Saarela (2015) government projects, such as infrastructural projects and projects promoting welfarism, such as affordable housing, are usually non-profit, whereas private housing projects are usually commercialised. There is therefore the tendency to use sub-standard materials for non-profit and welfare projects, as against commercialised housing projects.

1.2 Statement of the problem

All forms of production are associated with some level of risk. These risks may be related to finances, marketing, technology, human resource, or organisational strategy (Chapman, 2001). Risk management has, thus, become central to organisational management. In the construction sector risk management, Osipova (2008) attributed the essentialness of risk management to unique complexities and stakeholder relations that underlie construction contracts and which impact construction outcomes. According to Lopes (1998), construction is a high hazard multi-faceted industry which requires effective risk management in the project cycle. The essence is to secure a successful project completion within the specified timeframe, budget, quality, environmental safety, labour health standards, and customer satisfaction targets (Shen et al., 2011). Central to the achievement of these objectives are the key stakeholders who review tenders, offer bids, draw-up construction requirements, manage the human resources, procure materials, and generally supervise the construction cycle (Adams, 2008; Halpin, 2006).

According to Hastings et al. (2015), there is a higher tendency to cut costs in regard of non-profit construction projects, such as government-funded affordable housing. The concept of affordability also means that costs should be kept low in order to generally make the housing units, practically affordable. In Ghana, the Kuffour-led administration started the implementation of public-sector affordable housing projects in 2006. The project consists of 4,720 housing units, spread out nation-wide at Saglemi, Nungua Borteyman and Kpone in the Greater Accra Region, Asokore-Mampong in the Ashanti Region, Koforidua in the Eastern Region, Wa in the Upper West Region, and Tamale in the Northern Region. In an exclusive interview with a newspaper Today, on June 29, 2016, the Head of Public Relations Unit of MWRWH,

Mr. Abraham Otabil, who disclosed the project was stalled when works got to about 60 percent of completion because the Kuffour-led administration lost power to the Mills-led administration, and funds for the project were cut. However, the Ghana News Agency (2015) reported that a Memorandum of Understanding (MOU) was signed between the Government and SSNIT under which the latter is expected to finish all outstanding works on the project in 18 months.

The projects currently being embarked on involves the completion of over 1,200 rooms in 389 one-bedroom flat apartments, 736 units of two bedroom-flat apartments and 52 trading stores sitting on a 50 acres of land, at Asokore-Mampong, the capital of a sprawling metropolis crafted from the Kumasi Metropolis. It also involves the completion of 1,502 housing units at Saglemi, near Ningo-Prampram, made up of 744 single room and 792 two-bedroom, self-contained apartments. A report by Mubarik (2018) in Daily Graphic on Friday said the fate of the Saglemi housing project, executed at $180 million, is not different from that of other state housing schemes in different parts of the country that have either been abandoned or are being worked on at a snail's pace. This makes risk management a core concept to achieving the goals of the government funded affordable housing project in Ghana.

While several studies have assessed risk management in relation to meeting project objectives in the Ghanaian context (Agyakwa-Baah, 2009; Frimpong, Oluwoye, & Crawford, 2003), much has not been done particularly in the specific context of the affordable housing projects. These studies concentrate on the comprehensive and holistic approach with a focused view aimed at identifying construction risks, their probability of occurrence and the impact on project objectives. For example; the study by Agyakwa-Baah (2009) explore the project risk management practices of Ghanaian Building Contractors. Also, Frimpong, Oluwoye,

and Crawford (2003) studied the significant risk factors in Construction Projects in Ghana. In view of this, the study directs its attention on certain aspect of construction project risk management which is affordable housing project in Ghana. This study explores this literary gap concerning the risk management practices and their effectiveness in achieving the objectives of the affordable housing project in Ghana.

1.3 Aim and Objectives of the study

The aim of the study is to assess risk management practices in construction projects focussing on government funded affordable housing projects in Ghana. The specific objectives of the study are to:

- examine peculiar risks associated with government funded affordable housing projects in Ghana;
- determine risk management practices adopted by the various stakeholders of government funded affordable housing projects in Ghana;
- develop a risk management framework for government funded affordable housing projects in Ghana; and
- develop recommendations for improving the management of risk associated with government funded affordable housing projects based on the study findings.

1.4 Research questions

The following research questions will be answered to augment the study objectives:

- What peculiar risks are associated the government funded affordable housing projects in Ghana?

- What are the risk management practices adopted for government funded affordable housing projects in Ghana?
- How would the developed framework reduce the risk associated with affordable housing projects in Ghana?
- What are the ways of effectively managing risks associated with government funded affordable housing projects in Ghana?

1.5 Significance of the study

The study provides practical and theoretical insight into the internal and external risks of construction firms, with specific reference to the government-funded affordable housing projects. This can serve as a baseline upon which risk aversion and risk management strategies can be built within the context of government-headed construction projects. It can also serve as a generic context within which construction firms can operate and achieve their project objectives. The risk management strategies examined in this study can uncover the diverse techniques of managing risks and the measures which are taken to overcome risks. Such knowledge cannot enlighten contractors on options they might not have previously considered but can also serve as impetus to explore newer ways and adaptable strategies of managing risks.

Theoretically, the study tests the use of block maxima concepts of risk management as against peak-over-threshold models, or a mixture of both approaches. Analysing the stakeholders' perspectives of risk management could help in the identification of mismatch and similarities between theoretical convictions about risk management and the actual practices in the construction industry. The challenges that may be identified could also be known to assist in the proper redress of issues that may reduce the effectiveness of risk management in construction projects. The study

is exploratory and thus, adds new knowledge to the existing body of literature on risk management in construction. The study also suggests further research areas to tease out research interests into future studies within the academia.

1.6 Methodology

In carrying out the design of this survey, the methodology used is the quantitative method. This was initiated through secondary data obtained through textbooks, journals, previous research works and the internet, structured questionnaires were administered to site managers scheduled to be on site. The study only involved the Borteyman, Koforidua and Kumasi government funded affordable housing projects, which included a total of 159 site managers. Analysis of the gathered data was done with the help of Statistical Package for Social Sciences (SPSS) computer software and Relative Importance Index (RII). This helped to evaluate and analyse the results, from which conclusions and recommendations were done.

1.7 Scope of the study

The study covers the affordable housing projects at Asokore Mampong in Kumasi, Koforidua and Ningo - Prampram in Accra. The site managers responsible for the execution of the government funded affordable housing projects in Ghana was the focus. The study specifically concentrates on the particular risks associated with government funded affordable housing projects in Ghana; the risk management practices adopted by the various stakeholders of government funded affordable housing projects in Ghana, risk management framework for government funded affordable housing projects in Ghana; and recommendations for improving the

management of risk associated with government funded affordable housing projects based on the study findings.

1.8 Organisation of the study

This work is organized into six main chapters. The Chapter One consists of the introduction which deals with the background to the study, statement of the problem, research objectives, and research questions, scope of the study, significance of the study, and organization of the study. Chapter Two reviews theories and concepts, which are related to the study. It presents theoretical and empirical perspectives of risk management and its effects on construction projects. The conceptual framework that guides the study is also discussed in the second chapter.

Chapter Three focuses on the research methodology. It presents the research approach, research design, population, sample size and sampling technique, data collection, validity and reliability of the study, data analysis and ethical consideration of the study. Chapter Four presents the findings of the study. Chapter Five discusses the findings of the study and Chapter Six highlights the summary of the major findings, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews theoretical and conceptual issues for the development of a risk management framework for the construction industry. It discusses topical and empirical findings within the context of risk management in the construction industry. The conceptual issues reviewed are synthesised with the theoretical and empirical review into and the conceptual framework for the study.

2.2 Contingency theory of risk management

Contingency theory is underscored by Fielder's (1964) seminal work on leadership styles and the factors that account for effective leadership. Fielder (1964, 1986) theorised that there is no best way to organise a corporation, to lead a company, or to make decisions (Gunhan & Arditi, 2007). Instead, the optimal course of action is contingent or dependent upon the internal and external situation to which uncertainties are central. Contingent leaders, therefore, effectively applies their own style of leadership to the right situation.

According to Ritchie and Marshall (1993), the contingency theory aims to calculate the probability of existence of relationships between specific elements in the environment of organisations and identifying various organisations' responses to these elements in order to provide guidelines for other organisations with similar environmental influences. Therefore, the aim of the theory is to develop organisational-specific frameworks applicable to specific sub-sectors of an industry. Ranasinghe (1994), similarly, indicated that contingency theory aims at improving

organisational effectiveness by responding to uncertainty in performance and removing or decreasing the negative outcomes of unforeseen events. Therefore, the contingency theory is one of managing uncertainties, which is the fundamental factor of risks in the construction industry.

The central argument of the contingency theory is that there isn't 'one best way' for managing risk, but rather there is 'one most appropriate' approach for each specific situation. Therefore, the technique for solving any problem is dependent on the specific context of the problem. Longenecker and Pringle (1978) used the term 'contingency' to denote the influence of the environment (external source of risk) on operations in the construction sector. From the notion of contingency theory, Mikes and Kaplan (2014) theorised that risk management also vary according to the nature, intensity, and scope of risks, just as risk management also varies by type of organisation and the sector of the firm where the risk is prone or endemic. Therefore, a contingent theory of risk indicates that effective risk management framework is a function of appropriate strategies in response to the specific organisational and industry contexts.

Schoech (2006) established that the contingency theory attempts to relate management frameworks, such as a decentralised or unilateral approach to the behavioural context of the risk – for example whether the risk is internally or externally generated. Schoech (2006), therefore, argued that while the risk management approach could be generically adopted by firms, the specific context of the risk exposure would determine the detailed application of the risk management framework. Based on Carlisle's (1976) risk management concept, Schoech's (2006) developed a contingency-risk management framework (Figure 2.1), which presents the centre circle as the organisation or the agency of interest whereas all the factors

within the circle depict the divisions within the organisation where risk exposures might occur.

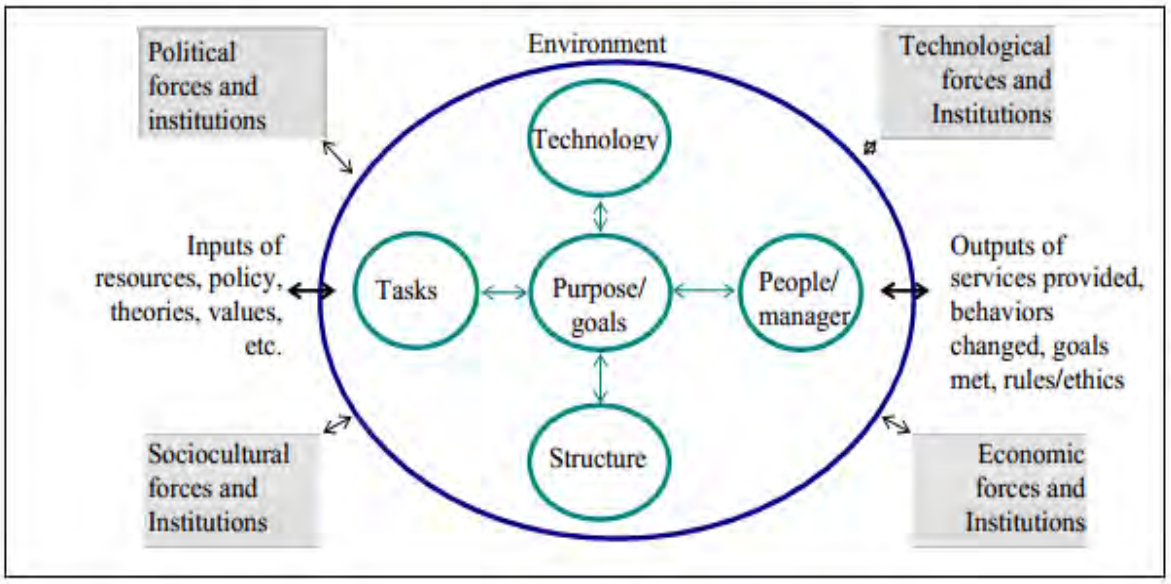

Figure 2. 1: Contingency theory of risk management
Source: Schoech, 2006

The area outside the circle, but within the rectangle denotes the possible sources of risk exposure from the external environment. The model centrally argues for risk management processes to be tailored to specific context of the risk exposure. This forms the fundamental rational for this study to develop a risk management framework, which is construction-industry-specific. Kast and Rosenzweig (1973) pointed out that the theory does not ignore universal principles for management, but rather argues for the uniqueness of each management situation. In this case, it is proposed that a middle ground between universal principles and unique frameworks exist, in which universal principles are used together with unique specifications of the current situation for the most appropriate framework of risk management (Gong & Tse, 2009; Longenecker & Pringle, 1978). Therefore, within the context of construction management, the choice between block-maxima (extreme value theory) and peak-over-threshold (POT) models becomes a matter of contingency. Thus, the

pertinent questions relate to whether the specific organisational context supports total risk avoidance proposed by block maxima model or whether a peak-over-threshold model is possible, in which risks are kept under a specified threshold, beyond which they are classified as high and unsustainable (McNeil, 1999; Coales, 2001).

2.2.1 Critiques of the contingency theory of risk management

The contingency theory has been criticised by authors like Galbraith (1973) and Schoonhoven (1981) on the ground that it lacks clarity. These authors argued that Thompson (1967), a contingency theorist, suggested that a particular structure should be appropriate for a given environment, but he failed clarify the specific form of the interaction intended by the contingency theory.

Hahn (2007) also criticised the theory that, its fundamental logic acknowledges intuition and judgment as only tools available for management, but discounts the value of previous knowledge. However, Noor and Tichacek (2009) argued that the criticism is contradictory in itself. They raised questions regarding the possibility of managing risks by 'judgment' without prior knowledge and experience. While the theory has been criticised for overlooking similarities in different cases, Ashour (1973) has argued that the theory rather emphasises the uniqueness of each in order to justify why the decisions may differ in each situation. The rationale is that if each project is totally different, learning cannot be taken from one project to another. Therefore, it is based on the experience, knowledge, and available information about the new project that one can make decisions on developing appropriate and effective strategies for managing the project and associated risks.

Donaldson (2001) also criticised the theory on the grounds that although organisations can predict their contingencies, but the contingencies themselves

change, which renders a contingency approach ineffective. In response, Noor and Tichacek (2009) asserted that as organisations attempt to forecast, they decrease possible operational errors and risks, which leads to performance improvement, relative to what it would be if it were not to forecast contingencies.

2.2.2 Applying contingency theory to risk management in construction

Contingency theory recognises that there is a range of contextual variables, such as external environment, technology, organisational structure and size, cost, culture, people involved, supply chain, and strategy, which work alone or together to influence on construction projects (Gong & Tse, 2009). According to Ghahramanzadeh (2013), a frequent outcome of a construction project is variation that may lead to adverse impacts on time, cost and quality. Therefore, utilising contingency theory in projects is useful for mitigating these variations that arise later, through organisational learning, which uses past experiences and applies them to current situations where possible.

Some studies have established that in construction, contingency covers an estimated value of the risks, which are not covered by contract terms or insurance, but may be encountered during the project's implementation (Blok, 1982; Smith & Bohn, 1999; Serplla et al., 2014). The practical way, according to these studies, is to add a fixed value of 5-10 percent of total costs to be added to project cost as the contingency cost. Other studies, on the other hand, propose 10 percent additional contingency value of project cost (Flanagan & Norman, 1993; Ghahramanzadeh, 2013; Gunner & Skitmore, 1999; Ling and Boo, 2001; McCaffer, 1976; Morrison, 1984).

Hillson and Murray-Webster (2004), however, contended that given the complicated nature of construction projects, the common traditional practice of

allocation of a fixed percentage (5% to 15%) of the estimated budget or the contract value as the contingency may not suffice. This further makes it imperative to manage risks, not from a generic purview, but tailored to specific construction projects.

Moreover, there are other factors that contingency allocation is dependent on. Ranasinghe (1994) mentions that the attitude of involved people towards risk (risk averse, risk neutral, risk taking), the expected return, how well the scope of the project is defined at the time of cost estimation, the level of risks on a project, organisation's state in relation to available work, the type of contract chosen for the project, the economic situation of the country in which the project is taking place conditions the contingencies of risks. Figueiredo and Kitson (2009), therefore, advise that contingency estimation should be considered as one part of the risk management process and the contingency plans should be balanced between general and specific approaches to cover the impacts of risks, but not to exceed the needs of the project.

2.3 The concept of risk in construction projects

Many early and contemporary studies have conceptualised risk to include to the probability of losses occurring (Bernstein, 1996; Carter & Doherty, 1974; Flanagan & Norman, 1993). For example, Popva-Clark (2011) also maintains that risk is the potential that a chosen action or activity, including the choice of inaction will lead to a loss or an undesirable outcome. Calycamp (2012) emphasised that any concept of risk is built on fundamental concepts of chance, likelihood, or probability, and that the probability concept in risk is conceived as a combination of frequency-based calculation and a degree of belief. Thus, in any field or business, risk is constructed as an objective structure-agency phenomenon that influences the possibility that a target or goal is achieved.

Jones (2006) elaborately explained a risk as the probable frequency and probable magnitude of future loss. In this concept, risk is seen as a probability, which refers to the continuum between absolute certainty and impossibility. Risk is also addressed as both a frequency and a magnitude component, which suggests that the frequency of the risk can have relations to the magnitude and probability of incurring a future loss (Jones, 2006). Thus, in spite of significant differences between field of inquiry and application, risk is generally defined in probabilistic terms. Risk is also positioned at the intersection between achievements of instrumentally-constructed mechanisms to achieving project objectives and the likelihood of failure.

Based on the ISO 31000:2009, Hopkin (2012), on the other hand, conceptualised risk, not in terms of probability of loss, but the effect of uncertainty on objectives. Thus, Hopkin (2012) established that a risk is generally the probability of an unpredicted event to cause an unwanted or desired effect. However, this has been criticised an unnecessary attempt to alter a universally understood word in a way that causes considerable confusion (Alesin, 2001), and that as always, the word risk should be used to refer only to undesirable possibilities (Kindinger & Dardy, 2000).

Risk is an inevitable phenomenon in an industry as dynamic as construction, irrespective of the size of the project. For example, Smith (2003) found that the construction industry is subject to more risks because of distinctive characteristics of construction such as financial intensity, complex procedures, lengthy duration, offensive environment and dynamic arrangements of organizations. Zou et al. (2006) also emphaised that in construction, decisions including the scope of the project, the quality standards, time, purchases and costs, communication channels and the contract management options vary from one project to the next. Specific to the construction industry, Akintoye and Macleod (1997) defined risk as a variable in the process of a

construction project whose variation results in uncertainty as to the final cost, duration, and quality of the project. Due to construction projects' complexity and uniqueness, not only does the number of existing risks invariably go beyond those found in other industries, but the risks also change from one construction project to the next (Palencher, Heath & Hocke, 2010).

Several studies have identified the factors, which affect the level of risks in the construction industry to include the market, level of competition, size of the project, political and economic variations, and expertise of stakeholders (Flanagan & Norman, 1993; Akintoye & MacLeod, 1997; Smith, 2003; Smith, Merna & Jobling, 2006). There are, however, arguments regarding the degree of risk in different phases of a construction project. Studies including Hayes, Perry, Thompson and Willmer (1986), Godfrey (1996) Chapman and Ward (1997), as well as Hassanein and Afify (2007) agree that the greatest degree of risk exist in the earliest phase of the project when available information about the project is the least; that is at the conceptual phase. However, Wang, Tiong, Ting and Ashley (2004) argued that risks of construction projects increase as the project progresses and this illustrates that each phase of the construction project includes more risks than the previous one. However, Ghahramanzadeh (2013) counter-argued that this greatly depends on the type of the project, the type of the contract, and type of the risks.

A broad classification of the types of risks in construction, as indicated by Flanagan and Norman (1993) includes pure/static risks, which are relating only to potential losses with no potential gain, and dynamic/speculative risks with possibility of potential gains as well as losses. Smith and Bohn (1999), conversely, classified risk into internal and external risks. They defined internal risks as the ones generated inside

the project and more probable to be controlled whereas external risks are originated outside of the project and therefore mostly not controllable.

From yet another perspective, Smallman (1999) categorised construction risks into direct and indirect risks, whereby internal risks include human, organisation, and technological (HOT) risks and indirect risks cover regulatory, infrastructural, and political (RIP) risks. Ghahramanzadeh (2013) compared and found similarities between Smith and Bohn's (1999) classification of internal and external risks and Smallman's (1999) concept of direct and indirect risks, as both classifications present the extent to which the risks are specific to the project.

Hillson and Murray-Webster (2004) maintained that risk can be categorised into epistemic risks, aleatory risks, dynamic risks, and static risks. An epistemic risk, according to Hillson and Murray-Webster (2004), is more related to a lack of knowledge about matters having an influence on the outcome. Sohizadeh, Hassanzadeh, Raddum and Hole (2011) also note that the lack of information may result from lacking the essential knowledge or using the wrong methods and tools to identify or assess risks. Thus, epistemic uncertainty may be described as an unknown event from an unknown set of possibilities (Sohizadeh et al., 2011). An aleatory risk is a risk that could be regarded as random, estimated with probabilities and consequences to a set of possible known outcomes, but still, in the end, with a random outcome. In construction, Kishk and Ukaga (2008) maintain that epistemic risk is introduced whenever assumptions are made about the project. Such assumptions are made due to incomplete knowledge of the environment to be absolute certain. Proske (2008) therefore asserts that risks must be seen in terms of the acceptable rate of losses, since alaetory uncertainties can always lead to some level of losses.

