Risk allocation on Building projects in the Zambian Construction Industry (ZCI)

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A thesis submitted to the Faculty of Engineering and Built Environment, University of the Witwatersrand, in fulfilment of the requirements for the degree of Doctor of Philosophy in Quantity Surveying

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DECLARATION

I declare that this thesis “Risk allocation on building projects in the Zambian Construction Industry” is my own unaided work. It is being submitted for the Degree of Doctor of Philosophy in Quantity Surveying in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree in any other University.

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ABSTRACT

Desirable project delivery is normally hampered by risks; when risks eventuate they make it difficult for a project to be delivered within time, budgeted cost and to the expected quality. This is exacerbated by risk misallocation between contracting parties in the form of incomprehensive allocation or inappropriate allocation, or wrong or inappropriate resources or methods of allocation. The literature is unclear as to why misallocations persist in the construction industry and the discourse of this research is the identification of reasons of why this persists and the rectification thereof. This research is an exploratory and explanatory study aimed at uncovering why risk misallocation is recurrently contributing to project failure in the Zambian building sector, with a view of devising a mechanism for aiding risk allocation. To achieve this, purposeful semi-structured interviews, a questionnaire survey and document analysis across building projects using different contract forms were used to uncover sources for risk misallocation, using structuration and Gilbert's management theory as theoretical lenses. The approach used was both inductive and deductive to varying extents. The nature of misallocation in the industry includes resource misallocation, unbalanced and unfair allocation, and inappropriate allocation mechanisms. It was found that current contract practice (reflected in selection criteria and contract conditions) and risk practice (reflected in unsystematic and un-formalised risk management practices) are contributing to risk misallocation, resulting in poor performance of the building sector. This realization led to the devising of a systematic process model to serve as an interventionist tool to ameliorate this challenge. This deemed to be useful in providing guidance for desirable risk allocation outcomes. The mechanism was validated by using a questionnaire with purposively sampled industry professionals in the Zambian construction industry and Delphi expert panel using a questionnaire which took an introductory round and 2 main rounds.

Keywords: Building projects, mechanism, Risk misallocation, Sources, Threats, Zambia.

DEDICATION

To my family for their unconditional support.

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Last but not least, my saviour Jesus Christ. *Behold I am the Lord, the God of all flesh. Is anything too hard for Me?* –Jeremiah 32:27.

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LIST OF ABBREVIATIONS AND ACRONYMS

BOQ	Bill of Quantities
CIDB	Construction Industry Development Board
EIZ	Engineering Institute of Zambia
FIDIC	International Federation of Consulting Engineers
GMP	Guaranteed Maximum Price
GMT	Gilbert's Management Theory
ICE	Institute of Civil Engineers
JBCC	Joint Buildings Contracts Committee
JCT	Joint Contracts Tribunal
JLC	Joint Liaison Committee
ITB	Information to bidders
NCC	National Council for Construction
NEC	New Engineering Contract
PM	Project Manager
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PPP	Public Private Partnerships
QS	Quantity Surveyor
QSRB	Quantity Surveyors Registration Board
RM	Risk Management
RICS	Royal Institute of Chartered Surveyors
SIZ	Surveyors Institute of Zambia
ST	Structuration Theory
TCC	Target cost Contract
ZCI	Zambian Construction Industry
ZIA	Zambia Institute of Architects
ZPPA	Zambia Public Procurement Agency