Adams (2008) also categorised risks into subjective and objective. Subjective risks are qualitatively identified based on the experience and knowledge of the analyst, whereas objective risks are quantitatively established through calculation of their impact and likelihood. Adams (2008) believes that most of the construction project's risks are subjective because there are not sufficient historical data for their quantitative analysis and should be analysed according to analyst's judgment. The PMI (2004) established that construction-specific risks can be categorised into technical risks, organizational risks, project risks and external risks (TOPE risks), whereas Wiguna and Scott (2006) opined that in industry-specific risks in construction cover economic and financial risks, external and site condition risks, technical and contractual risks, and managerial risks.

Al-Bahar and Crandall (1990) establishes that risks in construction can be categorised under six thematic areas, which are natural disasters, physical risks, financial and economic risks, political risks, design risks and construction related risks. According to Adams (2008), some of the risks are associated with the construction process are fairly predictable or readily identifiable while others may be totally unforeseen. For example, acts of God or natural disasters, such as floods and earthquakes may be not be as predictable or controlled as other types of risks, such as theft, inflation, design and other pollution. However, these risks have implications for procurement, as they may increase costs, damage, changes in project design, or equipment failure.

Zou et al. (2010), on the other hand, identified fifty-one construction risks, but noted that twenty of them were the major risk factors, which could be classified under five broad thematic areas of cost, time, quality, environment and health. Doloi (2009)

also classified risks into eight ways: Technical risk, managerial risk, resource risk, productivity risk, design risk, payment risk, client risk and subcontractors' risk. They also identified several risks subdued under these broader eight categories. Laryea (2011), on the other hand, identified tight project schedule, design variation, excessive approval procedures and high performance/quality expectations as the top five construction risks. He asserted that general safety, inadequate site information, disputes, price inflation and noise pollution were the bottom five construction related risks.

Jean-Lou, Kang, Kim and Park (2011) note that construction risks are mainly related to contractors, clients and designers, with few related to government bodies, subcontractors/ suppliers and external issues. These risks are also interrelated in such as way that a risk in one classification can cause impairment in the project completion. In this respect, Mumtaz, Kaminky and Krivtsov (2011) maintain that construction risks spread through the entire project life cycle and many risks occur at more than one phase, with the construction stage as the most risky phase, followed by the feasibility stage. Thus, Rahim, Hamid, Zaimi, Majid, and Singh (2008) suggest an integrated approach to identify potential risks in time, and to make sound preparations for carrying out safe, efficient and quality construction activities under a well-structured risk management programme.

Risks, irrespective of their type, should be managed in order to decrease or remove the negative outcomes and discover the opportunities at the earliest chance for maximising the benefits realised from them (Oladinrin, Olatunji & Hamza, 2013). At the outset of a project, all risks lie with the client but depending on the selection of the procurement system and the contract for any construction project, the risks may be transferred to other parties than just the client during the project. The impacts of

risks, in terms of frequency and intensity, can therefore vary based on the procurement option and the type of project (Noor & Tichacek, 2009; Oladinrin et al., 2013).

2.4 Types of Risk in construction projects

Risks in construction have been classified in different ways. Tah, Thorpe and McCaffer (1993) categorized project risks into external and internal risks and developed a fuzzy model for contractor's risk assessment at the tender stage. External risks are those that are prevalent in the external environment of projects, such as those due to inflation, currency exchange rate fluctuations, technology change, major client induced changes, politics, Climate, Weather Condition and major accidents or natural disasters. They are relatively non-controllable and so there is the need to continually scan and forecast these risks and in the context of a company's strategy. Similarly, internal risks are relatively more controllable and vary between projects. These internal risks cover uncertainties due to labour, plant, material and subcontractor, resources and the site conditions. Consequently, many researchers identified several risk factors and they are classified into different types depends on the nature of risk such as Physical, Environmental, design, Financial, Contractual / legal, Construction, Political, Management, Natural hazards, Safety and Delay risk (Mustafa, 1998; Dey, 2002; Wiguna and Scott, 2006; Goh, Abdul-Rahman & Samad, 2013; Akincl & Fischer, 1998; Razakhani, 2012).

2.4.1 Financial risks

Financial risks categorised by Edwards and Bowen (1998) include interest rates, credit ratings, capital supply, cash flows, and rentals. Dada and Jagboro (2007) in their study of the impact of risk on project performance identified finance as one of

the main risk factors; however, the emphasis of that study was on building procurement. Hassanein and Afify (2007) also identified financial risks as one of most significant relevant to construction contracts within Egyptian context. Within the Ghanaian context, a study by Agyakwa Baah (2007), on stakeholders' perception of causes of delays on construction projects also found that delay in payment as the major cause of delays on construction projects.

2.4.2 Resource Risks

Risk is a risk factor that can serious affect the progress of any project. Defective materials arise when there is a considerable degree of incompetence on the part of the contractor's supply chain management. Risk factors such as the shortage of staff, operatives, materials or plants can arise and prevent the stakeholders from achieving the project objectives (Lester, 2007). In Ghana, finding labour for a project is not a problem, but plants and equipments are a major problem for most construction organisations especially the local contractors. Three resource risks are adopted in this study, namely 'productivity of labour and plant', 'availability of labour and plant', and 'defective materials and material shortage' (Tah & Carr, 2000).

2.4.3 Technical risks

Manelele and Muy (2008), untested engineering, technological or manufacturing procedures entail some level technical risk that can result in the loss of time, resource, and possibly harm to individuals and facilities. Technical risk is measured as an expected value derived from prior experience that led to undesirable results. Technical risks categorised by Edwards and Bowen (1998) include design

failure, equipment and systems failure, estimation error, collision and accidents. Manelele and Muya (2008) study within Sub-Saharan Africa also identified lack of technical advice as one of the project initiation risks. Within this study, the variables included in the technical risk factors are 'design changes' and 'construction methods'. It is worth noting that the Santoso, Ogunlana, and Minato (2003) classification of technical risk was further sub-divided into material, equipment, technique, construction process, construction site, and ground condition.

2.4.4 Economic risks

Economic risks categorised by Edwards and Bowen (1998) include material supply, labour supply, equipment availability, inflation, tariffs, fiscal policies, and exchange rates. Manelele and Muya (2008) in their study of risk identification in community-based projects also identified some economic risks under the theme of material procurement risks that included unavailability of non-local materials in local shops. Similarity, Lowe (1987) in his study of cash flow and the construction client identified inflation and interest rates among the economic factors. On the other hand, Santoso et al (2003) which identified, ranked and categorised high potential risks in high rise building construction in Jakarta included the 'inflation', and 'exchange rate fluctuation' risk events under the theme of financial risks, therefore even though the general classification of risk might be different according to other studies.

2.4.5 Environmental risks

Three variables were considered under this category namely; 'weather conditions', 'ground condition and contaminants' and 'site conditions'. Wang *et al.* (2004) study which sought to identify and evaluate risks and their migitation measures

identified twenty-eight critical risks and environmental protection was ranked as the least critical risk that can affect construction projects in China. According to Tchankova (2002), the environment's influence on the people and people's influence on the environment are very important aspects of this source of environmental risk.

2.4.6 Operational risks

Managerial risks categorised by Edwards and Bowen (1998) include productivity, quality assurance, cost control, and human resource management. This study also acknowledges that projects rely on clients, consultants, contractors amongst other stakeholders. Aje, Odusami and Ogunsemi, (2009) in their study of the impact of construction contractors on project performance identified management capability as having the significant impact. Similarly, Hassanein and Afify (2007) which aimed at identifying the most significant risks relevant to construction contracts also found limited project management experience among the Egyptian contractors as one of the barriers to the identification of risk. Interestingly, this sample also included international contractors who were able to identify the relevant risks than their Egyptian counterparts. Incompetent labour as one of skilled labour risks as identified by Manelele and Muya (2008) could also be grouped under the human resource management sub group of the managerial risk factor as categorised by Edwards and Bowen (1998).

2.4.7 Government and political

According to Lester (2007), internal politics inevitable occur in all organisations and these manifests themselves in different stakeholder's opinions and attitudes in the organisation. Tchankova (2002) also observed that the ruling party of

a nation can affect organisations in many ways. He added that the difference in the ruling system raises different attitudes and policies towards businesses. The study by Harinarain, Othman, and Pearl (2008) aimed at identifying and quantifying the risk sources to the contractor also identified the government authorities as a source of risk to the contractor in particular when dealing with regulations. Two factors are included under the government and political theme, and these are 'change of government' and 'change of government policy' (Harinarain, et al., 2008).

2.4.8 Relationship risks

As demonstrated by Lester (2007), relationships to the project by stakeholders can vary from very supportive to antagonistic but he noted that depending on the field of influence, it must be considered and managed. Tchankova (2002) opines that changes in people's values, human behaviour and state of social structure are another source of risk. Three relationship risks are included within this category namely; 'poor communication amongst project team', 'lack of commitment', and 'organisation and co-ordination' (Tchankova, 2002).

2.4.9 Security

Accidents and injuries, theft on site and vandalism are the three risk factors that were placed under the composite 'security' risk factors. Health and Safety is an area that the Ghanaian construction industry needs a lot of improvement in. Due to the fact that measures are put not in place, a lot of accidents occur on various sites in Ghana. Helmets, working gloves, reflectors, steel boots, amongst other protective wear are not found on most construction sites in Ghana because the organisations find

it expensive to provide for all workers and do not feel the impact of this risk when injuries and death occur because labour is always readily available. This is evidenced by the fact that the Ghanaian construction industry accounts for the highest rate of occupational deaths compared with other industrial sectors (Kheni, Dainty & Gibb, 2008). Theft on sites is another issue in Ghana. The workers as well as outsiders try to steal materials, tools and equipments. When this happens, it creates problems for the organisations because they have to purchase these items all over again. Although vandalism is very destructive, it does not generally occur on sites in Ghana.

2.4.10 Legal risks

Legal risks refer to damage or any loss incurred to a business due to negligence in compliance with laws related to the business. It can be encountered at any stage of business proceedings. Types of risks such as compliance risk, regulatory risk, operational risk etc. may contribute to the term 'legal risk. Legal risks categorised by Edwards and Bowen (1998) include contract clauses, regulations and codes. In a study conducted by Tchankova (2002), he found that the legal system creates risk by disparity of current or new laws to the environment. Two legal risks are adopted in this study, namely ‘contract flaws’ and ‘local laws’.

2.5 Impacts of risks on construction project

The presence of risks in construction projects requires that preventive measures must be put in place to militate against the possible negative impacts of the risks on the construction project (Akintoye & Macleaod, 1997). Adams (2008) established that the impacts of risks or the threat of risks leads to the administration of certain preventive, control and responsive measures which are economic, socio-

political or relational. The issue of economic risk factors is of paramount importance given that the construction industry faces numerous challenges that the places it at risk of economic crisis. There are issues of price controls, exchange rate volatility, and internal crisis, such as cost overrun, which make budgeting a difficult activity in the construction industry (Berggren, 2005). The relevance of these factors lays in the fact that the industry deals with huge investments and a slight increase in cost percentages could amount to hefty amounts in actual currency value. Figueiredo and Kitson (2009) emphasise that price fluctuations and high inflation have contributed to considerable instability in the industry.

It can also be argued that financial risks are vital to organisations and the economy as a whole (Gunhan & Arditi, 2007). Freezes on capital, delays in payment, bankruptcy of stakeholders or financial failure all create difficult situations for firms carrying out projects. As a common practice, contingency costs are added to budgeted costs to cover unexpected price increments, inflation, unfavourable exchange rates that might increase the cost of exports, accident claims and other unexpected expenses (Hopkin, 2012). This requires accurate forecasting based on past experiences or econometric models. Thus, the threat of risks leads to additional budgets, which may strain the client of financial resources.

The socio-political risk factor may occur in the form of change of government and change in government policies, which in Hubbard's (2009) opinion are ever-present risk factors, especially for public works. Therefore, the inference to be drawn is that most government projects and pending payments are put on hold when a different ruling party comes into office (Davies & Tomasin, 2006). This situation creates problems for the industry because monies are locked up and, therefore, organisations are not able to take on other private jobs. In terms of the relationship

risk factor, it is worth noting that effective communication is vital to project success and must be established early in the project (Chileshe & Yirenkyi-Fianko, 2011). The project objectives must be clear to all stakeholders and if necessary community sensitisation might be needed to gain community support for the project, especially for public works. Thus, the threat of relationship risk might in the end lead to additional pre-project execution time to build a solid relationship and understanding among the major stakeholders of the project, as well as the beneficiary community (Claycamp, 2012).

Another risk factor is that of resources. In developing African countries, finding labour for a project is not a problem, but factories and equipment are a major problem for most construction firms, especially local firms (Chileshe & Yirenkyi-Fianko, 2011). One major challenge mentioned by professionals who work for local firms was that local construction organisations are gradually dying out because foreign firms carry out almost all the projects, leaving very few projects for local firms (Oladinrin et al., 2013). The threat of out-competition by foreign firms also becomes a major factor for local firms. The impact can only be assuaged if local firms become as resourced as foreign firms, and operate in a structure that out-competes or at least is at par with the structure of foreign competitors (Baradan, & Usmen, 2006).

2.6 Risk management in construction industry

Risk management is the systematic process of identifying, analyzing and responding to projects risk. It includes maximizing the likelihood and the impact of positive events and minimizing the likelihood and the impact adverse events to meet the project objectives (Augie & Kreiner, 2000). The possibility of foreseeing a problem is risk while the act of gathering human resources together to achieve set objectives efficiently is management. It involves identification, assessment, analysis, managing and

avoidance, and reduction of risk the risk which gives higher loss are managed whenever there is a prior format, while the ones with less possibility of occurring are latter handled, but this is a difficult task to fulfil and highly misunderstood.

According to Agyakwa-Baah (2007), the characteristics of the threat to risk is the first management process, next is evaluating its weakness to certain assets in order to determine the risk, that is taking into consideration the expected possibly of risk occurring of some assets. Furthermore, the methods of reducing risks are identified and possible solutions are taken to risk its influence. Normally, there are lot of time wasted trying to tackle risks but if it is properly assessed and prioritized it will not happen. Organization and planning satisfies risks identification at an early stage, continual tracking it and evaluating and re-evaluating, actualization of actionable remedies, communication and coordination, according to (Kremljak, 2004). He structured risk management practices into four classes namely, planning, assessment, handling and monitoring. (Perry & Hayes, 1985) affirmed to this theory and added that in addition there should be identification of advantageous alternative action plan, increase confidence and improve chances of success in order to have a successful manageable risk. A simplified framework for risk management identified four (4) steps with many different projects risk management process and tools used. They involve:

- Identification of risks
- Quantification of risks
- Planning for risks
- Monitoring and control of risks

As per Chileshe & Yirenkyi-Fianko (2011), the four steps must be effectively and continuously followed in order to manage project risk. At each stage or whether there are deviations, it is important for those steps to be carried on from time to time at different levels. Managing risk is the most difficult part of project management and

the project team should have recognisable and identification skills to trace the consequences of undertaking a particular project. However, in the construction industry where designing and selection of construction method are influential, it is very essential to identify risk at an early stage of the project. Risk assessment and management practices (RAMP) are well organized and implemented within the developed counties; however, there are insufficient quantities of studies which examined risk management practices within the West African context, and focusing on the Ghanaian construction industry. Lack of tools and awareness of appropriate techniques are one of the possible reasons for low significance of risk assessment and management practices within Ghana.

2.6.1 Risk Management Planning

The act of creating an organized and detailed risk management is risk planning (Smith & Merritt, 2002). This involves the practices, procedures, strategy development, setting of goals and objectives, control activities, resource identification etc. this initial stage of the process describes how risk will be managed and description of the management components. Products projects and process must have a much laid down plan to manage risk (Raftery, 1999).

2.6.2 Risk Identification

Risk identification is a process for uncovering any risks that could potentially affect a process. This step is of considerable importance as other processes such as risk analysis and response can only be undertaken on the potential risks that have been identified (Oluwaseyi, 2012). Risk identification is a simple but difficult task as there are no absolute procedures that may be used to identify risks in a project. Managers

often rely heavily on their experience and on the insight of other key personnel involved in the process (Oluwaseyi, 2012). Depending on the process documentation available and the nature of the process, a variety of considerations may prompt risk discovery.

Identification of potential threats follows the first step of risk planning, discovering and out ling those elements that affect the objectives of an organization (Raftery, 1999). In addition to identifying the sources of risks and it is when the source of risk is identified that the consequences of that source are known. Investigation the consequences of sources or the problem it causes is very important under this very risk management process. Identification of risk reveals two types of risks (controllable and uncontrollable). Controllable are voluntarily undertaken and its outcome is part of the direct control of a project while those risks which do not influence a project is termed as uncontrollable risks as observed by Chege and Rwelamila (2000). The identification the constituents of risks determines which risks are likely to affect the project and documenting the characteristics of each. Risk identification should be performed on a regular basis throughout the project, it is not a one-time event according to (PMI, 1996).

2.6.3 Risk Assessment

Managing changes has led to the introduction of techniques for risk assessment as a major part of the planning process. Risk assessment concentrates on quantifying identified risks by using statistical analysis, since the identified risk in most cases can be either quantitively or subjectively assessed factors (Lockyer & Gordon, 1996). The damage or loss evaluates the extent of a risk effect, and also involves an analytical relation of risks to life cycle. Risk assessment leads to implementation of plans, so it

is only prudent that the most refined decisions are valued at this very stage. The level of risk should be estimated and a better understanding drawn from the identification of the sources, causes and nature of risks. Assessment of risk involves developing a performing supporting analysis, probability consequences scale, determining probability, documentation of results and significance levels or ratings. It is a common practice to compare the risk analysis with the criteria for risk to determine whether the risk level is tolerable for the project or not (Flanagan & Norman, 1993). Estimation of risk by identifying undesired events; the likelihood of occurrence of these events and the result in case of occurrence or consequences are the primary objective of assessment. However, the main problem has to do with the determination of possibility of occurrence due to lack of statistical information for some occurrences (Flanagan & Norman, 1993).

2.6.3.1 Risk Analysis

Risk analysis techniques are grouped into qualitative and quantitative methods (Oztas and Okmen, 2004). The potential risks are analyzed using a qualitative or quantitative method to evaluate their potential impacts (Zou et al., 2010). Another way of defining risk analysis is estimating what could happen if an alternative action or response were selected (Smith, 1999). According to Gray and Larson (2003), analyzing risks could be qualitative or quantitative. Qualitative analysis represented in experts opinion and it could carry serious errors based on the respondents or the decision maker judgment skills. On the other hand, the qualitative method is more reliable and it requires serious data collection and more detailed analysis. To identify the potential risk factors (RF) and investigate their impact on construction projects

completion, a classification that covers all types of presented potential risk factors is needed (Tchankova, 2002).

2.6.4 Risk Handling or Control

This stage discusses how to implement identified techniques in order to overturn known risks. Planning and execution are the core component of this stage, the mind-set is to tackle risk at different levels. The effectiveness of the knowledge of whether there will be decrease or increase correctly identifies risks and reduces the amount of it purposefully. During the other stages of the management process, there might be errors, but this stage of the RMP requires careful execution not to repeat the same the main problem has to do with the determination of possibility of occurrence due to lack of statistical information for some occurrences. errors identified or analysed. Kremljak (2010), identified four ways of handling risk and they are risk avoidance, risk reduction risk sharing and risk retention.

Risk avoidance involves eliminating and stopping any activity or process that may carry risk towards the achieving of goals. Reduction of risk, on the other hand, means reducing the extent of possibility of loss. It is important to find a correlation between negative effect of risk and benefits. The use of technology helps in carrying out this process. The third way of handling risk is sharing through insurance. When a project is insured it reduces the loss burden as another party handles the risk factor of the project. In any case if there is any default the risk will surely revert to the first party. Risk retention concludes the fourth method of controlling risk, according to Kremljak, in situations where the cost incurred in managing the risk far over cedes its negative effects. The approval of losses or gains of a specified risk revolves around

this particular method of risk control and some cases such risks cannot be insured against because of its magnitude.

2.6.4.1 Risk Response Strategies

The Project Management Institute in 1996 highlighted three ways of risk responding in projects: avoiding is eliminating a specific threat by removing the cause. Most at times specific risk can be eliminated as not all risks can be eliminated by project management teams; mitigation is the introduction of new technology or buying insurance, for example, to reduce the expected monetary value by reducing its probability of occurrences; accepting as the name implies is accepting whatever the consequences of the risks might be. Dealing with a lower profit of some activity is passive while developing a contingency plan executable when risks occur is active (PMI, 1996).

There had been suggestions as to how to respond to residual risks by reducing uncertainties by obtaining additional relevant information leading to a re-evaluation of risk impacts. Another school of thought is the elimination of the risk factor through complete or partial re design. There were suggestions of transferring the risk to other sub-contractors and insuring the occurrences of the risk factors. Rizk in 2003 added to the assertion above that a further abortion of these project when the risks are intolerable and no favourable mechanisms could be taken to mitigate the damages. (Rizk, 2003). Four identifiable and discreet appropriate methods of treating construction related risks are avoiding, reduction, transfer and risk retention as buttressed by the findings of similar studies (Akintoyne & MacLeod, 1997; Enshassi & Mayer 2001; Education and Learning Whales, 2001).

- **Risk Avoidance**

Risk avoidance at times is called risk elimination is not a generalized risk response practice in construction industry as the avoidance of placing a bid or the reluctance in project funding, for example, terminate the life of the project even during the earlier days of the project. In a bid to totally eliminate risks in construction industries, the above cited examples are impracticable and lead to delays and cost overruns. A rather constructive approach/condition could be adopted in order to avoid risk. A contractor may tender for a contract with a higher bid, or place conditions on the particular bid, or signing a pre-contract or negotiating a favourable pre-contract condition, for not bidding on contracts that harbour higher risks as observed by Flanagan and Norman in their research conducted in 1993.

- **Risk Transfer**

This risk response practice employs the transfer of risk from one management team to another or from one project to the other. The introduction of insurance premiums in construction projects are beneficial, however, it does not discharge all the identified risks of the project but covers a portion of risks (Tummala & Burchett, 1999). Moreover, the transfer of risk essentially can be done in two ways: transferring the risk from the responsible entity for by hiring sub-contractor on the hazardous projects; and retention of the property or activity but transferring the financial risk through surety and insurances packages.

- **Risk Retention/ Acceptance**

This risk response practice involves an internal management mechanism channelled at reducing controlling risk (Zhi, 1995). Akintoyne and MacLeod (1997)

suggested that, it is conducive when avoiding the risk been handled by a particular company is impossible, there might be a small or insignificant financial loss and the probability of its occurrences are insignificant, making it uneconomical to transfer.

The foreseeable or unforeseeable risks are financed and controlled by the contractor or company and there are two methods devised to retain risk in construction projects. A passive retention method occurs when the contractor performing the work borne all the risks which may occur through ignorance, negligence, or absence of decision. Passive retention method is non-insured. On the other hand, a self-insurance is a deliberate management mechanism devised to handle risks upon making a thorough analysis of the likely losses to be encountered and finding alternative strategies. In 2007, Agyakwa-Baah, identified that risks are mostly handled by construction companies by adding a contingency of 10% to the cost of the project cost to address any risk. Moreover, the importance of the industry is seen in its contribution to GDP and the percentage allocated to construction works in the national budget of Ghana (Agyakwa-Baah, 2007).

Akoi-Gyebi (2009), also noted the contribution of the construction industry ranging from the direct importation of buildings and components to supplemental domestic production and to the use of design and implementation expertise provided by foreign consultants and contractors. He identified other areas of contribution which were within road transportation, as it was the widely available form of transport in Ghana: it carries in excess of 97% of all passenger and freight traffic. Aside linking agricultural production areas with local, regional and national markets, road transportation links all major cities, towns and villages. There has been abundant changeling of funds into the road sector in recent time by Governments with the goal of maintaining or improving the state of the roads. Risk contingencies are a result of

past experiences concealed within the bidding process, according to Mills (2001), and furthers elaborates that contingencies protect the contractor's interests in the event that a risk occurs.

In the construction industry, the simple use of contingency sums to deal with risk is unlikely to encourage more effective management of projects, nor to lead to greater efficiency. Rather there should be a more comprehensive understanding of the nature of risks they encounter, their chances of occurrence and impact on a stakeholder's organization

- **Risk Reduction/ Mitigation**

This is a general terminology used to signify the reduction of probability its adverse on the project. There might lead to an entirely elimination of risk events as observed in risk avoidance. According to Piney (2002), it is only prudent to not stress on the impact of the risk because it becomes unacceptable when the promising effect reaches a level. The adoption of one of these approaches will work in reducing the potential risk impact on a project (Piney, 2002).

2.6.5 Risk Monitoring

Checking on identifiable risks and new risks as well as monitoring of residual risks are expected as the project progresses. This stage of the management process ensures that implementation of risk schedule and evaluation how to reduce it and special reports prepared often to ascertain the possibility of new risks and ways to handle them. This is a life time cycle as well as the project is existent and managers in industries, according to Kremlijak (2010), should have a complete data on future events by providing contingency plans based on the system in question objective

Kremljak (2010). In the developing construction sectors, this phenomenon is common and experimental tools should be tried to bring acceptable solutions. Many research works have been done on risk management practices in construction industry; a common similarity among all the studies is the significant outcome of risks influencing the delivery of a construction project. Chen, Hao, Poon and Ng (2004) identified 15 risk factors on the basis cost of a project. Chen found escalation of material price and inaccurate budget as the highly ranked risk events. Shen (1997) study also revealed eight significant risk events accounting for delay in construction projects using construction professionals as respondents. Shen also suggested that, the most important as of risk is the ability to treat it and constantly monitor how measures are been affected. Tam et al., (2011) also conducted a study in a study with the aim of identifying factors affecting safety dimension of construction performance, the study also revealed management and project managers inability to create the awareness of safety on construction sites, lack of capacity building workshops and managers unwillingness to inject resources in safety related issues. Other studies have been done on risk management on phases of a project to ascertain the prevailing risk factors and their effects on the project objectives.

Uher and Toakley (1999) also studied on the social and cultural issues affecting the implementation of risk management practices on a project life cycle, it was discovered that, there is relatively low risk at the conceptual phase of the project. And according to Abdou (1996), classified risks in construction under financial, time, design phase, contractual, organizational and the construction itself. The signification step in undertaking risk management exercise is risk classifications which involve structuring diverse risks factors affecting a construction project. Perry and Hayes (1985) presented a critical approach in managing risks effectively and divided them

in terms of risks retainable by the three main parties to the project, thus the client, contractor and consultant. They combined a general approach backed by a system showing the levels of the work.

2.7 Risk management framework

A risk management framework encapsulates the structure for identifying and managing risks (Tah et al., 1993). While there are generic frameworks for risk management, Fuertes, Casals, Gangolells, Forcada, Macarulla and Roca (2013) argued that effective frameworks are those tailored to the specific organisational context. In describing the fundamental elements of a risk management framework, Cooke and Williams (2004) noted that the framework captures the organisational intent, the organisational capabilities, the processes of continual improvement, and the measures of accountability.

At the core of the framework lies the risk management approach, which has the potential to reinforce or disrupt the achievement of organisational goals. The framework also captures the tactical and strategic relations that exist between the risk management approach and the organisational characteristics. In a more elaborate framework, the different components of risk management can be disintegrated into individual frameworks. For example, Ceric, Marcic and Ivandic (2011) applied a framework for identifying risks, risk treatment, and risk reporting, which were all enclosed in the overall risk management framework.

According to Broadleaf Capital International (2017), typically, risk management frameworks aim to convey an understanding of the implication of risk exposure to staff and managers. The framework also establishes the structure for planning the day-to-day opportunities for managing risks in a strategic and tactical

manner, and in the same way assists staff to develop and implement risk identification and treatment measures according to the accepted criteria of the organisation and its industrial relations.

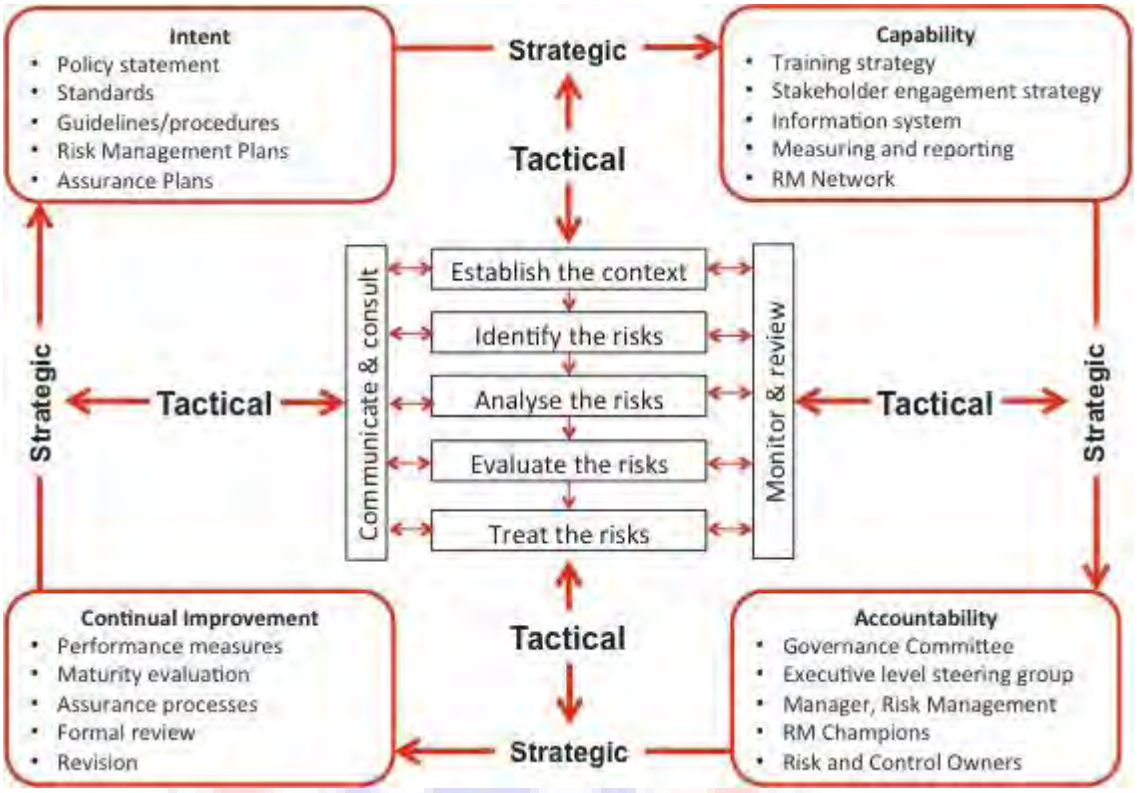

Figure 2. 2: Strategic and tactical components of the risk management framework
Source: Broadleaf Capital International (2017)

The risk management framework is underscored by five major components of risk management; namely establishing the context, risk identification, risk analysis, risk evaluation, and risk treatment (Berg, 2010; Nirenjena & Basha, 2014; Project Management Institute, 2004). Chapman and Ward (1997), on the hand, disaggregated the five components into define, focus, identify, structure, ownership, estimate, evaluate, plan, and manage. Gabel (2010) rather proposed a six-step process of risk management including planning, identification of risk events, qualitative risk analysis, quantitative risk analysis, risk response planning and risk monitoring and control.

The Project Management Institute (2004) emphasised that the planning component defines how to implement and practice the risk management framework's sub-processes. Berg (2010) acknowledged this is synonymous to establishing the context of the risk by taking into consideration the project's dependency on environment, the project size, contractual relationships and its capabilities, as well as the organisational culture, goals, and *risk* management policy.

Risk identification is characterised by isolating the possible risks by breaking down the risk structure and brainstorming the sources, classification and effects of the risks (Flanagan & Norman, 1993; Maytorena, 2005; Berg, 2010). Adams (2008) observed that this is done via stakeholder discussions, review of historical records related to other similar projects, cold eyes reviews, collecting historical information available, and also by conducting a SWOT (strengths, weaknesses, opportunities, and threats) analysis.

Several other surveys conducted among the construction industry show that checklists and brainstorming are mostly used in risk identification to determine matters regarding risk evasion, contract pricing and in assisting the realisation that the job should or should not be attempted (Akintoye & MacLeod, 1997; Uher & Toakley, 1999; Lyons & Skitmore, 2004). Adams (2008) noted that through risk identification, a risk register, containing the risk description, estimated impacts, risk probability, and risk score is the created, and also informs the process in terms of whether to absorb the risk through a peak-over threshold or to avoid the risks from a block-maxima perspective.

According to Oztas and Okmen (2004), the main categories of risk identification covers financial, economic, managerial, legal, design, construction, and environmental risks. They emphasised that, during the risk assessment, the common

practice is to evaluate and rank the risks, with the purpose of prioritising risks for management. Thus, Oztas and Okmen (2004) propose the judgemental risk analysis process (JRAP) model, also described by Osipova (2008) as a pessimistic risk analysis methodology.

Once the risk has been identified, Gabel (2010) and Mumtaz et al. (2011) noted that the next thing to do is to assess the risks. They separated risk assessment into qualitative and qualitative analysis and thus, define risk assessment as the determination of qualitative and/or quantitative value of risk related to a concrete situation and a recognised threat. Quantitative risk assessment requires calculations of two components of risk, which are the magnitude of the potential loss and the probability that the loss will occur (Berggren, 2005), whereas subjective judgment, intuition and experience are used mostly in qualitative risk assessment (Hopkin, 2012).

Quantitative analysis of risks include probability analysis, sensitivity analysis, scenario analysis, simulation analysis, and correlation analysis, whereas qualitative techniques may cover direct judgment, ranking options, comparing options and descriptive analysis (Minassian & Jergeas, 2009; Ranasinghe, 1994). Quantitative analysis is, therefore, based on a simultaneous evaluation of the impacts of all identified and quantified risks and a calculation of the single loss expectancy of an asset (Jean-Lou et al., 2011; Tan, 2002). The single loss expectancy can be defined as the loss of value to asset based on a single security incident. The project team then calculates the annualised rate of occurrence (ARO) of the threat to the asset, which is an estimate based on the data of how often a threat would be successful in exploiting vulnerability (Miller, Guo, Wiedenback, & Ray, 2009). Sohizadeh et al. (2011)

conclude that this makes it possible from a financial perspective to justify expenditures to implement countermeasures to protect the asset.

Gabel (2010) noted that the risk response strategy is the process of developing options and determining actions to enhance opportunities and reduce threats to the project's objectives. It identifies and assigns parties to take responsibility for each risk response, through a risk allocation strategy, which assigns entities accountable to the risk. However, different authors and institutes have mostly focused only on negative impacts of risk and have not suggested any response for the positive impacts (Ghahramanzadeh, 2013).

Berkeley, Humphereys, and Thomas (1991) as well as Flanagan and Norman (1993) categorised risk responses into avoidance, reduction, retention, and transfer, which are found along the block-maxima and peak-over-threshold continuum. The Association for Project Management (APM) (2000) sectioned risk responses into remove, reduce, avoid, transfer, and acceptance, whereas Figueiredo and Kitson (2009) divided risk responses into avoidance, mitigation, acceptance, research, transfer, and monitoring. The Projects in Controlled Environments (PRINCE) (2009) categorised risk responses based on both threats and opportunities as avoidance, reduction, fallback, transfer, acceptance, and sharing.

Risk avoidance involves changing some aspect of the project so that the threat either cannot have an impact anymore or can no longer happen. However, an inadvisable aversion to risk may result in overlooking opportunities for profits, as risk may be associated with benefit (Loosemore, Raftery & Reilly, 2006). Risk reduction is a proactive action taken to either reduce the probability of the event occurring or to reduce the impact of it, whereas fall-back refers to a reactive form of reducing the impact of the threat with no influence on the probability. Transferring risks involves

reducing the impact of risks, mostly only the financial impacts, by assigning the risk reduction responsibility to a third party (Zou et al., 2010). In accepting the risk, a conscious decision is taken for retaining the threat, but the risk can be shared within pre-agreed limits, among the stakeholders of the project (Loosemore et al., 2006).

The PRINCE (2009) indicated that the risk responses for opportunities are to exploit, enhance, reject, and share. Exploiting involves grasping an opportunity to make sure it will happen and its impact will be realised. Enhancing is a proactive action taken to enhance the probability of the event occurring or to enhance the impact of it, whereas rejection is a deliberate decision taken for not exploiting or enhancing the opportunity. In sharing, the stakeholders share the gain (within pre-agreed limits), normally when the cost is less than the cost plan. However, Ghahramanzadeh (2013) criticises that, risks are inherently negative, but uncertainties can have a positive notion, thus, PRINCE (2009) classification of 'positive' risks is fundamentally flawed.

Some studies have found that in construction management, the type of the contract chosen for the project determines the ratio of risk transferred to the involved parties (Davies & Tomasin, 2006; Oladinrin et al., 2013). In fixed price contract the contractor is responsible for majority of the tasks and the risks are mostly transferred to contractor than the client, whereas in the reimbursable contract the client deals with majority of the financial risks (Davies & Tomasin, 2006). In billed rates and turnkey contracts, the contractor is responsible for executing the majority of the phases of the project and client only pays the contractor. Partnership contracts, however, involve a balance in sharing the risks between the parties based on the details of the contract (Akıncı & Fischer, 1998).

According to Gabel (2010), the response to the risks must be monitored and controlled to identify residual risks. The purpose of risk monitoring is to certify that the risk identification, analysis, and response processes are effective. Claycamp (2012) further emphasised the results of the monitoring process require a blend of qualitative judgements and quantitative measures to determine the health of the project. Akıncı and Fischer (1998), pointed out that the requirements for monitoring may include checking the status of the identified risks in the risk registers periodically, evaluating the efficiency of the risk responses used, as well as identifying new risks, assessing them, and developing risk responses for them.

Hillson (2004) addressed the importance of identifying the person(s) accountable for successful implementation of the response action. Berggren (2005) emphasised that such as approach helps in detecting the impact of the response action on achieving the project's objective. The monitoring of the risks is also related to the future performance of the risk management and thus, the results of the risk assessment and effects of the risk response need to be communicated and adjustments made through a change management and/or issue resolution process (Lyons & Skitmore, 2004). The ability to describe the history of the project and how it evolved is essential to developing lessons learned for the future.

Based on these generic risk management frameworks, several other frameworks have been proposed in the context of construction. For example, Figure 2.3 shows the framework developed by Cooke and Williams (2004). They asserted that there are several risks within the construction industry which must be assessed for their potential to cause losses. The criticality of each risk varies from project to project and the risk control measures will also vary within the context of specific projects. They also included the concept of residual risks in their model and asserted

that residual risks can be elusive, and should be inculcated in any risk framework in the construction industry.

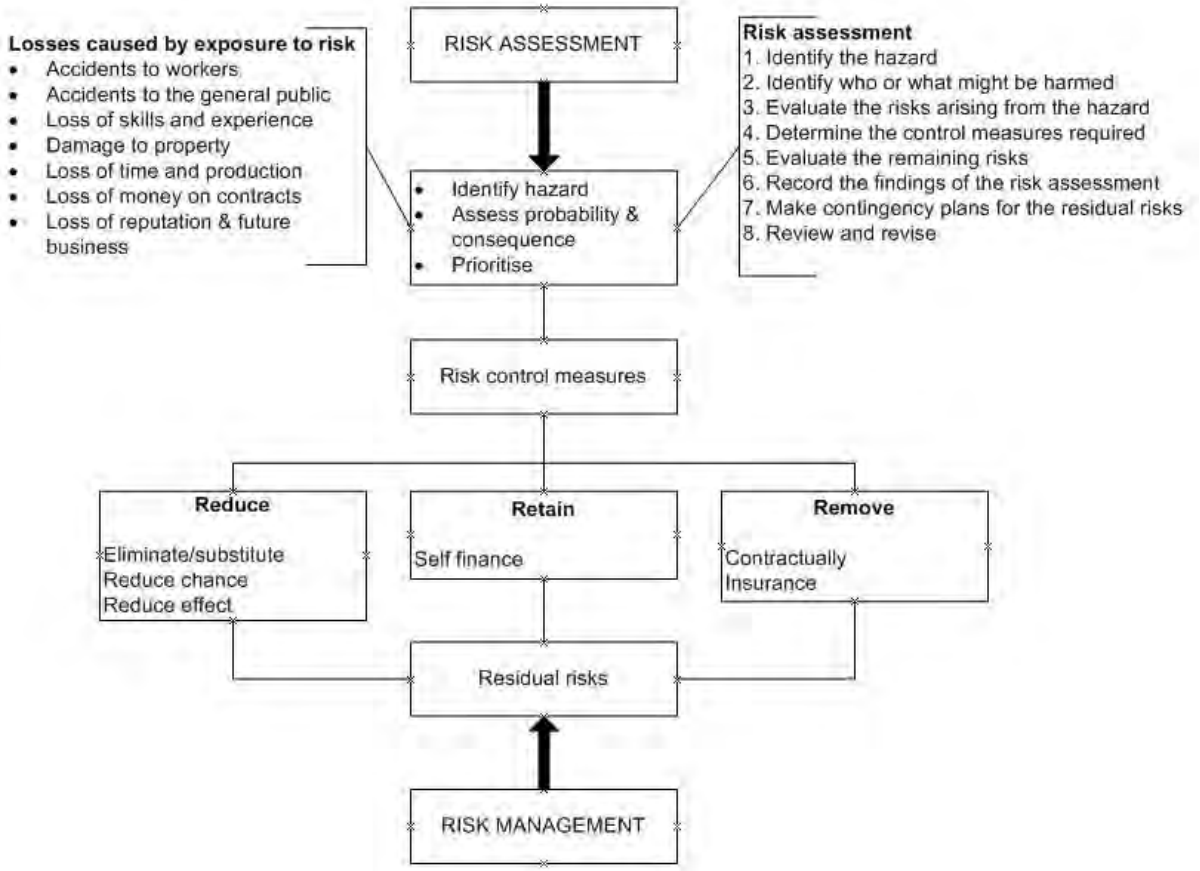

Figure 2. 3: Risk management framework
Source: Cooke and Williams (2004)

With specific reference to the risk response, Ceric et al. (2011) developed the model in Figure 2.4 to exhibit the structure for responding to different categories of risks. Based on their classification of risks as undesirable, unacceptable, acceptable, and negligible, a mix of risk treatments is presented. They established that unacceptable risks are treated by avoidance or by transfer. They proposed risk retention for undesirable and acceptable risks.