CHAPTER 1 INTRODUCTION

1. Introduction

The global construction industry in 2010 was valued at US$ 7.4 trillion and at US$ 8.5 trillion in 2015, representing a growth of 8.7 % (PRNewswire, 2014). The value by 2020 is expected to be US$ 10.3 trillion, with the most growth projected in Africa and East Asia between 2016 and 2020 (CIC, 2015). The construction industry plays a substantial function in any national economy, and the undertakings of the industry are fundamental to realising the national socio-economic development goals of providing shelter, infrastructure and employment (Oladinrin, et al., 2012). However, construction projects globally are bedevilled with cost overruns, time overruns and quality shortfalls (Diekman et al, 2011; Janipha & Ismail, 2013; Kaliba et al., 2009; Muya et al 2013; Meng, 2012; Zhang & Fan, 2014; Zou et al, 2007). Consequently, within the construction industry there has been constant innovation and change in the types of contract, in the forms of contract and in the procurement systems, in order to mitigate the challenges mentioned. There has been a shift to the use of different types of contracts: for example, the shift to traditional templates complemented with relational contracting practices (Poppo & Zhou, 2014); the shift from fixed-price contracts to hybrids of various types (Chan, et al., 2011); and the shift from fragmented procurement systems to integrated systems (Hanna, et al., 2013; Osipova & Apleberger, 2007). This has been done to improve the project deliverables of time, cost and quality. Subsequently, risk management has also become commonly used, mainly on the understanding that appropriate and equitable risk allocation will influence project delivery positively (Simu, 2007; Chileshe & Kikwasi, 2014; Tang, et al., 2007). Nevertheless, the construction industry is faced with misallocation (Alsalman & Sillars, 2013; Akintoye & MacLeod, 2001; Hanna, et al, 2013) of contractual and non contractual risk and it is unclear why this is so.

1.1 Background

The *Project Management Institute* (PMI), (2004) defines risk as "an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective." (p.238), while risk management can be described as a formal and methodical process of identifying, analysing and responding to risks throughout the lifecycle of a project to attain the ideal level of risk elimination, mitigation and/or control (Wang, et al., 2004). Developed countries could be said to have formalised risk management practices in construction and consulting firms (Hanna et al., 2013; Lehtiranta & Juunonen, 2014) while developing countries have risk management practices which are not fully formalised in construction and consulting firms (Goh & Abdul-Rahman, 2013; Perera, et al., 2009; Kululanga & Kuotcha, 2010). Serpell, et al. (2015a) point out that risk management in a developing country organisation is normally inadequate, lacks a systematic and formal approach and often produces poor results.

In Zambia, the reports from the Auditor General's office for the period 2006 to 2015 all indicated poor project delivery in the Zambian construction industry (ZCI). The universal challenges of cost overruns, time overruns and poor quality are particularly intense (Kaliba et al 2009; Muya, et al., 2013, Kaoma and Muya, 2016), and abandonment of projects is rife (Auditor General's Report, 2009,2010,2011,2012, 2013, 2014, 2015). This could be an indicator that the risks associated with carrying out projects in the construction industry are high and risk allocation is not balanced. Risk allocation is defined as the assigning of management responsibility and liability for risk(s) (Alsalman & Sillars, 2013). Risk misallocation refers to allocation of risks wrongly or inappropriately (Hanna, et al., 2013) in terms of imperfect methods of allocation and/or imperfect response methods and/or allocation to the inappropriate party between client and contractor and/or allocation of inappropriate resources or simply lack of allocation.

The focus in this study was on known contractual and non-contractual risks (threats) in the building construction sector. The building sector in Zambia has the highest number of projects undertaken and over 80% exhibit quality weaknesses, cost and time overruns (ZDA, 2013; Auditor General's Report, 2009,2010,2011,2012, 2013, 2014, 2015). The contract is generally the major tool utilized for risk allocation (Andi, 2006; Osipova & Eriksson, 2011) yet it may not outline all risks (Murdock & Hughes, 2008). Both contractual and non-contractual risks were considered because risks have to be appropriately and comprehensively allocated for the effective and efficient delivery of a project (Andi, 2003). Therefore, contracting parties are expected to put measures in place for risks not included in the contract so as to make the management of risk comprehensive.

1.1.1 The Zambian Built Environment

The Zambian construction industry comprises five main sub-sectors: assembly, manufacturing, supply, clientele and design (Shakantu et al, 2000). The construction process that necessitates construction involves official and recognised relationships among clients, architects, engineers, surveyors, planners, contractors, manufacturers and material suppliers (Muya et al., 2003). It is essential to understand how contract selection is done in the ZCI as various options exist. Hackett, et al., (2007; Bunni (2009); Zaghoul and Hartman (2002); Osipova & Eriksson (2011) have pointed out that the first step in risk allocation is the selection of an appropriate contract type and form.