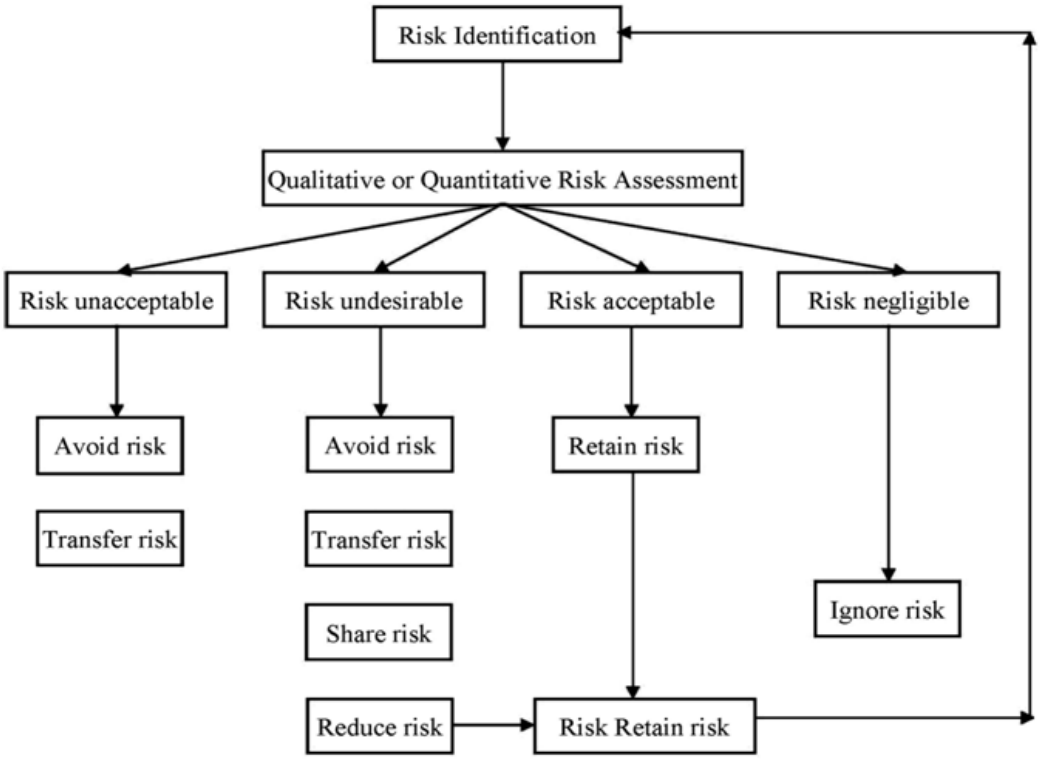

Figure 2. 4: Risk response model
Source: Ceric et al. (2011)

2.8 Validating risk management practices in construction

The process of validating risk management tools conforms to evaluating the effectiveness of the tools in achieving their intended purposes (Oyewobi, Ibironke, Ganiyu & Ola-Awo, 2011).). According to the Project Management Institute (2004), risk management process and practices are of no essence if they do not effectively protect stakeholders against avoidable financial losses, physical injury, and do not achieve acceptable rate of success in responding to risks, in terms of transfer, and risk absorption.

The purpose of validating the effectiveness of risk management processes is to verify if the intended level of risk acceptance and the aims of the risk responses are being achieved (Akıncı, & Fischer, 1998). This implies that there should be some benchmarks for the determination of the effectiveness of the risk responses strategies

and the entire risk management process. In many construction firms, a contingency cost is estimated and added to the actual project value cost. This could be derived from quantitative calculations of the trends in inflationary rates, currency exchange ratios, health claims and injury claims, insurance claims, and other uncertainties that can be quantified in currency terms (Finnerty, 1996; Mak & Picken, 2000; Williams, 2003).

The most prominent benchmark for assessing the effectiveness of risk management processes is the measure of costs, within or beyond the projected costs and contingency costs (Godfrey, 1996). Depending on the contractual arrangement, the contractor or the client may stand the chance of making losses when actual costs exceed budgeted costs (Davies & Tomasin 2006). Thus, an effective risk management process would keep expenditures within forecasts, but not to the detriment of quality of the project or the safety of the workers (Cleland & Gareis, 2006). Cost-cutting in order to keep expenditures within budgeted costs can result in project failure, which is the ultimate risk for any project, whereas over-expenditure reflects misled forecasting on the part of the stakeholders (Potts, 2008). However, since risk management is closely related to the forecasting ability of the stakeholders, it can be concluded that failure to spend within budgeted costs, and thus incurring losses, exemplifies ineffective risk management (Ehsan, Mirza, Alam, & Ishaque, 2014).

Specific indicators, such as the industry-specific injury indices, and firm-specific accident rates and standards, as well as the acceptable limits of rework and related costs can also be adopted as the benchmarks for assessing the effectiveness of risk management practices (Edwards, 1995). Thus, the totality of safety training, planning and execution of projects, as well as the design and construction risks inform the risk management process (Eshan et al., 2014). According to Miller and Lessard (2001), uncontrollable external risks, such as inflation, natural disasters, government

policies, currency exchange rates, and socio-cultural influences can only be forecasted and preparations made to avoid, absorb or transfer their related risks. For example, a forecasted weather change over a period of time could lead to the reinforcement of bunkers to withstand strong weather patterns. Similarly, forecasted high inflationary rates could inform the project on the contingency costs to allocate to the budget.

In the other scenario, on-site risks are usually internal and controllable, for example, health and injury risks can be controlled by training and fall management (Eshan et al., 2014). Thus, training as a risk management practice can be evaluated for effectiveness if accident rates reduce to industry-specific or firm-specific accepted levels. According to Hallowel and Gambastese (2011), a successful fall management program provides a uniform set of procedures for all workers and is an essential part of project pre-planning. While the regulations may vary, fall prevention measures should be in place to protect all individuals working at heights of six feet or higher. They isolated falls as a health risk because falls remain the highest cause of injury and fatalities in the construction industry.

In some instances, socio-cultural settings pose severe risks to construction processes. According to the PRINCE (2009), this happens when improper community entry measures are adopted and architectural designs and the purpose of the construction are not approved by or understood by the community or society at large. An effective risk management process covers considerable social and cultural exposure, by embarking social sensitisation programmes which seek to heighten the social acceptability of the project. For example, intended roads might pass through sacred lands and might require demolishing privately own structures (Palencher et al., 2010). The reasons, purpose and factors that account for such requirements must be communally accepted to ensure the safety of the project and the workers.

The benchmarks adopted for accessing the effectiveness of the project risk management will differ according to the type of the project, whether public or private, the purpose of the project, whether non-profit or for profit-making, the scale of the project and the procurement options (PMI, 2004). The fundamental assessment areas however, often cover, costs and procurement benchmarks, that is to say, whether the procurement processes were successful devoid of fraud and embezzlement (Eriksson, 2007). This will require, multiple signatories, check and balances, segregation of duties, and effective monitoring of procurement activities, such as inventory management, delivery monitoring, store-keeping and accurate cataloguing (Eriksson & Westerberg, 2011).

Effective analyses of qualitative and quantitative information of the risk description, probabilities and impacts are also important for effective risk management (Sohizadeh et al., 2011). The quality of information of the risks determines the quality of the risk response strategy. Thus, a constant environmental scanning is necessary to gathering the requisite information on risks, from external factors, such as competitors, political and policy issues, environmental acts and interest groups. Internal and project specific factors are also covered in the environmental scans (Ward, 1999; Zou et al., 2010). They may include employee agitations and motivation, costs and budgets, expertise and risks that may be posed by the stakeholders, such as consultants, contractors and clients, such as decision to change build designs, which puts the project at risk of rework at additional costs and time (Dada, 2010).

2.9 The concept of affordable housing

Housing may be used to refer to buildings or structures in which individuals and their families live (Nguyen, 2005). However, housing refers to more than the physical structure or aesthetic qualities of a building. It must meet certain legal regulations and must also be equipped with basic services including access to safe water, sanitation, and safety (Rick & Lubbell, 2007). Wiener and Rutherford (2009) therefore notes that the concept of housing is multilayered, with legal bindings, aesthetic concerns, security, and basic amenities, including electrification, safe water, and sanitary concerns. They propose that in order to understand the multi-layered dimensions of housing, it is useful to frame housing conditions and needs within three main categories, namely; availability, adequacy, affordability.

Lubell (2006) maintains that is it important to think of housing availability in terms of the number of unique housing needs to the number of vacant units offered for rent or sale that are both affordable and appropriate for the population. A mismatch between the needs of residents within an area and their housing choices refers to a state of housing shortage or housing deficit. Source maintains that housing deficits refer to the number of housing units needed yearly to meet population growth. In most cases, Mintz-Roth (2008) suggests that housing deficit is most severe in multifamily construction and the cumulative need for rental housing, especially for low-income people often far exceeds the supply. Furthermore, the shortages in affordable housing are even more profound.

Housing adequacy is traditionally quantified in terms of the physical conditions of the home, which are the quality of plumbing, electrification, sanitation, safe water, and safety (Brown, 2001). The physical characteristics of the home may also be measured to determine if there is sufficient and appropriate living space to

accommodate the residents, including such measures as overcrowding and handicapped accessibility for the elderly and disabled. Rick and Lubbell (2007) add that more recently, adequacy has come to express more qualitative measures of resident satisfaction with the home, the neighbourhood, the community, and even the region.

Adequacy has become a term to refer to residents' satisfaction with the whole gamut of attributes associated with their home and the range of housing options within the area. It may extend over concerns of the existence of a nearby social services, reasonable access to good-quality jobs, shopping, schools, and public transport, the frequency of interaction with the neighbours, the levels of civic engagement, and other quality of life indicators (Chisholm, 2003). Cater (2008) opines that generally, renters are more likely to experience substandard housing conditions than home owners, mostly due to the fact they have less disposable income and control over the upkeep and maintenance of their units.

Households that live in substandard conditions or overcrowded situations can experience a variety of health and social problems. However, a household can live in a safe, affordable home, but still experience high levels of stress due to living in neighbourhoods with high crime or long commutes to work. Thus, housing adequacy can be a key determinant of resident satisfaction and dissatisfaction across a range of indicators (Wiener & Rutherford, 2009).

Housing affordability encompasses availability and adequacy of housing and characterises the concepts in monetary value. Boamah (2010) asserts that affordable housing encompasses not only the static structure called a house but the entire spectrum of environmental factors that make living acceptable and comfortable. Among them are good access routes, ventilation, sanitation and access to basic human

needs such as water. Boamah further asserts that housing affordability therefore involves the ability of households to consume other basic necessities of life such as food and clothing in addition to accessing adequate housing. It includes the ability of households to consume housing that permits reasonable standard of living, ability of mortgagors to effectively meet mortgage obligations, and households' access to adequate standard of housing without denying them access to other basic necessities of life.

The technical definition for affordable housing involves statistical units of price measurements, which establish the cost of housing in relation to the average income of the population. However, the reference average income differs from country to country and may also vary from region to region. Wekley (2003) identifies units as affordable if gross rent, including the costs of utilities borne by the tenant is no more than 30 percent of a household's net income. In another way, a unit can be termed as affordable if the carrying cost of purchasing a home is not more than 30 percent of the net income. If households are paying more than these amounts, they are described as experiencing housing affordability problems; and if they are paying 50 percent or more for housing, they have severe housing affordability problems and heavy cost burdens.

2.10 Empirical studies from Ghana

This section reviews some of the current studies on risk management in the construction industry in Ghana. The purpose is to draw essential lessons from them to inform this study. Moreover, the types of risk pertaining to the construction industry and the risk response may be conditioned by the financial, economic, demographic

and environmental conditions, which may differ significantly from studies in other regions.

Laryea (2008) focused on health and safety risk management on construction sites in Ghana. He adopted a qualitative method of research and with a descriptive design, studied 14 construction sites through observation and interviewed purposively selected workers on the site to clarify observed phenomena on the sites. The results revealed a poor state of health and safety on Ghanaian construction sites. The primary reasons were a lack of strong institutional framework for governing construction activities and poor enforcement of health and safety policies and procedures. Moreover, the Ghanaian society does not place a high premium on health and safety of construction workers on site. Interviews with workers indicated that injuries and accidents are common on sites. However, compensation for injury is often at the discretion of the contractor although collective bargaining agreements between Labour unions and employers prescribe obligations for the contractor in the event of injury to a worker. The study recommended that clients, contractors and consultants of the construction sector in Ghana should ensure that every construction contract takes comprehensive account of health and safety requirements for the project, environment and the workers.

In another study, Chileshe and Yirenkyi-Fianko (2011) analysed the perceptions of threat risk frequency and impact on construction projects in Ghana. Their study aimed to investigate perceptions of the likelihood of occurrence and severity of risk in construction projects. A quantitative approach was mainly used for the study, but a mix of qualitative research techniques was also applied. The targeted respondents were drawn by random sampling from a list of all registered construction-related firms operating within the Greater Region of Accra (Ghana). Snowball

sampling technique was utilised to identify clients from the obtained lists. The study covered 34 contractors, 46 consultants, and 23 private and public clients. They used one-way between-groups analysis of variances (ANOVA) and a post-hoc test to analyse the statistical differences in the opinions of the respondents.

Chileshe and Yirenkyi-Fianko (2011) found that the pertinent risks were related to construction method, price inflation, exceptional weather, ground conditions and site contamination, as well as poor communication among the project team. The contractors rated 'construction methods' higher than did the clients, and they also rated 'exceptional weather' higher than either the clients or the consultants. On the other hand, consultants rated 'price inflation' higher than the clients. Significant differences between the sub-groups were also found regarding the potential impact of the threat risk of price fluctuation. The consultants rated the 'price fluctuation' threat risk higher than either the contractors or the clients.

These studies concluded that despite the existence of remedial strategies to protect some of the stakeholders from these risks, there is a fear of being blacklisted, thus compromising future opportunities (especially among contractors) should legal action be taken to redress the identified problems (such as such delayed payments). The study recommended the introduction of bespoke rather than standard contracts, as these might introduce contract flaws and contribute towards helping the project stakeholders monitor these potential risks and take appropriate action.

Baradan and Usmen (2006), studied the practical application of risk management techniques in infrastructural delivery in the Ghanaian construction industry. Their study adopted a mix of quantitative and qualitative methodological approaches, in which a descriptive design was employed. They determined their sample size of 204 from a population of 619 using the statistical relation by Kumar

(1999); Clarke and Cook (1998). In total, 58 consultants, 34 client's firms, and 26 contractors were covered and questionnaires were used to gather data from the respondents on the risk impact of scope changes in the various work sections and its eventual effect on the contingency margins of the project.

The study found that most of the respondents had professional membership with Ghana Institute of Surveyors, Ghana Institute of Engineers or Ghana institute of Architects. Analysis of structured questionnaire distributed to professionals in the built environment indicates that some 71% of built environment professionals have no knowledge about risk management theories and techniques with only 6.2% of respondents have applied a risk management tool before in their professional practice. The study concluded by recommending that some key project management knowledge areas be included in curricula of built environment programmes to enhance professional responsibility through rather than relying on experience alone. Thus if the deficit in infrastructural development is to be closed, the key agents of infrastructural development must be abreast with effective technological knowhow through varying risk techniques.

2.11 Conceptual framework

The conceptual framework presents a modified framework of risk management within the specific context of construction firms. While this is generic to all construction firms, the model can be modified to specific organisational context. The framework builds on the original idea of Broadleaf Capital International (2017), but adds that there are risks that are not controllable by the construction firm. It also segregates and adds risk related contractual relation between the firm and client. This suggests that the two most important stakeholders in the contract involve the client

and the construction firm. Thus, a critical analysis of the risks that may threaten their relations and by extension the project should be meticulously dealt with.

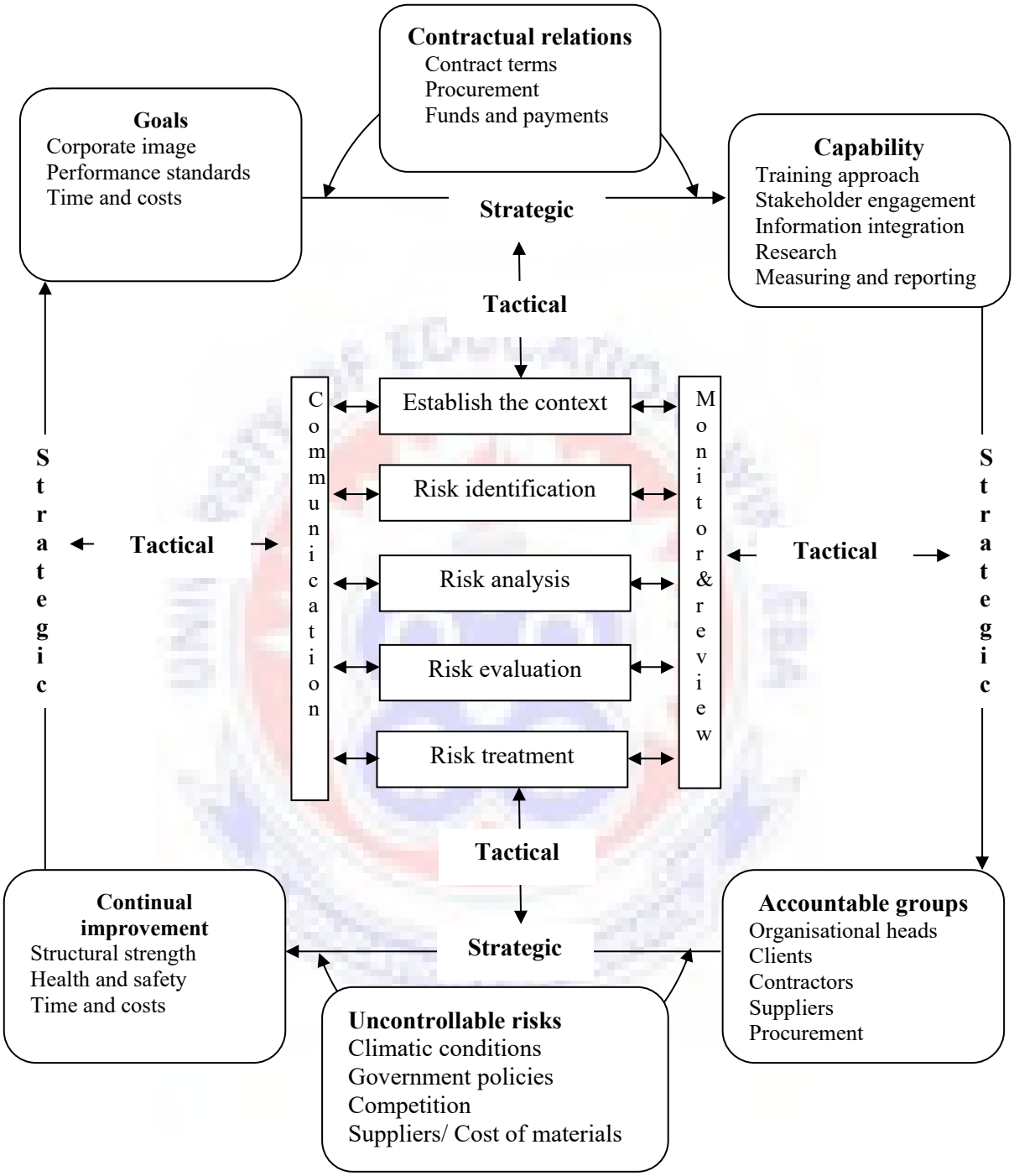

Figure 2. 5: Risk management framework for construction firms

Source: Author's construct, 2018

The framework adopts the idea that, at the core of risk management lays the five-step risk management model (Berg, 2010; Nirenjena & Basha, 2014; Osipva &

Alpleberger, 2007; Project Management Institute, 2004). The framework proposes that construction firms should establish the context of risk, taking into consideration their corporate goals, capabilities, the accountable entities, risks that are beyond the control of the focal firm, and the desired improvements that the firm seeks to make. This framework adds that the context of risk should consider the project's dependency on environment, the project size, contractual relationships and its capabilities, as well as the organisational culture, goals, and *risk* management policy.

Risks in the six cardinal components; namely corporate goals, capabilities, accountable entities, uncontrollable external risks, and continual improvements should be identified, analysed, evaluated, and treated. The divide between risk absorption and total risk avoidance must also be a fundamental guide in the risk management process. The framework proposes that a mix of risk absorption and risk avoidance should be employed in treating risks. Some uncontrollable risks, such as unpredicted weather/ climate variations cannot be avoided (Ceric et al., 2011) but an absorption plan must be in-place. However, risks such as procurement fraud, time and cost overruns, quality control risks, and disputes between clients and contractors can be avoided using appropriate strategies (Gabel, 2010).

The framework also establishes the strategic and tactical links between the major components. A tactical approach in this framework is defined as utilising specific resources, such as experiences, best practices, plans, processes, and teams, to achieve sub-goals that support short-term missions that are flexible to market conditions (Owyang, 2014). In relation to this, a strategic approach is defined as utilising resources, such as experience, research, analysis, thinking, and communication to advance the overall long-term mission of the organisation (Owyang, 2014). The framework proposes that the tactical and strategic approaches

are connected by communication and monitoring, leading to continual improvement and the achievement of the organisational goals.

2.12 Chapter summary

The chapter discussed the theoretical and practical underpinnings of risks management in construction projects. The literature shows that risks result from both internal and external sources, but their effects can be prevented, transferred or absorbed. The response to the risk is however contingent on the context within which the risk occurs and the risk attitude and appetite of the firm. The risk management framework proposed asserts that by analysing the risks within the organisational context, continual improvement can be achieved leading to the realisation of the long-term organisational goals. The next chapter describes the methodological approaches used for the study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents methodology adopted for the study. To be specific, it presents and justifies approaches used in the data collection based on the research questions. The chapter covers aspects such as research design, populations, sampling technique and sample size, sources of data, data collection instruments and procedure, pre-testing of questionnaire and data analysis techniques adopted for the study.

3.2 Research approach

A research approach, according to Rajasekar, Philominathan and Chinnathambi (2013), refers to a logical and systematic technique used for obtaining new and useful information on a particular topic. Traditionally, the research methods in any study were categorised as either quantitative or qualitative, which conformed to the great epistemological distinctions of positivism and interpretivism. Fellows and Liu, (2003) provide that there are two principal approaches to research namely; qualitative and quantitative approaches. However, Denzin and Lincoln assert that research approaches may be categorized as qualitative, quantitative or multi-methodology. Also, Creswell (2003) concurs with Denzin and Lincoln on their assertion of three major approaches. He identified a third approach which he calls the mixed method approach earlier referred to as multi-methodology by Denzin and Lincoln.

The quantitative research method adopts a deductive and objective view, which is characterized by tangible data such as counts, weight, mass, and other

physical measures (Fellows & Liu, 2003). Boateng (2014) emphasizes that the quantitative method is used to determine the extent of a problem or the existence of a relationship between aspects of a phenomenon by quantifying the variation. It usually includes the investigation of frequencies and different measurable variables with the aim of explaining a certain phenomenon (Phoya, 2012). Phoya asserts that the advantage of the quantitative approach is that it measures the reactions of a great many people to a limited set of questions, thus facilitating comparisons and statistical aggregation of the data, and so the results can be generalized. Also, quantitative method has the advantage of allowing the researcher to reach conclusions with a known degree of confidence about the extent and making of precise statements (Weiss, 1998). The quantitative method deals with numerical measurements which mainly consist of several kinds of data collection tools including questionnaires and checklists. Examples of quantitative designs include experimental research, correlational research, and survey research.

Qualitative research on the other hand, adopts the inductive and subjective view of knowledge of the real world. It views individuals or organizations in a holistic manner rather than isolated variables and hypotheses (Phoya, 2012). The qualitative method seeks to explore the meanings, attitudes, values, beliefs people associate with a phenomenon in order to establish a better understanding, rather than to test to support or disprove a relationship (Boateng, 2014). Cresswell, (2003) observed that qualitative data provide depth and details through direct quotations and a careful description of programmes, situations, events, people, interactions and observed behaviours. This is possible because the qualitative method gives the respondent the opportunity to speak freely, which can provide important data that would not be obtained by the quantitative method (Yin, 2003). In addition, the qualitative method

incorporates evidence gathered from multiple perspectives and do not rely on only the researchers' pre-set categories, thus they provide a comprehensive and a full range information and richness in details (Dehlor, 2006). Some major example of qualitative research includes case study, ethnography, and grounded theory.

The third approach as indicated by Denzin and Lincoln (2000); Creswell (2003) is the multi-methodology or mixed methods approach. As the name implies, it is the combination of both quantitative and qualitative approaches (methods) to collect and analyze data in a particular study (Denzin and Lincoln 2000; Creswell & Clark 2007; Morgan 2006). Collins, Onwuegbuzie and Jiao (2007) contend that since the 1960s, an increasing number of researchers in various fields of social and behavioural sciences have been advocating the combination of quantitative and qualitative approaches commonly known as mixed methods research to the study of various social phenomena. The mixed method approach involves collecting both numeric and text information, either simultaneously or sequentially, so as to best understand research problems, with the final database representing both quantitative and qualitative information (Creswell & Clark, 2007). Johnson and Onwuegbuzie (2004, pp 17-18) describes the mixed methods approach as a "logic of inquiry which includes the use of induction (or discovery of patterns), deduction (testing of theories and hypotheses), and abduction (uncovering and relying on the best of a set of explanations for understanding one's results)". According to Morgan (2006), the assumptions underlying the mixed methods approach represent bipolar extremes, whereas it tends to emphasize both the inductive-subjective-contextual approach and deductive-objective-generalizing approach. Therefore, this approach presents the situation whereby research problems can be understood better by employing both methods rather than by using only one method (Creswell, 2003). With respect to the

research issue under consideration as well as the specific objectives of the study, the researcher was of the opinion that a quantitative view of the study will present the researcher with a better understanding of risk management practices in construction projects focussing on government funded affordable housing projects in Ghana. Therefore, in line with the research questions posed, the researcher deemed it appropriate to quantitative approach for the purpose of data collection and analysis.

3.3 Research paradigm

A paradigm is "a set of beliefs, values and techniques which is shared by members of a scientific community, and which acts as a guide or map, dictating the kinds of problems scientists should address and the types of explanations that them" (Kuhn, 1970, p.175). Boateng (2014) contends that the choice of a particular research paradigm can arguably be based on: a researcher's philosophical beliefs/views of the world, the research topic of interest, the level of existing knowledge pertaining to the topic, and the range of skills researcher may have in methodological approaches. In the social sciences, positivism, which is the underlying paradigm for quantitative research approach, holds that social science is identical in its logic to natural science, science involves the search for general laws about empirical phenomena and that discovery and explanation depend on a rigorous empirical scrutiny of any particular phenomenon (Ragin, 1994; Sayer, 1985). In other words, once a social phenomenon can be established in some general laws, it can be empirically verified, thus resulting in the creation of authentic knowledge (Husserl, 1970). According to Kheni (2008), the choice of research methods in management and social sciences embodies the researcher's assumptions about the nature of the social world, the nature of the knowledge to be obtained and methods of gaining knowledge. He asserts that these

assumptions or paradigms are important, since a researcher's chosen research methods should be most appropriate for a context matching its underlying assumptions.

This study adopted quantitative approach, which involves a systematic and empirical manipulation of social phenomena via statistical, mathematical data or computational techniques (Given, 2008). Therefore, this study aimed to measure the concept of risks in a form that can lend itself to mathematical derivations and for further interpretation. The major limitation to this approach is that, it is weaker in its explanatory power, as compared with qualitative studies. In order to lessen the effects of this weakness on the study, some open-ended questions were inculcated in the instrument for data collection for further elaboration of certain responses.

3.4 Research design

An important aspect of any research is the design. It is the logical sequence that connects the empirical data to the initial questions of the study and, ultimately, to its conclusions (Sarantakos, 2005). Denzin and Lincoln (2000, p.22) defines a research design as "a set out guidelines that linkup the elements of methodology adopted for a study namely; relating the paradigm to the research strategy and then the strategy to methods for collecting empirical data". It is a plan that guides the researcher in the process of collecting, analyzing and interpreting observations (Nachmias & Nachmias, 1996). It involves the practical procedures adopted for accessing the subjects of the research. In order words, a research design is referred to as the advance planning of the methods to be adopted for collecting relevant data and the techniques to be used in their analysis, keeping in view the objective of the research and the availability of staff, time and money (Agyedu, Donkor & Obeng, 2013). Agyedu et al. assert that the researcher needs to state the type of research

design employed to test the hypotheses or to answer the research questions that guide the study.

The study adopted descriptive research design. Key (1997) reports that methods involved in a descriptive study design range from the survey which describes the status quo, the correlation study which investigates the relationship between variables, to developmental studies which seek to determine changes over time. Sarantakos (2005) confirms that descriptive research aims at describing social systems, relations or social events and providing background information about the issue in question and also to stimulate explanations. A descriptive design is therefore adopted because the study ultimately seeks to describe risk management practices in affordable housing projects in Ghana and from that develop a new framework to manage risks in that sub-sector of the construction industry.

3.5 Study population

Given that the study explored risk management practices in construction projects focusing on affordable housing projects in Ghana, it was necessary to identify and target the site managers who handled the affordable housing projects. This is elaborated in Table 3.1. All the commissioned and active affordable projects are listed in Table 3.1, along with the site managers on site. In total 291 site managers were scheduled to be on site. At the moment, only the Borteyman, Koforidua and Kumasi projects are being constructed, thus, the study only involved the Borteyman, Koforidua and Kumasi government funded affordable housing projects, which included a total of 159 site managers.

Table 3. 1: Population of the Study

Project site	No. of units	No. of site managers on site
Borteyman, Accra	1572	102
Kpone, Tema	1788	104
Kumasi	1092	37
Tamale	400	18
Koforidua	380	20
Wa	200	10
Total	5095	291

Source: National Black Chamber of Commerce, 2018

3.6 Sample size and sampling technique

The sample size is a small group of people chosen from the targeted population. Getting a sample in a research is very important. This is because all members of the study area cannot be studied. Moss (1994) is of the view that one cannot study everyone everywhere doing everything. In determining the sample size, all 159 site managers were used. Given the relatively small number of site managers, a census survey was adopted to sample all the 159 site managers on the Borteyman, Koforidua and Kumasi government funded affordable housing projects were included in the study. In census every element of the study population is considered. The key advantage of census is to give a high degree of statistical confidence in the survey results. According Creswell and Plano-Clark (2011), a census study occurs if the entire population is very small or it is reasonable to include the entire population (for other reasons).

3.7 Data collection

Data collection in research is the stage where the necessary data according to the purpose and objectives of the research are gathered from the field (Sikpa, 2011). The ways for gathering these data is what is termed as data collection methods. Two main sources of data used for a research work are primary source and secondary source. The methods used in collecting the primary data included questionnaire while the secondary source included data from published and unpublished books, magazines, journals, and websites.

3.7.1 Questionnaire

In order to achieve the aim and objectives of the study, well-structured close-ended questionnaires were designed to gather information from site managers of the government funded affordable housing projects in Borteyman, Koforidua and Kumasi. Close-ended questionnaires were used because of the fact that they are easy for respondents to answer and they are also easy for researchers to analyse data (Gay, 1996). The questions focused on these forms of dichotomous response and rating scale questions. The researcher gave out the questionnaires personally to the respondents, and collected them at the appointed time in order to minimize low responses. It is to be emphasized that the questionnaire allowed respondents time to think through the questions to provide accurate answers. The questionnaire guarantees high efficiency in data collection and high generalizability of results over the more intensive research designs.

The questionnaire was categorized into two, the first about the profile of the respondent and the second about the risk management of government funded affordable housing projects. The first part sought information on the background of

respondents; gender, age category highest academic qualification, number of years of experience in the construction industry, and number of years worked on affordable housing projects in general. The second part of the questionnaire is sub-divided into three sections. The first section sought to identify the particular risks associated with government funded affordable housing projects in Ghana. The second section sought to determine the risk management practices adopted by the various stakeholders of government funded affordable housing projects in Ghana. They were asked to identify the extent to which they agree to each statement. These statements were ranked based on a rating scale of 1 to 5 where "1= Strongly Disagree and 5= Strongly Agree". The third section of the questionnaire asked the respondents to validate the proposed risk management framework for affordable housing projects in Ghana

3.7.2 Pre-Testing of the Questionnaire

Prior to the major survey, a pilot survey was carried out. The pilot study is a trial run that can help the researcher to modify the survey instrument to ensure that the respondents in the main survey did not have many problems in completing the questionnaire (Moore & Abadi, 2005). The importance of the pilot study was to test the wording of the questionnaire, identify ambiguous questions, test the intended technique for data collection and measure the usefulness of the potential responses. The research instruments were pre-tested in the government funded affordable housing project in Kumasi by using a sample size of 10 randomly selected site engineers. They were grouped into five groups of two and they reviewed the questionnaire in batches within five weekly bases. At every stage, necessary amendments were made before given the same amended questionnaire in turns of batches till the last group ended. The pilot questionnaires were administered and

collected by hand in order to help increase the response rate. Covering letters explaining the purpose of the pilot study were attached to the questionnaires. Then, the respondents were asked to critically assess the questions and provide their opinions based on the significance and understanding of the questions, length and time for completing questionnaire and recommendations were all considered to amend the questions.

3.7.3 Procedure Adopted for Administering the Questionnaires

The questionnaires were distributed personally and collected by the researcher. A total of 159 questionnaires were administered to site managers. A letter of introduction was obtained from the researcher Head of Department to carry out the research work in the selected study area. The researcher visited the authorities of the participated construction firms and when the permission was granted, the researcher administered the questionnaires personally and gave them appropriate time as recommended by Nachmias and Nachmias (1996). Structured questionnaires containing close ended questions were administered to respondents. All the respondents were able to read and understand the questionnaire items and therefore completed the questionnaire independently.

3.7.4 Reliability of Data Instruments

According to Polit and Hunger (1985) “The reliability of an instrument is the degree of consistency which measures the attribute, it is supposed to be measuring”. Cooper and Schindler (2001) is of the view that, the ultimate test of a sample design is how well it represents the characteristics of the population, it purports to represent in measurement terms, and the sample must be valid. Validity of a sample depends on

two considerations: accuracy and precision. “Accuracy is the degree to which bias is absent from the sample” (Cooper & Schindler, 2001) whereas “Precision is measured by the standard error of estimate, a type of deviation measurement: where the smaller the standard error of estimate, the higher the precision of the sample”. The survey instrument designed for this research study was organised to discover the work force diversity that enhance construction firms’ performance in Ashanti Region of Ghana. Hence, reliability was done to determine the measurement scale that had been developed to find out whether it will produce consistent results if measurement is done on repeated basis. This study deployed internal consistency method in determining the instrument reliability with the Cronbach Alpha, as the relevant coefficient to evaluate. The internal consistency of each factor was determined by examining each item inter-correlation and computing the Cronbach’s Alpha. The minimum advisable level is 0.7 (Nunnally, 1978; Cronbach, 1951) although it may be reduced to 0.6 in survey research (Hair, Anderson, Tatham & Black, 2006; Conca, Llopis & Tari, 2004) and anything less than 0.6 is usually rejected (Malhotra & Grover, 1998). Cronbach’s alpha reliability test was conducted which yield a reliability coefficient of 0.81. This coefficient was deemed was high enough to justify the use of the instrument for the study.

3.7.5 Validity of Data Instruments

There are various methods for determining validity and reliability: face validity, content validity, construct validity and criterion–related validity. In this research, the researcher conducted a content validity. According to Flynn, Schroeder and Sakakibara (1994) content validity is a technique which the items in a scale measure the same construct and it can be evaluated sending the questionnaire item to

experts on the subject (academicians well versed in the construction studies) to check the comprehensiveness of the items under each construct. The feedback from these experts would then be used to improve the content as well as ease understanding to eliminate ambiguity and duplication of tests. Content Validity is used to ensure that the measure is actually measure what it is intended to measure (i.e. the contents), and no other variables. Using a panel of "experts" familiar with the content is a way in which this type of validity can be assessed. The participants can also examine the items and decide what that specific item is intended to measure. Content validity is concerned with the way the instrument appears to the experts and the participant (Pickard, 2012). The content validity was conducted by requesting an expert (my supervisor) to provide his views on the relevance of questions on the questionnaire. My supervisor indicated whether each question on the questionnaire was relevant or not, and even adjusted the objectives of this study to suit the questionnaire. Based on his recommendations, questions that were deemed not valid were taken out of the questionnaire.

3.8 Data Analysis

Quantitative data were gathered for the study using questionnaires. After cleaning up the data from the construction site questionnaire survey and rectifying the few errors that were identified in the filling of the questionnaires, the data were coded and fed into SPSS software, version 23.0, for Windows. Analysis was undertaken to generate a descriptive picture of the data gathered. With the SPSS software, descriptive statistics, and Pearson's correlation analysis were used to analyse the quantitative data obtained from the constructional site questionnaire. The analysis

(presented in the next chapter) is organised under themes derived from the data and the research questions that guided the entire investigation.

3.9 Ethical considerations

Ethics are principles and guidelines that help us uphold the things we value (Johnson & Christensen, 2012). Ethical aspects, such as access and acceptance, informed consent, privacy and confidentiality, and misinterpretation and misrepresenting of data were taken into consideration as this study dealt with schools, focusing directly on site managers. Opie (2004) emphasises that research comes into the lives of people who are the focus in various ways, taking their time, involving them in activities they would not otherwise have been involved in, providing researchers with privileged knowledge about them, and therefore potentially power over them. A letter seeking permission to conduct the study in the various sites was written.

The first ethical issue of access and acceptance was addressed, as Cohen, Manion and Morrison (2007:55) state, that "the relevance of the principle of informed consent becomes apparent at the initial stage of a research project - that of access to the institution or organization where the research is to be conducted, and acceptance by those whose permission one needs before embarking on the task". Furthermore, "access to personal records, both as a primary or secondary source of data, must be approached both ethically and legally" (Anderson & Arsenault, 1998:21).

In this research, respondents' demographic details such as age, gender, educational background, and experience of the site managers were investigated. Permission was needed from the construction firm and the site managers concerning this research. All the site managers were given information about the aims, nature and

procedures of this research. The researcher hoped that the information would assist in obtaining access to the respondents and gaining acceptance for the research.

The informed consent offered information to the participants on "the nature and the purpose of the research, the risks, and benefits" (Anderson & Arsenault, 1998:18). According to Anderson and Arsenault (1998), informed consent involves the purpose of the research, risks and discomfort, benefits, participant's rights and statements. Informed consent has to "ensure the individual's mental capacity, disclose sufficient information, provide sufficient time and privacy, provide the safeguard, ensure the individual's awareness" (Antle & Regehr, 2003:137).

The privacy of the participants and their confidentially was addressed. Some of the stories told related to the site managers personal experiences. Therefore, their individual privacy had to be respected. "It is the duty of researcher to protect the identity of individuals, there is a distinction between one's public role and private life" (Anderson & Arsenault, 1998:21). "Having empathy can be beneficial in research… if (the confidential information is) not handled correctly, can cause discomfort and even a job loss". Keeping the participants and their schools anonymous, using the promise of confidentiality (Anderson & Arsenault, 1998; Cohen Manion & Morrison, 2000), was vitally important.

3.10 Conclusion

This chapter focused on the research design and the methodology to be utilised to accomplish the objectives of the study. Firstly, the structure of the research methods employed in this study was discussed, and the considerations that were taken into account in adopting the research methodology were presented. Secondly, detailed descriptions of the population of the study, the data collection instrument, and the

main survey procedures were provided. Finally, the ethical considerations were described. The presentation and analysis of data collected through these methods will be presented in the next chapter.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF RESULTS

4.1 Introduction

The chapter presents the analysis of field data in relation to the research objectives and research questions. The chapter is organized into seven main sections namely; an introduction, response rate, demographic characteristics of the respondents, risks associated with the affordable housing projects, risk management practices adopted by the stakeholders, risk management framework for affordable housing projects, and validation of the proposed risk management framework.

4.2 Response Rate

A total of 159 questionnaires were issued to the site managers on site and a total of 142 questionnaires were returned completed. The response rate achieved was therefore 89.3%. This is an acceptable response rate for analysis (Punch, 2003). According to Johnson and Owens (2003), a response rate of 20% is considered too low, 80% is considered high in social research.

4.3 Demographic Characteristics of Respondents

The demographic characteristics of respondents concentrates on their gender, age category, educational level, and number of years the site managers have worked in construction industry.

4.3.1 Gender of Respondents

The study set to gather information on the gender of the respondents. The gender distribution of the participants is presented in Table 4.1.

Table 4. 1: Gender of Respondents

Gender	Frequency (N)	Percentage (%)
Male	144	98.0
Female	3	2.0
Total	**147**	**100.0**

Source: Researcher Field Work, 2018

From Table 4.1, the male site managers account for 98.0%; while 2.0% is the portion of the female site managers This ratio led to the conclusion that there are more male in the construction industry than females. This is an indication of the fact that construction work is preserve for a particular sex as men are seriously engaged in it.

4.3.2 Age group of Respondents

The responses with regard to the age category of the respondents are presented in Table 4.2.

Table 4. 2: Age category of Respondents

Age (Yrs)	Frequency (N)	Percentage (%)
20-30	15	10.2
31-40	84	57.1
41-50	37	25.2
51-60	10	6.8
Above 60	1	0.7
Total	**147**	**100.0**

Source: Researcher Field Work, 2018

From Table 4.2, 10.2% of the respondents were between the age bracket of 20-20 years, 57.2% were in the age bracket of 31-40 years, while 25.2% were in the age group of 41-50 years, 6.8% were between the ages of 51-60. The remaining 0.7% of the respondents were above 60 years. From the illustration, most site managers who handled the affordable housing projects are below 41 years, followed by site managers

between 41-50. The variations in the age distribution of the respondents helped the researcher to obtain different views from the respondents.

4.3.3 Educational level of respondents

The site managers were asked to indicate their level of education. Educational level has been extensively used by social science researchers to indicate individual integration and involvement in phenomenon in the society (Berry, 2011). The results are shown in Table 4.3

Table 4. 3: Educational level of Respondents

Education	Frequency (N)	Percentage (%)
Masters degree	44	29.9
First degree	87	59.2
Higher National Diploma (HND)	10	6.8
Other	6	4.1
Total	**147**	**100.0**

Source: Researcher Field Work, 2018

The results obtained indicate that most (n=87) of the respondents representing 59.2% were persons with first degree holders, following 29.9% of the respondents with Masters degree. In addition, 6.8% of the respondents were Higher National Diploma (HND) holders. The remaining 4.1% of the respondents were holding other qualification. This implies that most of the construction activities are managed by persons with high educational background and are in the good standing to argue professional on the issue.

4.3.4 Number of Years worked in the Construction Industry

The site managers were asked to indicated their years of practicing as professionals as shown in Table 4.4.

Table 4. 4: Number of years worked in construction industry

Experience	Frequency (N)	Percentage (%)
Less than 5years	12	8.2
5-10years	29	19.7
11-15years	63	42.9
16-20years	32	21.8
Over 20years	11	7.5
Total	**147**	**100.0**

Source: Researcher Field Work, 2018

As depicted in Table 4.4, 8.2% of the respondents have been practicing over for less than 5 years, 19.7% have been in the construction industry for 5 – 10 years, 42.9% of the respondents have been in the construction industry for 11 – 15 years. However, 21.8% of the respondents have been practicing over 16 – 20 years, whilst the remaining 7.5% of the respondents have been in the construction industry for over 20 years. This indicates that majority of the site managers have been the construction industry for more than 10 years. Although the study did emphasize on the actual years of experience of the correspondent it was concluded that with at least a year experience is good enough to make an objective analysis of situation. This indicates that much of the information used for this study is obtained from very experienced Contractors in terms of projects executed and from respondents (site managers) who are at the decision-making positions and thus will have better information regarding risk and its management and can be considered as expert judgement and thus credible for the purposes of the study carried out.