Projects are usually procured in a traditional way with some cases of integrated procurement. Zambia's public procurement guidelines (Zambia Public Procurement Act, 2008, part 1-3) provide for lump-sum/fixed-price contracts, time-based contracts, percentage contracts and cost-plus-fee contracts. A type of contract common within the ZCI is the lump-sum or fixed-price contract. The contracts in use are the Federation of Consulting Engineers' *Red Book* (1998), the *Green Book*, the *Engineering Procurement Construction* (EPC), the Joint Liaison Committee (1972) contract, and the *General Conditions of Contract* (GCC, 2013). The GCC (2013) is commonly known as the ZPPA contract and has three suits namely; open national bidding contract document, open international bidding contract document and the small works bidding contract document. All these contracts are of the lump-sum type, apart from the GCC, which can be used as an admeasurement contract. An additional form of contract, *New Engineering Contract* (NEC) is hardly used only in the private sector.

The infrastructure needs in Zambia are vast, including improved road infrastructure, energy infrastructure, water infrastructure and housing. Of the 67,523 km of road, only 9,403 km is tarred (Raballand & Whitworth, 2014). The installed energy capacity is 1850 megawatts, with the current energy deficit at 250 megawatts, while a potential of 6,000 megawatts awaits development (Zambia Development Agency, 2013). Only 34% of the population has access to clean piped water (Foster & Dominguez, 2010); this demonstrates the need for more water infrastructure development. Importantly, there is a housing shortfall of approximately 1.5 million units (Zambia Development Agency, 2013). The Zambian government is committed to reducing this infrastructural backlog (Vision 2030; Fifth National Development Plan), but efficient and effective delivery of infrastructure is needed to mitigate the endemic challenges of quality shortfalls, cost/time overruns and project abandonment.

The challenges associated with project delivery are mostly attributed to incomplete contracts, poor management of risk in the implementation stage, poor risk sharing (Sibanyama, et al., 2012), shortage of artisans (Kaoma and Muya, 2016) and one-sided contracts with risk(s) mainly allocated to the contractor (Mukumbwa & Muya, 2013) . Nonetheless, these shortfalls could be minimised (El-Sayegy, 2008) through the application of risk management strategies to manage projects and influence contract documentation for either bespoke contracts or standard forms, as well as for risk allocation; which in turn would aid risk management in the construction phase, resulting in the desired project delivery. Muya, et al., (2013) have argued that the industry does not currently have any successful corrective measures for poor performance resulting from risks. Therefore, development of a mechanism is proposed. Apart from the causal factors affecting performance identified by Kaliba, et al., (2009) in their study of *engineering/road projects* in which they used 15 interviewees, they argued that contracts are incomprehensive. It is unclear why contracts are not comprehensive to begin with. Likewise Sibanyama, et al., (2012) investigated *architectural and engineering* construction projects using a questionnaire survey and semi-structured interviews, attributed poor performance evidenced by rampant claims to contracts not being comprehensive and poor risk sharing without giving insights as to why the situation was as found.

Though the "contract" has been blamed for the poor performance, it is unclear the contributions of contracting parties involvement in the poor performance of the industry resulting in risk misallocation. Additionally, aside from the contract it is unclear the measures put in place to alleviate risk in general practice and contract selection. In contrast, Mang'elele and Muya, (2008) through a brainstorming approach recognised poor identification of risks impacting on *community projects* as a deficiency in the public sector contracts. Furthermore, Mukumbwa and Muya, (2013) used 260 viable questionnaires and 15 semi-structured interviews to blame negative performance in the ZCI on consultants drafting one-sided contracts and using unfair clauses. Consultants should be in a position to draft fair contracts if operational conditions allow. Given the diverse nature of projects exhibiting elements of risk misallocation it would appear that misallocation is a recurring contributing source of poor performance in the ZCI. However it is unclear whether the sources are structural (environment, rules) related, or agency (consultants and contractors) related or both.

This research was aimed at establishing why risk misallocation by the client is recurrently contributing to poor project delivery in the ZCI from an agency and structural perspective. Thereafter to formulate a mechanism through which risk allocation can be done using a risk management approach in the construction industry with the building sector as a model. The mechanism was formulated based on findings as to why risk misallocation exists, as models in the literature do not focus on the issue of why poor allocation, inappropriate allocation and misallocation of risk is prevalent; instead they deal with how allocation should be more appropriately shared between client and contractor after identifying misallocated risks. The formulated mechanism uses various rational decisions through a process improvement approach that can be applied at various stages of the risk allocation process and project stages keeping in mind the shortfalls of current practice in risk allocation.