4.4 Risks are associated with the affordable housing projects

The particular risk association with affordable housing projects in Ghana were assessed in this section of the study with the aid of Likert Scaling questioning type. The site managers were presented with questionnaires containing questions assessing the risk associated with affordable housing projects. Table 4.5 shows the Relative Importance Indices (RII) and the rankings of particular risk associated with the affordable housing projects.

Table 4. 5: Responses on risk associated with the affordable housing project

Particular risk factors	ΣW	Mean (ΣW/N)	RII	Rank
Design variations	541	3.68	0.736	1
Tight project schedule	520	3.54	0.707	2
Bureaucracy of government	518	3.53	0.705	3
Delays in payment	512	3.48	0.697	4
Changes necessitated as a result of government policy	507	3.45	0.690	5
Excessive approval procedures in administrative government departments	465	3.16	0.633	6
High performance or quality expectations	448	3.05	0.610	7
Materials shortages	376	2.56	0.512	8
Unavailability of sufficient amount of skilled labour	367	2.50	0.499	9
Incomplete approval and other documents	360	2.45	0.490	10
Unsuitable construction program planning	350	2.38	0.476	11
Variations by the client	347	2.36	0.742	12
Inadequate program scheduling	344	2.34	0.468	13
Unavailability of sufficient professionals and managers	329	2.24	0.448	14

Source: Researcher Field Work, 2018
Key: 1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5 = strongly agree

As indicated in the Table, fourteen (14) risk factors were identified from literature to be associated with affordable housing projects and they were left to the respondents to indicate how significant these factors were using a five (5) point likert scale ranging from one to five with the label from strongly disagree to strongly agree. Design variation of the projects suggest to be the most highly ranked risk with a relative importance index (RII) of 0.736. This was followed by tight project schedule,

which had a RII of 0.707. The third (3rd) ranked risks associated with the affordable housing projects was bureaucracy of government in executing the projects with RII of 0.705. In addition, delays in payment was ranked 4th with RII of 0.697, changes necessitated as a result of government policy was ranked 5th with RII of 0.690 as a particular risk associated with affordable housing projects. Excessive approval procedures in administrative government departments was rated 6th with RII of 0.633 as a risk factor associated with affordable housing projects. Moreover, the 7th rated risk factor associated with affordable housing projects is high performance or quality expectation with RII of 0.610.

On the other hand, the least ranked risk factors associated with the affordable housing projects are; materials shortages (RII=0.512), unavailability of sufficient amount of skilled labour (RII=0.499), incomplete approval and other documents (RII=0.490), unsuitable construction program planning (RII=0.476), variations by the client (RII=0.742), inadequate program scheduling (RII=0.468), and unavailability of sufficient professionals and managers (RII=0.448). These statements were ranked 8th, 9th, 10th, 11th, 12th, 13th and 14th in the ranking order respectively. This shows that, there are numerous risks associated with the affordable housing projects.

4.4.1 Assessment of types of Risk affecting Affordable Housing projects

Further analysis was carried out to evaluate the relative importance of the impact of occurrence of types of risk factors on the affordable housing projects in Ghana. Table 4.6 summarises the result of the financial risk indicators on affordable housing projects (AHP).

Table 4. 6: Assessment of financial risk indicators on affordable projects

Financial risk	N	ΣW	Mean (ΣW/N)	RII	Std. Dev.	Rank
Bankruptcy of stakeholders	**147**	529	3.60	0.719	1.296	1
Escalation in project cost due to inflation	**147**	516	3.51	0.702	1.279	2
Procurement related corruption	**147**	478	3.25	0.650	1.354	3
Under-budgeting contingency costs	**147**	348	2.37	0.473	1.211	4
Under-budgeting of project overheads	**147**	345	2.35	0.469	1.204	5
Average (ᾱ)	**147**	**443**	**3.02**	**0.603**	**1.267**	

Source: Researcher Field Work, 2018

Note: *1=Strongly not severe; 2=Not severe; 3=Neutral; 4=severe; 5=Strongly severe*

The result in Table 4.6 indicates that "Bankruptcy of shareholders (RII = 0.719, Std. Dev. = 1.296)'', "Escalation in project cost due to inflation (RII = 0.702, Std. Dev. = 1.2979)" and "Procurement related corruption (RII = 0.650, Std. Dev. =1.354)'' were ranked as the most financial risk indicators affecting the affordable housing projects in Ghana. On other hand, "Under-budgeting contingency cost (RII = 0.473, Std. Dev. = 1.211)'', and "Under-budgeting of project overheads (RII = 0.469, Std. Dev. = 1.204)" were ranked as the least financial risk indicators affecting the affordable housing projects in Ghana. The average Financial Index is ($\bar{\alpha}$ RII_F = 0.6026). It is therefore clear that the construction industry which invest the affordable housing projects is faced with a lot of financial challenges and this requires aids from government to formulate beneficial economic policies. This could be achieved by strengthening of the existing financial policies and regulatory framework. Table 4.7 shows the result of the time schedule risk indicators on affordable housing projects.

Table 4. 7: Assessment of time schedule risk indicators on affordable projects

Time schedule risk	N	ΣW	Mean (ΣW/N)	RII	Std. Dev.	Rank
Enlargement of the project's scope without a corresponding increment in completion time	**147**	554	3.77	0.754	1.135	1
Pressure to finish project exactly on time	**147**	542	3.69	0.737	1.292	2
Shortening the schedule for project completion	**147**	444	3.02	0.604	1.254	3
Average (ᾱ)	**147**	**513**	**3.49**	**0.698**	**1.227**	

Source: Researcher Field Work, 2018
Note: *1=Strongly not severe; 2=Not severe; 3=Neutral; 4=severe; 5=Strongly severe*

The result in Table 4.7 reveal that "Enlargement of the project's scope without a corresponding increment in completion time (RII = 0.754, Std. Dev. = 1.135)", Pressure to finish project exactly on time (RII = 0.737, Std. Dev. = 1.292)" and "Shortening the schedule for project completion (RII = 0.6041, Std. Dev. = 1.254)" were ranked as the most time schedule risk indicators on affordable projects. The average time schedule risk Index is ($\bar{\alpha}$ RII_{TS} = 0.698). Table 4.8 displays the result of the design risk indicators on affordable housing projects.

Table 4. 8: Assessment of design risk indicators on affordable projects

Design risk	N	ΣW	Mean (ΣW/N)	RII	Std. Dev.	Rank
Changes in scope of the project	**147**	520	3.54	0.707	1.289	1
Changes in specific layouts of the project's plan	**147**	490	3.33	0.667	1.416	2
Remodelling of parts of the project	**147**	440	2.99	0.599	1.515	3
Average (ᾱ)	**147**	**483**	**3.29**	**0.658**	**1.407**	

Source: Researcher Field Work, 2018
Note: *1=Strongly not severe; 2=Not severe; 3=Neutral; 4=severe; 5=Strongly severe*

The result in Table 4.8 show that "Changes in scope of the project (RII = 0.707, Std. Dev. = 1.289)", and "Changes in specific layouts of the project's plan (RII = 0.667, Std. Dev. = 1.416)" were ranked as the most severe design risk indicators affecting

the affordable housing projects in Ghana. In addition, "Remodeling of parts of the projects (RII= 0.599, Std. Dev. = 1.515)" was ranked the least design risk indicator affecting the affordable housing projects in Ghana. The average design risk Index is ($\bar{\alpha}$ RII_D = 0.658). Table 4.9 depicts the result of the safety risk indicators on affordable housing projects.

Table 4. 9: Assessment of safety risk indicators on affordable projects

Safety risk	N	ΣW	Mean (ΣW/N)	RII	Std. Dev.	Rank
Poor adherence to, and implementation of precautionary measures	**147**	537	3.65	0.731	1.363	1
Inadequate insurance coverage for staff	**147**	509	3.46	0.693	1.376	2
Improper use of safety gadgets	**147**	478	3.25	0.650	1.428	3
Inadequate safety gadgets	**147**	463	3.15	0.630	1.300	4
Inadequate insurance coverage for the projects and facilities	**147**	425	2.89	0.578	1.335	5
Inadequate training of staff on training	**147**	385	2.62	0.524	1.366	6
Average ($\bar{\alpha}$)	**147**	**466**	**3.17**	**0.634**	**1.361**	

Source: Researcher Field Work, 2018
***Note:** 1=Strongly not severe; 2=Not severe; 3=Neutral; 4=severe; 5=Strongly severe*

The result in Table 4.9 show that "Poor adherence to, and implementation of precautionary measures (RII = 0.731, Std. Dev. = 1.363)", "Inadequate insurance coverage for staff (RII = 0.693, Std. Dev. = 1.376)", Improper use of safety gadgets (RII = 0.693, Std. Dev. = 1.376)", and Inadequate safety gadgets (RII = 0.630, Std. Dev. = 1.300)" were ranked as the most severe safety risk indicators affecting the affordable housing projects in Ghana. However, "Inadequate insurance coverage for the projects and facilities (RII = 0.578, Std. Dev. = 1.335)" and "Inadequate training of staff (RII = 0.524, Std. Dev. = 1.366)" were ranked as the least safety risk indicators affecting the affordable housing projects. The average safety Index is ($\bar{\alpha}$ RII_S = 3.6072). Table 4.10 gives the summary of the Relative Importance Index (RII) and the weighted values of all the risk affecting affordable housing projects in Ghana.

Table 4. 10: Weighted Values of the Various Risk Types

Risk	Mean	RII	Weighted value(W)	Rank
Time schedule risk (TS)	3.49	0.698	4	**1**
Design risk (D)	3.29	0.658	3	**2**
Safety risk (S)	3.17	0.634	2	**3**
Financial risk (F)	3.02	0.603	5	**4**

Source: Researcher Field Work, 2018

As depicted in Table 4.10, time schedule risk was ranked first, followed by design risk. Moreover, safety risk was ranked 3rd in the ranking, and financial risk was rank the least risk affecting the affordable housing projects in Ghana. This implies that risk is not properly managed in the completion of the affordable housing projects in Ghana. The application of Risk Management Index (RMI) will therefore enhance performance of affordable housing projects in Ghana.

4.4.2 Assessing the Risk Management Index (RMI)

Indices are used to assess the performance and determines the weakness in overall design of a project. The index is generally a number derived from the collection of a broad range of individually generated values or indicators that are used to characterize or evaluate specific aspects of the system (Gray & Carton-Kenny, 2004). The overall score of the risk index on affordable housing project is calculated by using the proposed formula below:

$$RMI = \frac{\sum \bar{\alpha} \text{ x W}}{N\,(\sum W)} \ldots\ldots\ldots\ldots (1)$$

RMI = Risk Management Index

ᾱ RII = Mean severity index of the various risk types

W= Weighted value attribute to the indicator of the risk type

N= Numerical indicator for each of the risk type.

Therefore, the formula can be expanded as:

$$RMI = \frac{\bar{\alpha}RII_{TS} \text{ x } W_{TS} + \bar{\alpha}RII_{D} \text{ x } W_{D} + \bar{\alpha}RII_{S} \text{ x } W_{S} + \bar{\alpha}RII_{F} \text{ x } W_{F}}{N\ (\sum W)}$$

$\bar{\alpha}RII_{TS}$ = Mean time schedule risk

$\bar{\alpha}RII_{D}$ = Mean design risk

$\bar{\alpha}RII_{S}$ = Mean safety risk,

$\bar{\alpha}RII_{F}$ =Mean financial risk,

$$RMI = \frac{3.49\ (4) + \ 3.29(3) + 3.17(2) + 3.02(1)}{4(4+3+2+1)}$$

$$RMI = \frac{13.96 + \ 9.87 + 6.34 + 3.02}{4(10)}$$

$$RMI = \frac{33.19}{4(10)} = \frac{3.319}{4} = 0.82975$$

$\therefore$ RMI $= 0.82975$ **Or** 82.98%

This implies that the affordable housing projects are exposed to 82.98% risk. The result of the RMI indicated that risks are not properly managed in undertaking the affordable housing projects.

4.5 Risk management practices adopted by the stakeholders

The second research question survey was designed to explore the risk management practices adopted by the various stakeholders of the affordable housing projects. A list of the most risk management practices was sourced from an extensive literature review. In the questionnaire, the respondents were asked to identify the most effective strategy for managing the risk. Table 4.11 summarises the responses of the site managers.

Table 4. 11: Responses on risk management practices

Risk management practices	N	Responses					
		Elimination		Reduction		Transfer	
		N	%	N	%	N	%
Freezes on capital	147	111	75.5	35	23.8	1	0.7
Delays in payments	147	58	39.5	85	57.8	4	2.7
Bankruptcy of stakeholders	147	110	74.8	33	22.4	4	2.7
Corruption in procurement	147	97	66.0	49	33.3	1	0.7
Under-budgeting contingency costs	147	33	22.4	111	75.5	3	2.0
Changes in design scope	147	26	17.7	121	82.3	--	--
Risk of rework	147	26	17.7	108	73.5	13	8.8
Tight project schedule	147	20	13.6	125	85.0	2	1.4
Disputes among stakeholders	147	19	12.9	127	86.4	1	0.7
Injury and fatalities	147	23	15.6	124	84.4	---	--
Changes in building regulations	147	34	23.1	113	76.9	--	--
Cost overrun	147	93	63.3	48	32.7	6	4.1
Time overrun	147	37	25.2	110	74.8	--	--

Source: Researcher Field Work, 2018

Table 4.11 displayed the risk management practices adopted by the stakeholders. Out of 147 site managers responded for quantitative study, 75.5%, 39.5%, 74.8%, 66.0%, and 22.4% of the respondents indicated that freezes of capital, delays in payments, bankruptcy of stakeholders, corruption in procurement, and under-budgeting contingency costs can be eliminated respectively. However, 23.8%, 57.8%, 22.4%, 33.3%, and 75.5% of the respondent asserted that freezes of capital, delays in payments, bankruptcy of stakeholders, corruption in procurement, and under-budgeting contingency costs can be reduced respectively. In addition, 0.7%, 2.7%, 2.7%, 0.7%, and 2.0% of the respondents mentioned that freezes of capital, delays in payments, bankruptcy of stakeholders, corruption in procurement, and under-budgeting contingency costs can be transferred respectively.

Moreover, 17.7%, 17.7%, 13.6%, and 12.9% of the respondents asserted that changes in design scope, risk of rework, tight project schedule, and disputes are eliminated among stakeholders respectively. However, 82.3%, 73.5%, 85.0% and 86.4% said that changes in design scope, risk of rework, tight project schedule, and disputes are reduced among stakeholders respectively. Conversely, 8.8%, 1.4% and 0.7% affirmed that risk of rework, tight project schedule, and disputes are transferred among stakeholders respectively. Furthermore, 15.6%, 23.1%, 63.3%, and 25.2% of the respondents revealed that injury and fatalities, changes in building regulations, cost overrun, and time overrun can be eliminated respectively. Conversely, 84.4%, 76.9%, 32.7%, and 74.8% indicated that injury and fatalities, changes in building regulations, cost overrun, and time overrun can be reduced respectively, whilst 4.1% of the respondents revealed that cost overrun can be transferred as listed in Table 4.11.

The results from Table 4.12 indicated that freezes on capital (75.5%), bankruptcy of stakeholders (74.8%), corruption in procurement (66.0%) and cost overrun (63.3%) can be eliminated by the stakeholders. On the other hand, it appeared that delays in payments (57.8%), under-budgeting contingency costs (75.5%), changes in design scope (82.3%), risk of rework (73.5%), and tight project schedule (85.0%) can be reduced by the stakeholders. In addition, majority of the respondents affirmed that disputes among stakeholders (86.4%), injury and fatalities (84.4%), changes in building regulations (76.9%) and time over run (74.8) can be reduced as well.

4.6 Risk management framework for affordable housing projects

Research framework was developed suitable for elaborate risk assessment of affordable housing project (AHP) in Ghana with a view to manage them. The study

adopted Bayesian Belief Network (BBN) for risk management to avoid, transfer, share, reduce, retain or ignore the risk associated with the affordable housing projects.

Bayesian belief network (BBNs) was developed at Stanford University in the 1970s (McCabe, AbouRizk, & Goebel, 1998). They are directed acyclic graphs (DAGs) expressing probabilistic cause-effect relations among the linked nodes. Each node represents a random variable that can take discrete or continuous values according to a probability distribution, which can be different for each node. Bayes' rule is expressed as follows:

$$P\left(\frac{B}{A}\right) = \frac{P\left(\frac{A}{B}\right) \text{X } P(B)}{P(A)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where: P (A)= is the probability of A, and

P (A|B) = is the probability of A given that B has occurred.

In adopting the Bayesian belief network for risk assessment, the risk level of each risk item identified in the AHP projects is measured and the dataset is modified for a Bayesian belief network analysis. The risk severity is determined using the degree of loss and the probability of occurrence. The dataset is modified using the risk matrix shown in Figure 4.1, to apply a Bayesian belief network. Risk = (the degree of loss) x (the probability of occurrence).

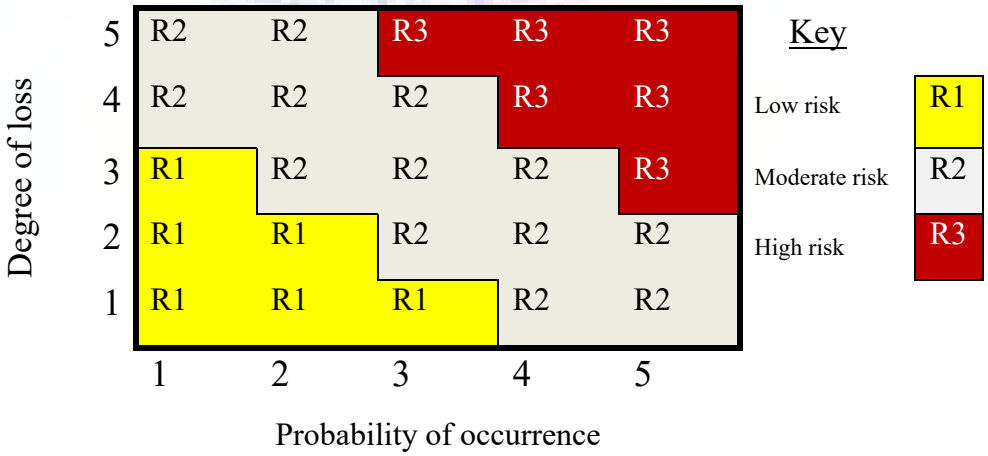

Figure 4. 1: Risk Matric for Bayesian Belief Network (BBN)
Source: McCabe, AbouRizk and Goebel (1998)

Figure 4.1 indicates that as both the degree of loss and probability increase, the risk is higher. It also shows the risk rating where the higher numbers indicate higher risk and the situation is unacceptable. On the other hand, the moderate numbers indicate moderate risk and the situation is acceptable with controls, whilst the lower numbers indicate lower risk and the situation is acceptable.

The framework commences by identifying the particular risk associated with the affordable housing projects. It consists of various risk indicators, and that the affordable housing projects are exposed to 82.98% risk, in which Engineering risks are predictable and those non-engineering risks are non-predictable. The predictable factors should be forecasted during the earlier stage of the project whereas the non-predictable factors involve uncertainties; this should also be estimated for the successful completion of the project because these risks will affect the cost, time, quality of the project.

Risk assessment is carried out by prioritizing the risk according to their mean score. This was done by evaluating the importance of the risk associated with AHP in Ghana. This was evaluated based on the measurement of the likelihood of the risk events and the impact of the accident caused by the risk event. Bayesian Belief Network (BBN) risk matrix is useful for the purpose of risk assessment for categorizing the importance in term of "likelihood-impact" level. Evaluating the severity of the risk associated with AHP in Ghana was performed by defining the severity of risk and selecting appropriate, effective aggregation system, the risk level for each identified risk variable was expressed synthetically.

Risk analysis provide an input to the risk evaluation for final quantification and formulation of the best response strategy. Typical inputs include the probability

of a risk factor occurring, factor interdependencies, their links with potential effects, the severity of these effects and, when necessary, the difficulty of detecting them.

Another phase of the framework call for an effective mitigation strategy for each of the risk identified and finally which is the ultimate aim of risk management is to deal with the risk inherent to affordable housing projects and thereby, exercising better control of the over the project, this is done by monitoring each step and effectively communicating hazards to project managers and other stakeholders. Continuous monitoring of both technical and human safety factors is important in order to keep the control measures updated at all times. The foremen have to take care of the safety as an indispensable part of their daily work. In some countries, the law requires a periodical safety inspection to be carried out at every construction site. Incident reporting includes both accidents and near-misses. An investigation of these occurrences may reveal the necessity to update the risk assessment. Figure 4.2 shows the framework developed for Affordable Housing Projects (AHP).

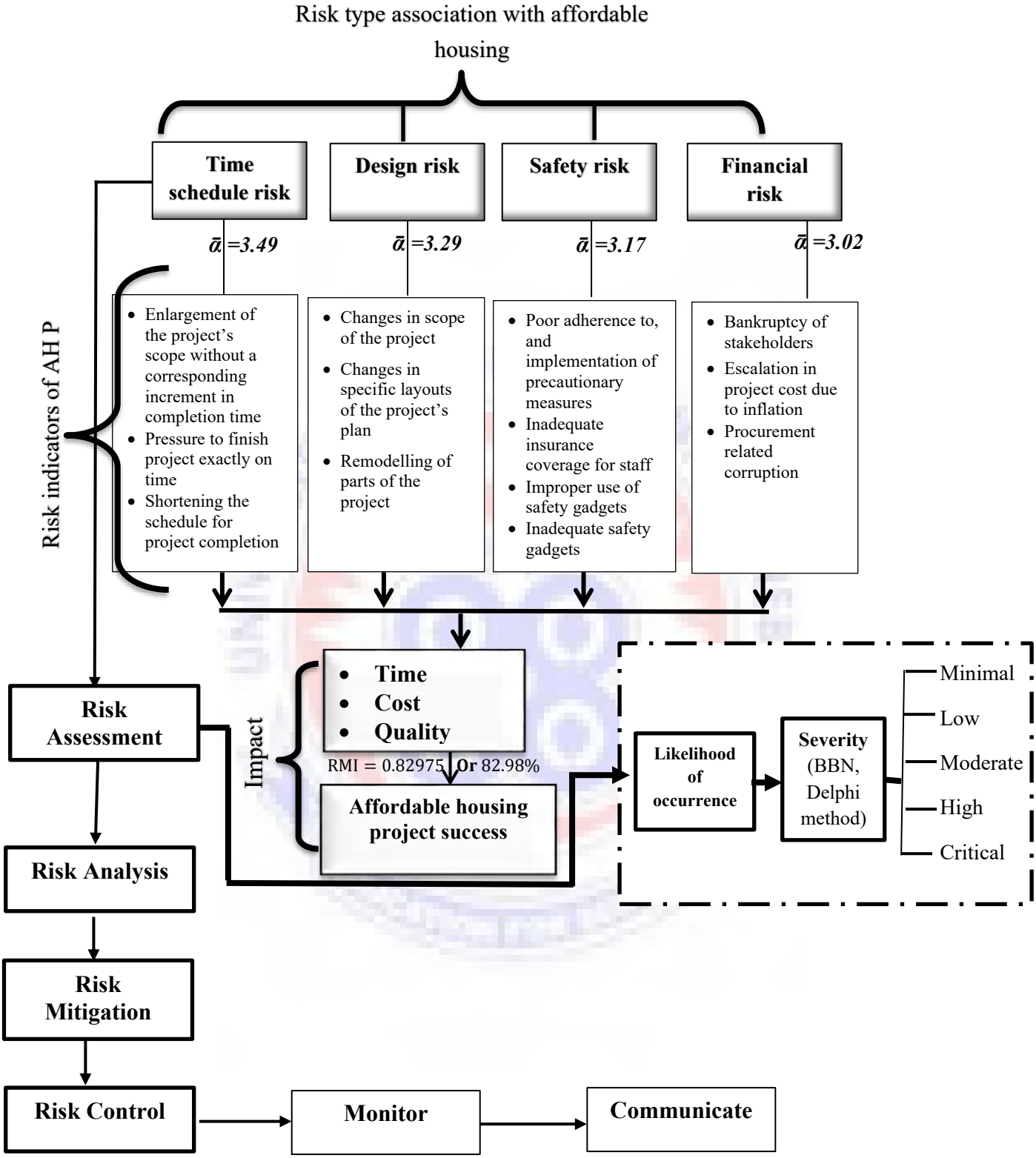

Figure 4. 2: Proposed Risk management for Affordable Housing Projects (AHP)
Source: Research Field Work, 2018

4.7 Validation of the proposed risk management framework

The proposed framework was verified using the questionnaire method. The experts filled in the questionnaire after they had suggested the appropriate risk response and after they were shown the results of risk management in all the phases through which the affordable housing project passes. The structural questionnaire (see Appendix B) required the experts to choose one of the answers offered. The explanation of each question, the answers provided by the experts and the conclusions in connection to the answers are shown in the various Figures.

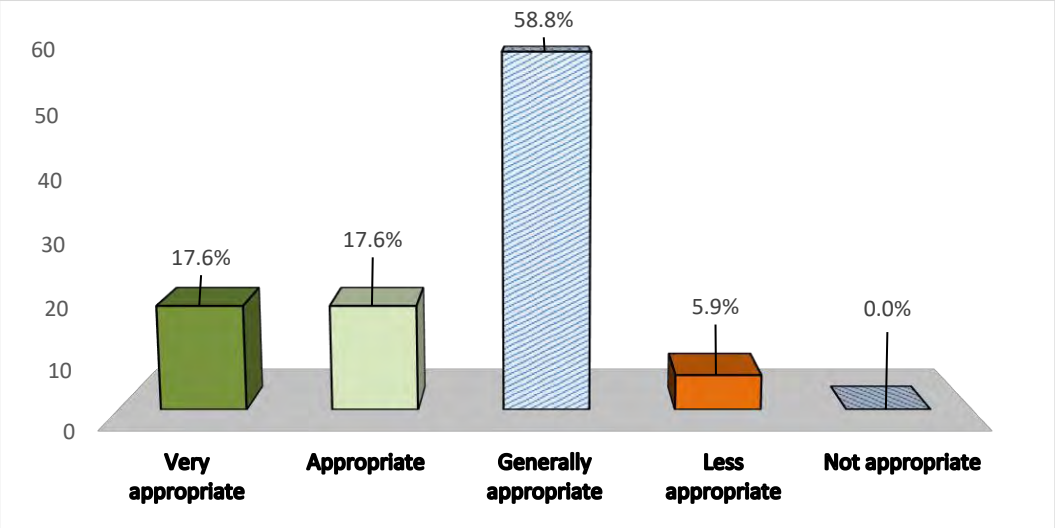

Figure 4. 3: Proposed breakdown of the framework
Source: Researcher Field Work, 2018

From Figure 4.3 the experts were asked "What do you think about the proposed breakdown of the framework". For some of the experts this had been the first encounter with this technique. From the data, 3 experts forming 17.6% considered the proposed breakdown of the framework *Very appropriate*, 3 experts representing 17.6% considered the breakdown appropriate, 10 experts constituting 58.8% considered it *Generally Appropriate* and the remaining 1 expert representing 5.9% considered the breakdown *Less Appropriate.* However, none of the experts

considered the breakdown to be *Not Appropriate*. The experts thus verified the breakdown of the framework proposed for the affordable housing project, which is especially important for the potential application of the framework in future projects.

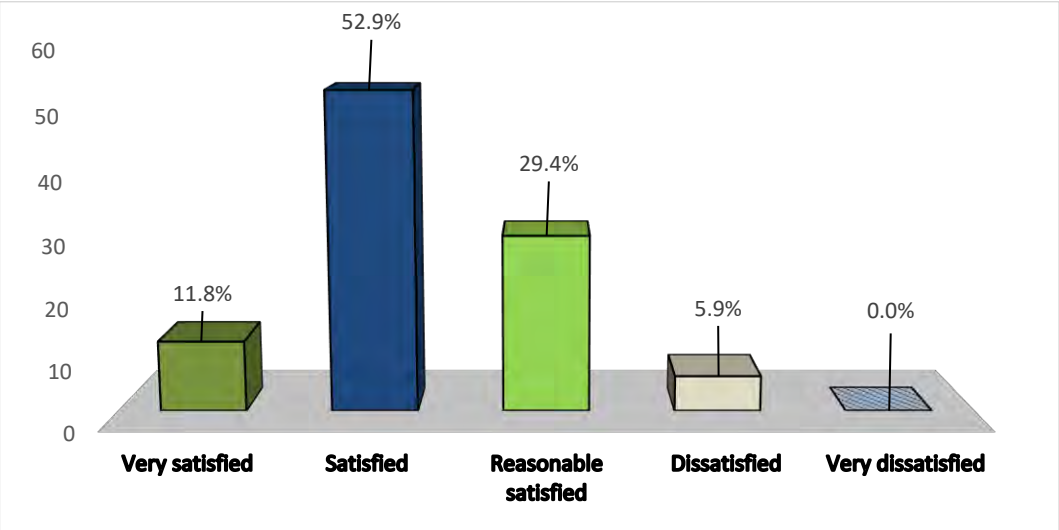

Figure 4. 4: Satisfied with the proposed risk management framework

Source: Researcher Field Work, 2018

The proposed framework offers process driven risk management as an alternative approach to risk driven project management. The respondents were asked whether they are satisfied with the proposed risk management framework for AHP in Ghana. The experts confirmed that this is a suitable approach because 9 of them representing 52.9% were *Satisfied* with it, 5 experts constituting 29.4% were *Reasonably Satisfied* and 2 experts constituting 11.8% were *Very Satisfied*, 1 expert forming 5.9% was *Dissatisfied.* None of the experts *Very Dissatisfied* with the approach. This indicates that the AHP framework can identify and appreciate the particular risk factors affecting the project completion and thereby minimising their impact by managing them.

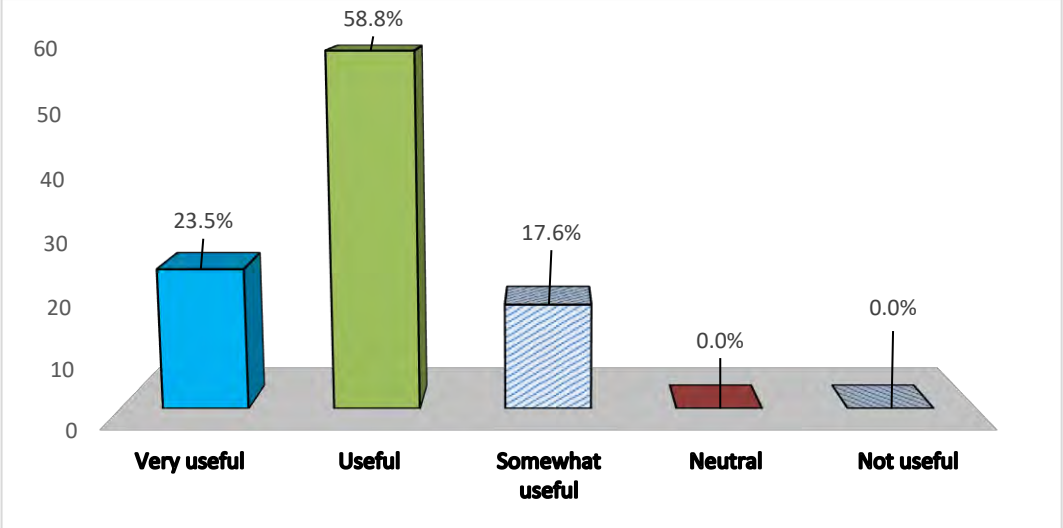

Figure 4. 5: Usefulness of Framework for risk management in the AHP
Source: Researcher Field Work, 2018

As depicted in Figure 4.5, the respondents were asked whether the framework is useful for risk management in the Affordable Housing Projects (AHP) in Ghana. This question tested the whether the goal of this research was successfully realised and the experts' answers are very encouraging. From the data collection, 4 experts constituting 23.5% considered the framework *Very Useful,* 10 of them forming 58.8% considered it to be *Useful,* 3 experts representing 17.6% considered the framework to be somewhat useful. However, none of the experts considered it to be Neutral or Not useful.

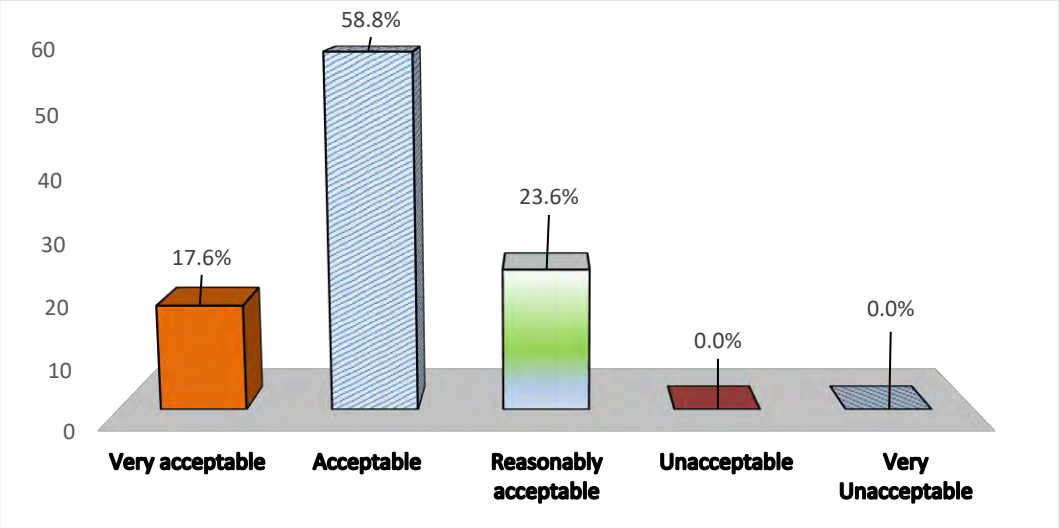

Figure 4. 6: Acceptability of the identified risk regardless of the project types and size
Source: Researcher Field Work, 2018

As displayed in Figure 4.6, a question was posed "What do you think of the proposed key risks in the Affordable Housing projects regardless of the project's type and size". The experts did not know how the particular risks had been identified so this question was asked to verify the identification process for the key risks described (i.e. time schedule risk, design risk, safety risk and financial risk). From the data collection, 3 respondents representing 17.6% answered that the key risks proposed are *Very Acceptable*, 10 respondents forming 58.8% indicated that the identified risks are *Acceptable*. The remaining 4 respondents constituting 23.6% asserted that the identified particular risks are *Reasonably Acceptable*. In addition, none of the respondents reveled that the identified risks are *Unacceptable or Very Unacceptable*. This affirmed that the risk identification would enable key stakeholders to understand and respond to the risks.

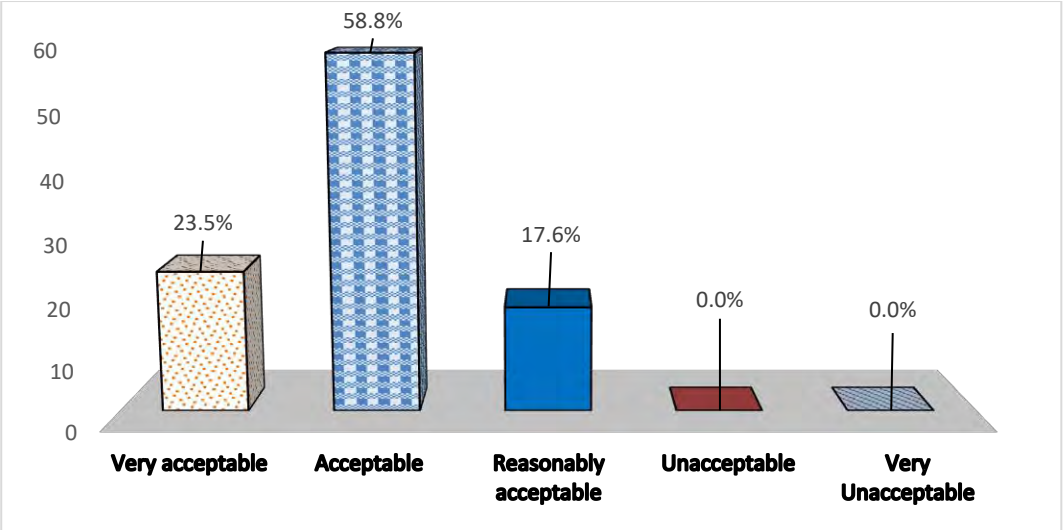

Figure 4. 7: Acceptability of the BBN matrix
Source: Researcher Field Work, 2018

The respondents about what they think about the acceptability of Bayesian Belief Network (BBN) risk matrix for risk assessment. For some of the experts this had been the first encounter with this technique whereby the decision-making process unfolds through a series of judgments about the interrelationships of alternatives with reference to given criteria and given goal. From Figure 4.6, 4 experts constituting 23.5% gave the answer *Very Acceptable*, 10 experts forming 58.8% indicated that the BB network is Acceptable. In addition, 3 respondents constituting 17.6% answer *Reasonably Acceptable*. None of the experts considered this technique *Unacceptable* or *Very Unacceptable*. This has verified the use of BBN for quantitative risk analysis in the proposed framework. Bayesian Belief Network (BBN) risk matrix is useful for the purpose of risk assessment for categorizing the importance in term of "likelihood-impact" level.

CHAPTER FIVE

DISCUSSION OF RESULTS

5.1 Introduction

This chapter of the study discusses the data collected to answer the various objectives the study set to achieve. It elaborates the risks associated with the affordable housing projects, and risk management practices adopted by the stakeholders. The study further discusses the risk management framework for affordable housing projects in Ghana. The last section also as validate the proposed risk management framework.

5.2 Risks are associated with the affordable housing projects

In assessing the risk associated the affordable housing projects in Ghana, it was revealed that design variations, tight project schedule, bureaucracy of government, delays in payments, changes necessitated as a result of government policy, excessive approval procedures in administrative government departments, and high performance or quality expectations affects affordable housing projects in Ghana. This implies that there several risks factors associated with the affordable housing projects. The finding concurs with the similar study conducted by Tipili and Ilyasu (2014) in Nigeria. According to the study, Bureaucracy of Government (RSIS = 0.3154, Std. Dev. = 0.1280), Design Variation (RSIS = 0.1257, Std. Dev.=0.0657), Tight project schedule (RSIS = 0.1206, Std. Dev. = 0.0664), Variation of construction program (RSIS= 0.1006, Std. Dev.= 0.0503) are the key risk factors affecting government construction projects in Nigeria. In developing countries like Ghana, government projects like buildings, roads etc are politically motivated and viewed by

many as additions to satisfy public demand. Many government building projects are left at the mercy of politicians and according to Agyakwa-Baah (2009), it is the ultimate goal of government to lead and fast-track infrastructure project the society and moreover, the performance of the government is assessed in the developing countries by developmental projects. This creates unnecessary pressure on government to start something which will be terminated because it is not accommodated in the government's budget.

It viewed that bureaucracy of government departments affects affordable housing projects buttress with the study by Berko (2007) who stated that, about 70% of infrastructure projects done in Ghana are not funded by the Government of Ghana but from foreign organizations and countries. Contractors are always complaining of delay in payment because of the unwinding bureaucratic system in governmental departments and agencies. Frimpong et al (2003) also identify bureaucracy in Ghanaian government departments as a contributory factor coupled with the nature of the funding of projects which could either be through domestic savings or foreign funding.

The response by the site managers that delays in payment is a particular risk associated with the affordable housing projects is consistent with literature in developing countries (Addo-Abedi, 1999; Agyakwa-Baah, 2007, Adams, 2008). As observed by Rameezdeen and Ramachandra (2008), the construction industry has always been closely related to the national economy. Adams (2008) provides further evidence within the Ghanaian context by stating that payment delays on the government stifles progress on projects. Other studies within the South African context aimed at risk identification, quantifications and classification (Othman & Harinarain, 2009; Harinarain & Othman, 2007) and Harinarain *et al*. (2008) study also identified clients and quantity surveyors as a source of risk to the contractors when dealing final account and final payment. Similar studies such as Adams (2004),

Agyakwa-Baah, (2007) revealed that delay in payment is the most important factor that brings about project delay. Unfortunately for most construction organisations, the Government is the main client of the industry and avoiding their projects means fighting for the few projects brought in by the private sector. There is so much bureaucracy in the Government agencies that it takes ages for certificates to be issued for payments. In additional, Addo-Abedi (1999 cited in Tuuli *et al*., 2007) observed that there is no form of compensation to contractors.

The view by the site managers that changes necessitated as a result of government policy and excessive approval procedures in administrative government departments affects affordable housing projects concurs with the study by Tchankova (2002) that the government system adopted by countries affect construction projects. It was argued by De la Cruz et al., (2006) that, winning political scores leads to unplanned infrastructure development which lacks the necessary funding and required coordination of such projects. Due to the loads on the government, government uses its power to influence negotiations between contractors and government institutions which then affect the project in a later day (Berko, 2007).

The study further revealed that time schedule risk is the most particular risk factor group affecting affordable housing projects. In addition, the next risk group for the affordable housing project success or failure is 'Design' risk group on which project heavily depends upon. Better the designing of the project, more probably the chances of the success of project. After this, 'Safety' risk group is the third risk factors as it includes the poor adherence to, and implementation of precautionary measures, inadequate insurance coverage for staff, improper use of safety gadgets, and inadequate safety gadgets. 'Financial' risk is ranked fourth as a risk factor group that affects affordable housing projects in Ghana. As it is evident that design risk factor affects affordable housing projects in Ghana, this is not surprising due to the fact that most

projects in the Ghanaian construction industry are procured using the traditional procurement option. As most design details are still unresolved at the pre-contract stage, there is a lot of uncertainties as to the final cost and completion duration.

The issue that safety risk affects affordable housing projects in Ghana agrees with the study by Cooke and Williams (2004) who stated that safety risk is a major risk factor that has significant impact on project productivity. Cooke and Williams asserted that safety risks arise from the impact of hazards (where there is no hazard there will be no risk), but there are hazards everywhere on construction sites. Rowlinson (2004) claimed that a series of moral, production and financial problems may be caused by safety risks on construction sites. Further, construction occupational fatalities and injuries lead to considerable human suffering, not only the workers directly involved, but also their families and communities. Santos-Reyes and Beard (2008, p15) have argued that both academics and practitioners have tended to address risks by focusing on technical aspects and looking for immediate causes of accidents after they have taken place. From this point, identifying and assessing the potential risks factors that may cause safety problems on construction projects is very important. From the safety risk management perspective, the occurrence of one safety event might lead to another risk event that could initiate a chain reaction on a construction project. Thus, the occurrence of a safety risk event may have an effect in the downstream stages of affordable housing projects in Ghana. Therefore, it is important to understand the interdependences of different safety risks in different project stages.