The Zambian Construction industry needs a mechanism to improve efficiency and enhance the sector's contribution to the economy. This industry has contributed between 10% and 15% to gross domestic product in recent years (BOZ, 2013). This could be maintained or improved if the industry were more efficient. An analysis of the reports by the Auditor General's office for the period 2006-2015 on construction projects indicates that approximately 80% of projects (mostly building projects) had time and cost overruns, quality shortfalls and the absence of contractor(s) on site for incomplete projects (Auditor General's Office, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015). An additional seven projects not covered in these reports all exhibited time and cost overruns (see Appendix 1 B). It is evident that poor risk allocation leads to poor performance of projects in terms of time, cost and quality inefficiencies, with their concomitant disputes and adversarial relationships between contracting parties (Akintoye & Macleod, 1997; Alsalman & Sillars, 2013; Mead, 2007; Ward & Chapman, 1997). Efficient risk management is significant to the wider economy as it improves the provision of infrastructure, thereby boosting business in various sectors and thus improving the gross domestic product (Banaitiene, et al., 2011). However, the ZCI in particular has not been particularly proactive in fully adopting sound risk management measures so it continues to experience poor project performance.

1.1.2 Prior Research

Various researchers have formulated risk allocation models/frameworks (Hanna, et al., 2013; Jin & Zhang, 2011; Lam, et al., 2007; Lehtiranta & Juunonen, 2014); nevertheless, the practical applicability of these could be limited as poor risk allocation and outright misallocation of risk continue in the industry. Moreover, the models do not ask the fundamental question of why risk allocation is poor/inappropriate in the first place but instead address what is misallocated and to whom it should be allocated (See Hanna, et al., 2013; Nasirzadeh, et al., 2014; Tian & Zhao, 2014; Wang, et al.; Tserng et al, 2009). Some models of risk allocation are focused on specific procurement methods hence their application is limited to such. For example, Lehtiranta and Juunonen (2014) modelled risk allocation in a collaborative strategy (construction management) focusing on the duties of participants at different phases of the project, using a case study approach which limited generalisation of their model (Hwang, et al., 2014). Likewise, Zhao and Li (2010) used a case study approach to model risk allocation using literature in international projects. The model of Jin and Zhang (2011) applied to public-private partnership (PPP) projects focussing on risk transfer based on capability and attitude using artificial neural networks based on fuzzy logic. Medda (2007) used a game theory approach to model risk allocation in the transportation sector. Other earlier approaches were quantitative in nature (Peckiene, et al., 2013) and applied purely mathematical approaches such as fuzzy logic or integer programming (Lam, et al., 2007; Zhang & Fan, 2014); these have limited practical applicability to non-academic practitioners. However earlier studies are foundational in that they identified who among the contracting parties should be allocated specific risk (Lehtiranta & Juunonen, 2014; Hanna, et al., 2013) while inputs for risk management were also identified (Zhao & Li, 2010).

1.2 Significance and Importance of the Study

The study is important as the outcome may form a basis for more efficient delivery of projects in the ZCI by enhancing the probability of success and maximising profitability while minimising the consequences of risky and uncertain events on construction projects (Chun & Ali, 2012). It is essential for risks to be suitably allotted in a contract since it is problematic even for the courts to assign responsibility for a particular risk if no clause exists in the contract that does so (Hanna, Swanson and Aoun, 2014). The gauge of contract efficiency and effectiveness is its adeptness to plainly assign risks between contracting parties (Hartman, 1996). This implies that foreseeable risks should be managed correctly (Subramanyan, et al., 2012) and additional measures put in place for non-contractual risks by contracting parties.

The proposed mechanism identifies potential risks on building projects and proposes guidelines for allocation and response measures as a process guide for risk allocation during all phases of the project life cycle except the operation and disposal phase. This is particularly important in the ZCI because of the following shortfalls among contractors as identified by Mashamba, (2009); lack of technical, business and managerial skills; poor contract management, poor organisational capacity and inability to price work accurately. Similarly Kaliba et al., (2013) identified the following shortfalls among consultants; poor contract management, coordination and supervision; and poor project management skills. Though skill related deficiencies have been noted, in the risk management context it is unclear where the skills lack in contracting parties in the ZCI. Additionally Skill or agency related deficiencies may not be the only issues surrounding poor performance because in instances were skilled labour was contracted, projects are delivered beyond time and schedule for instance the case of the government complex (2011) , the youth development centre (2013), Heroes stadium (quality issues-2014) and the Levy Mwanawasa Stadia (2011) are such examples. This point to environmental or structural impediments in the ZCI. These need to be identified for meaningful improvements to be made in project delivery in the ZCI.