The response that financial risk affects the affordable housing projects in Ghana aligns with Akintoye and MacLeod (1997), who mentioned that financial failure and delay in payments in construction projects poses a major risk. According

to the study by Hassim et al. (2009) in Malaysia, the construction stakeholders revealed that payments are major causes construction time overrun. According Hassim et al. financial related challenges are the risk mostly encountered by the contractors. Financial risk to contractor includes whether the building owner has enough money to complete the project, financial failure of the building owner or sub-contractors, availability of money to the contractor in a suitable manner and time to enable the contractor to progress with the work (Akintoye & MacLeod, 1997). According to the study by Berko (2007), contractors in Ghana always complain of delay in payment of work done and when these foreign organizations and government delay in the release of the required funds, the progress of the projects are slow down.

5.3 Risk management practices adopted by the stakeholders

In addressing management practices adopted by the stakeholders of construction projects, it appeared that freezes on capital, bankruptcy of stakeholders, corruption in procurement and cost overrun can be eliminated by the stakeholders. This indicates that all projects are at risk to potential problems in the form of events or risks, which influence the time frame, budget and quality of the affordable housing projects, however, all risks involve both threats and opportunities (Chapman and Stephen, 2002). The risk identification and analysis process help stakeholders to make judgment before problem occur. According to Raftery (1999) risk elimination is one of the forms of reaction to identified risks. The Project Management Institute (1996) highlighted that most at times specific risk can be eliminated. The view of the respondents' buttress with the study by Cretu et al. (2011) who indicated that in case of negative risk (threat) relating to freezes of capital, corruption, and cost overrun, it is preferable to eliminate or transfer the risk, however, if the risk is positive

(opportunity), it is preferable to enhance, exploit or share risk. According to Smith (2002), all construction parties carry risk at some point, and since every project combines risk and uncertainty, contracts between parties should allocate responsibility for risks during the project's life.

It was found that delays in payments, under-budgeting contingency costs, changes in design scope, risk of rework, and tight project schedule can be reduced by the stakeholders. In addition, the respondents affirmed that disputes among stakeholders, injury and fatalities, changes in building regulations, and time over run can be reduced as well. Smith (2008) indicated that risk can come from various sources including uncertainty in financial markets, threats from project failures (at any phase in design, development, production, or sustainment life-cycles), legal liabilities, credit risk, accidents, natural causes and disasters, deliberate attack from an adversary, or events of uncertain or unpredictable root – cause. Strategies to manage threats (uncertainties with negative consequences) typically include avoiding the threat, reducing the negative effect or probability of the threat, transferring all or part of the threat to another party, and even retaining some or all of the potential or actual consequences of a particular threat, and the opposites for opportunities (uncertain future states with benefits) (Smith, 2008). According to El-Sayegh (2008), there is a need for risk management processes to be used to manage construction risks. The impact of risk can be reduced by several ways such as obtaining more information, running more tests, allocating more resources, improving communications and allocating risk to parties who can control it (El-Sayegh, 2008).

According to Piney (2002), it is only prudent to not stress on the impact of the risk because it becomes unacceptable when the promising effect reaches a level. The adoption of one of these approaches will work in reducing the potential risk impact on a

project (Piney, 2002). According to Malek (2013), risk management practices ultimately minimizes the project losses and increase the likelihood that the project in completed on schedule and within the budget. Risk management is a proactive management tool used for early visibility of potential problem areas and possible mitigation measures. Risk management includes the entire project, including the design, engineering, business, contracts, finance, purchasing, estimating, and project management.

Knowing how much risk is involved will help decide if costly measures to reduce the level of risk or elimination are justifiable. It can also help to decide if sharing the risk with an insurance company is justified. Some risks, such as natural disasters, are virtually unavoidable and affect many people. All choices in life involve risk. Risks cannot be totally avoided, but the choice can be made so that risk is minimized.

5.4 Risk management framework for affordable housing projects

The study proposed the development of a risk management framework to improve the management and reduce the risk associated with affordable housing projects in Ghana. The framework was developed to rate the affordable housing projects risk by taking into account all the time schedule risk, design risk, safety risk and financial risk. It was based on literature review and personal communication from experts and site managers working on the Borteyman, Koforidua and Kumasi affordable housing projects. Existing models for evaluating risk especially in the construction sector were also reviewed on the basis of which the risk management framework was developed. Several researchers have developed risk assessment methodologies to suit their requirements (HSE, 2004; Lingard and Rowlinson, 2005;

Huges and Ferret, 2011). However, regardless of the differences in approaches or industries, most of the risk assessment methodologies are similar in terms of basic principles and contain the key components as it includes work analysis, hazard identification, risk estimation and risk evaluation. Some risk assessment methodologies include risk control as part of risk assessment, but this study considers that risk control is a separate part from risk assessment. Construction project risk management is the processes of identifying, analyzing, and responding to construction project risk (Project Management Institute, PMI, 2003). It involved the maximization of positive results (opportunities) and the minimizing of negative results and its consequences (treats).

The key components or steps for developing risk management framework for Affordable Housing Projects agrees with Nasir et al. (2003). According to Nasir et al., project risks management involves conducting risk management planning, engaging in risk identification, completing risk analysis, creating a risk response action plan, and monitoring and controlling risk on a project. Project risk management is a continuous process to be engaged in throughout the entire project. The purpose of construction project risk management is to increase the likelihood and impact of positive events and on projects and to decrease the probability and impact of negative events like cost and time overrun of construction projects. The six major processes involved in project risk management as stated by PMI, (2003) are; risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning and risk monitoring and control. Many approaches have been suggested for the classification of risks. However, all of them pointed to the identifying the primary source of risk central to construction activities which triggered the risk (Perry & Hayes, 1985).

5.5 Validation of the proposed risk management framework

The last research question deals with the validation of the proposed risk management framework. A group of experts, who in various ways played a major part in the realization of similar projects in the past and who are expected to have major participation in future projects, helped in the application and verification of the proposed framework. The application of the proposed framework and the experts' verification provided useful lessons and application. The experts supported the breakdown of the framework i.e. by identification of the risk, assessment of risk, analysis of risk, risk mitigation, risk control, monitoring of risk, and communicating hazards to project managers and other stakeholders.

The experts indicated that the proposed particular risks for the affordable housing projects is appropriate for the first analysis but it might be modified in the future as the project develops incorporating the project-related risks which may appear during project execution. According to Odimabo and Oduoza (2013), a properly implemented risk management process enhances the successful completion of building construction projects and thereby make the projects more profitable. When risk management is applied chaotically and arbitrarily, it can jeopardize the realization of the project as most of the risks are very dynamic all the way throughout the project lifecycle.

The Bayesian Belief Network (BBN) technique was found appropriate for establishing the risk priority list in each phase of the construction process. Some participants were not familiar with this technique, so it is possible that this problem might occur in the future. This would suggest that all participants should be made fully aware of the BBN technique before beginning to use the system. The experts found that the proposed framework helped in understanding the construction process

better and the assessment of risk. A variety of studies have used BBN to analyze how risks and disruptions influence construction projects. The BBN approach has proven to be a powerful tool when uncertainty is an important factor (Soberanis, 2010) and allows easy visualization of the network through its graphical nature. This makes it easy to localize a problem or identify vulnerable areas in the network.

The reason of choosing the BBNs as the base methodology is clear, because, BBNs offer consistent semantics for representing uncertainty and an intuitive graphical representation of the interactions between various causes and their effects. BBNs are useful when the information about the past and/or the current situation is vague, incomplete, conflicting, and uncertain (Fabrizio, & Kenett, 2007; Heckerman, 1996). Bayesian Belief Networks (BBN) provides identification and analyses of causal threats and quantification of risks associated with them. The BBN has both the quantitative and qualitative abilities to effectively measure the prevalence of risk factor on the vulnerable assets. The BBN inference support system is a tool that correlates and give causal relationships that exist between risk factors and risk key indicators with their associated operational attributes (Fenton, & Neil, 2011).

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The chapter presents the summary of the major findings of the study, and the relevant conclusions drawn from the findings indicating how the study has contributed to knowledge. In addition, it presents the recommendations made based on the findings of the study and the suggestions for future studies.

6.2 Summary of Key Findings

This section presents the summary of the major findings of the study under suitable themes developed from the respective research questions as follows:

6.2.1 Risks are associated with the affordable housing projects

- The study found that design variations, tight project schedule, bureaucracy of government, delays in payments, changes necessitated as a result of government policy, excessive approval procedures in administrative government departments, and high performance or quality expectations are the particular risk associated with the affordable housing projects in Ghana.
- The study revealed that time schedule risk is the most particular risk factor group affecting affordable housing projects. In addition, the next risk group for the affordable housing project success or failure is 'Design' risk group. After this, 'Safety' risk group is the third risk factor, whilst 'Financial' risk is the fourth risk factor group affecting affordable housing projects in Ghana.

6.2.2 Risk management practices adopted by the stakeholders

- The study revealed that freezes on capital, bankruptcy of stakeholders, corruption in procurement and cost overrun can be eliminated by the stakeholders.
- It appeared from the study that delays in payments, under-budgeting contingency costs, changes in design scope, risk of rework, and tight project schedule can be reduced by the stakeholders. In addition, disputes among stakeholders, injury and fatalities, changes in building regulations, and time over run can be reduced by the stakeholders.

6.2.3 Risk management framework for affordable housing projects

- The study proposed the development of a risk management framework to improve the management and reduce the risk associated with affordable housing projects in Ghana.
- The framework was developed to rate the affordable housing projects risk by taking into account all the time schedule risk, design risk, safety risk and financial risk.

6.2.4 Validation of the proposed risk management framework

- The study found that the proposed risk management framework for the affordable housing projects is appropriate for analysis but it might be modified in the future as the project develops incorporating the project-related risks which may appear during project execution
- The BBN technique was found appropriate for establishing the risk priority list in each phase of the construction process. The experts found that the

proposed framework helped in understanding the construction process better and the assessment of risk.

6.3 Conclusion

Construction projects are unique in terms of design, construction methods, personnel, location, etc. Variations in these factors induce different types of risk factors into construction projects. In addition, risk factors could come from many different directions, such as social, legal, economic, environmental, political, logistic, management and technological sources. The study found that time schedule risk, design risk, safety risk and financial risk are the most particular risk factor affecting affordable housing projects in Ghana.

The study indicated that risk management practices are adopted by the stakeholders. It appeared that the stakeholders try to eliminate freezes on capital, bankruptcy of stakeholders, corruption in procurement and cost overrun. Moreover, delays in payments, under-budgeting contingency costs, changes in design scope, risk of rework, and tight project schedule are reduced by the stakeholders. In addition, disputes among stakeholders, injury and fatalities, changes in building regulations, and time over run are reduced by the stakeholders.

The proposed framework established a creative approach to risk management in construction and at the same time the proposed framework provides a practical and usable tool for managing risk in the affordable housing projects and will assist project managers at the time they need to make decisions. It was found that the proposed particular risks for the affordable housing projects is appropriate for analysis but it might be modified in the future as the project develops incorporating the project-related risks which may appear during project execution. The BBN technique was

found appropriate for establishing the risk priority list in each phase of the construction process.

6.4 Recommendations

The following recommendation were made for the study

- It is recommended that risks must be identified before the beginning of project realisation or the realisation of any phase through which the project passes. The environment in which the project is realised produces new risks during project realisation. The new risks must be analysed together with those identified and analysed earlier, in a continuous attempt to assess the probability and adverse effect of new risks in relation to existing ones. This creates the need for continuous risk management in all phases of project realisation.
- The risk management technique (BBN) should be applied into any construction project at the initial stage of the project to get maximum benefit of the technique.
- The construction companies in Ghana that wish to use and benefit from risk management should first start to educate their staff in risk management. They should also include more in the educational package, and develop experiences to the workers through training, regular toolbox meetings. They should talk to individuals using the existing way to manage and control projects, and develop those methods. Suggesting an improvement in the traditional way of controlling projects emphasizes the importance of a systematic approach.
- Personnel with risk management background should be employed by clients, contractors and consultant to oversee the risk management process.

- As the study found that safety risk and procurement related corruption affect affordable housing projects, it is therefore recommended that Occupational Safety and Health Agency (OSHA) policy and procurement regulations should be incorporated. Also, procurement strategies that encourage risk sharing should be recommended by the government such as the New Engineering Contract (NEC) and partnering agreements.
- The payment regime for executed contracts should be streamlined to offer financial stability to the contractors. This can help contractors from collapse of their financial resources by using strict and enhance cash flow system and reduce the option of reliance on financial institutions loans.
- The contractor needs to be involved with a competent designer in the design process of projects to prevent situations where defective designs are passed to the contractor and subsequently have to redo the works because of design changes
- To minimise the chances of failure of the construction projects, the significant risk factors as revealed in this study should be properly handled in managing the risks.

6.5 Future Research

The framework proposed provides a basis for future evolution and development. As the framework is used in practice so it can be refined and developed. The framework has shown its usefulness as a generic tool and its application in a single project (i.e. Affordable Housing Projects). Future research should rely on experiences gained in the application of the framework and might concentrate on developing a database that contains the list of key risks identified through which the

construction project passes in its development and which are independent of its type, size and purpose.

As the Affordable Housing Project demands become more sophisticated, these tools may not stand the ever-increasing demand and sophistication in technology (which goes along the same direction with projects risks) of the project demand, thus there is need for the industry to search and research, view and review for the variables that will lead us to the development of more efficient tools and techniques for risks identification. There are still more efficient tools and techniques waiting out there to discovered and put to use.

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APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

DEPARTMENT OF CONSTRUCTION AND WOOD TECHNOLOGY

QUESTIONNAIRE FOR MANAGEMENT

TOPIC: Developing a Risk Management Framework for Affordable Housing Projects in Ghana

The questionnaire is prepared for the research work in partial fulfillment of the Award of MPhil Construction Technology. Your cooperation and honesty will be highly appreciated. All information that would be gathered from you would be treated strictly confidential. All responses will be confidential and will not be connected in any way to yourself or your institution. Thank you.

SECTION A: Personal Particulars

1. Please indicate your gender. *Please tick [√]*

Male	
Female	

2. What is your age category? *Please tick [√]*

Below 20 years	20 – 30 years	31-40years	41-50years	51-60years	Above 60 years

3. What is your highest academic qualification? *Please tick [√]*

Masters	
First Degree	
HND	
Other Please state……..	

5. How many years have you been working in the construction industry?
Please tick [√]

Less than 5 years	5-10 years	11-15 years	16-20 years	Over 20 years

6. How long have you worked on affordable housing projects in general?

Please tick [√]

Less than 5 years	5-10 years	11-15 years	16-20 years	Over 20 years

SECTION 2: Risks Identified in Affordable Housing Projects Construction Firms

7. For each of the listed construction risks, indicate with a tick [√] the significance of the risk to the affordable housing project. Please rate your responses using a scale of 1 to 5: Not at all significant (1), slightly significant (2), neither significant nor insignificant (3), somewhat significant (4), very much significant (5)

S/N	Risk associated with affordable housing	1	2	3	4	5
1	Delays in payment					
2	Tight project schedule					
3	Design variations					
4	Excessive approval procedures in administrative government departments					
5	Variations by the client					
6	Incomplete approval and other documents					
7	Unsuitable construction program planning					
8	Inadequate program scheduling					
9	Bureaucracy of government					
10	High performance or quality expectations					
11	Variations of construction program					
12	High performance or quality expectations					
13	Design variations					
14	Unavailability of sufficient amount of skilled labour					

15	Unavailability of sufficient professionals and managers					
16	Materials shortages					
17	Changes necessitated as a result of government policy					

8. What phase of the affordable housing project is most prone to risks?

a. Feasibility [ ]
b. Planning [ ]
c. Design [ ]
d. Construction [ ]
e. Others, please specify:……

9. To what extent do you agree on the following financial risks as having an impact on affordable housing projects? Please rate using a scale of 1 to 5: strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), and strongly agree (5). *(Please tick the box which best reflect your view).*

S/N	***Financial Risks***	***Rating***				
		1	***2***	***3***	***4***	***5***
1	Freezes on capital					
2	Delays in payments					
3	Bankruptcy of stakeholders					
4	Procurement related corruption					
5	Under-budgeting contingency costs					
6	Escalation in project cost due to inflation					
7	Under-budgeting of project overheads					
8	Others (please specify):					

10. To what extent do you agree on the following time-schedule risks as having an impact on affordable housing projects? Please rate using a scale of 1 to 5: strongly disagree (1),disagree (2), neither agree nor disagree (3), agree (4),and strongly agree (5). *(Please tick the box which best reflect your view).*

S/N	***Time schedule Risks***	***Rating***				
		1	***2***	***3***	***4***	***5***
1	Shortening the schedule for project completion					
2	Pressure to finish project exactly on time					
3	Enlargement of the project's scope without a corresponding increment in completion time					
	Others (please specify)					

11. To what extent do you agree on the following design risks as having an impact on affordable housing projects? Please rate using a scale of 1 to 5: strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), and strongly agree (5). *(Please tick the box which best reflect your view).*

S/N	***Design risks***	***Rating***				
		1	***2***	***3***	***4***	***5***
1	Changes in scope of the project					
2	Changes in specific layouts of the project's plan					
3	Remodelling of parts of the project					
4	Others (please specify):					

12. To what extent do you agree on the following safety risks as having an impact on affordable housing projects? Please rate using a scale of 1 to 5: strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4),and strongly agree (5). *(Please tick the box which best reflect your view).*

S/N	***Safety risks***	***Rating***				
		1	***2***	***3***	***4***	***5***
1	Inadequate safety gadgets					
2	Improper use of safety gadgets					
3	Inadequate training of staff on training					
4	Inadequate insurance coverage for staff					
5	Inadequate insurance coverage for the projects and facilities					
6	Poor adherence to, and implementation of precautionary measures					
7	Others (please specify)					

SECTION 3: Risk Management Practices in the Affordable Housing Projects

13. What is the most effective strategy for managing the following risks? Please tick the options in the boxes below.

S/N	Risks	Strategy (Tick one for each risk)		
		Elimination	Reduction	Transfer
1	Freezes on capital			
2	Delays in payments			
3	Bankruptcy of stakeholders			
4	Corruption in procurement			
5	Under-budgeting contingency costs			
6	Changes in design scope			
7	Risk of rework			
8	Tight project schedule			
9	Disputes among stakeholders			
10	Injury and fatalities			
11	Changes in building regulations			
12	Cost overrun			
13	Time overrun			

SECTION 4: Risk Management Framework Development

14. Are you willing to validate the model to be developed?

Yes [ ] No [ ]

If "Yes" provide your E-mail address/Telephone Number:……

……..

15. The risk model would ensure the site managers well informed decisions and achieves the strategic objectives of the affordable housing projects in Ghana.

Strongly disagree [ ] Disagree [ ] Neutral [ ] Agree [ ]

Strongly agree [ ]

16. The risk model would enable key stakeholders to understand and respond to the risks that may affect the affordable housing projects effectiveness and efficiency.

    Strongly disagree [ ] Disagree [ ] Neutral [ ] Agree [ ]

    Strongly agree [ ]

17. The model would provide information of the strengths and weaknesses in managing the risks.

    Strongly disagree [ ] Disagree [ ] Neutral [ ] Agree [ ]

    Strongly agree [ ]

18. What do you think should be considered in developing the model?

    ……..

    ……

APPENDIX B

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

DEPARTMENT OF CONSTRUCTION AND WOOD TECHNOLOGY

THE QUESTIONNAIRE FORM USED FOR VERIFICATION OF THE FRAMEWORK

PREAMBLE: The questionnaire is prepared for the research work in partial fulfillment of the Award of MPhil Construction Technology. Your cooperation and honesty will be highly appreciated. All information that would be gathered from you would be treated strictly confidential. All responses will be confidential and will not be connected in any way to yourself or your institution. Thank you.

Please tick [√] appropriately

1. What do you think about the proposed breakdown of the framework in 7 phases?

   Very appropriate [1] Appropriate [2] Generally appropriate [3]
   Less appropriate [4] Not appropriate [5]

2. How generally satisfied are you with the proposed risk management framework?

   Very satisfied [1] Satisfied [2] Reasonably satisfied [3]
   Dissatisfied [4] Very dissatisfied [5]

3. Do you find the proposed framework useful for risk management in the Affordable Housing projects?

   Very useful [1] Useful [2] Somewhat useful [3]
   Neutral [4] Not useful [5]

4. What do you think of the proposed key risks in the Affordable Housing projects regardless of the project's type and size?

   Very acceptable [1] Acceptable [1] Reasonably acceptable [1]

   Unacceptable [4] Very Unacceptable [5]

5. To what extent does using the proposed framework improve your understanding of process in construction?

   Very much [1] Much [2] Not much [3]

   Some [4] Not at all [5]

6. Is the proposed framework appropriate for a risk assessment in the stage in which you managed risks?

   Very appropriate [1] Appropriate [2] Generally appropriate [3]

   Less appropriate [4] Not appropriate [5]

7. What do you think about the acceptability of BBN for risk analysis in the decision making process?

   Very acceptable [5] Acceptable [2] Reasonably acceptable [3]

   Unacceptable [4] Very Unacceptable [5]

THANK YOU