The mechanism could minimise shortfalls by identifying risks in building projects and offering a process model and framework to allocate risks to the appropriate party, using appropriate methods and using effective response measures specifically for use by the clients and their consultants' on medium to large scale projects. The tool could also be applied by a contractor depending on how the procurement of a project is arranged, notwithstanding, that the client is the key driver of performance improvements and innovation (Latham, 1994; Zaghoul & Hartman, 2003). While a contractor may negotiate risk allocation (Laryea & Hughes, 2009); the client is the key player in risk allocation in a contract (Ward, et al., 1991; Uff, 2009; Hassanein & Afify, 2007). Emuze and Smallwood (2013) clearly pointed out that contract choice and hence risk allocation strategy is determined by the policy decision of the client. It is therefore important that the client appreciates that an inappropriate strategy on the retention and distribution of risk could jeopardise projects (Emuze & Smallwood 2013; Watermeyer, 2012). Moreover, temporary multi-organisations (TMO) are created by clients to initiate, manage and execute construction projects (de Blois & Lizarralde, 2010). It would therefore be important to establish if the client considers risk allocation and management when selecting a contract to use on a project. The study provides a basis for risk allocation improvement between contracting parties. This could in turn result in appropriate risk allocation and improved project delivery.

1.3 The Research Problem

Inappropriate allocation of risk remains a weak link in the risk management process and it results in poor project delivery (Alsalman & Sillars, 2013). Projects in the ZCI are characterised by quality shortfalls, cost overruns, time overruns and project abandonment (Auditor General's Office, 2013-2015). Inappropriate risk allocation by the client could be contributing to project failure mainly resulting from unfair allocation, incomprehensive contracts and poor risk sharing arrangements. Poorly managed risks in construction projects negatively affect project delivery (Banaitiene, et al, 2011; Wiguna & Scott 2006). This can be avoided or minimised through planning (Olsen & Osmundesen, 2005), which is normally done in the pre-contract stage. Risk management plan is a document that a manager prepares to foresee risks, estimate impacts, and define their mitigation (Olsen & Osmundesen, 2005).

In the ZCI it has been established that risk sharing is generally poor (Sibanyama, et al., 2012) and unbalanced (Mukumbwa & Muya, 2013; Sibanyama, et al., 2012). The approach of this study was to discover why risk misallocation is recurrent in ZCI in order to devise a mechanism for improvement. This is congruent with the work of Latham (1994) and others who advocated for the construction industry to allocate risks appropriately to the party most competent to manage it. Mead (2007), Akintoye and MacLeod (1997), Murdock and Hughes (2007), Uff (2010), Lu and Yan (2013), Osipova and Eriksson (2011) and Lehtiranta, (2014), have variously supported this view from different perspectives such as procurement and roles of project team members. In addition to this, the appropriate mechanisms and resources should be used (Gollenbeck & Schultmann, 2010).

The Zambian government as the major client for infrastructure development is currently committed to improving the status of infrastructure provision. This is expressed in current projects aimed at improving the road infrastructure such as Link Zambia 8000 and Pave Lusaka 2000, as well as in construction of health and educational facilities countrywide (ZDA, 2013). Others projects are documented in the Seventh National Development Plan 2017-2021 (Ministry of Finance and National Planning, 2017) and Vision 2030 (2006), a road map for Zambian development from 2006-2030. At the national level, funds are being borrowed to carry out these projects (Roy, 2014) which highlight the need to be effective and efficient as an industry. However, it would appear that the industry lacks comprehensive risk allocation in draft/document contracts (Sibanyama, et al., 2012) and lacks risk management skills in project participants (Muya et al., 2013) in the project cycle, leading to underperformance of the industry as a whole. Additionally, risk misallocation is a recurrent problem (See Kaliba et al, 2009; Muya et al., 2013 Mukumbwa & Muya, 2013; Mang'elele & Muya, 2008 for examples of misallocation) in the ZCI.

1.4 Knowledge Gap

Various risk analysis and management tools/ practices have been identified in the literature. However, risk allocation remains the weakest link in the risk management process leading to poor performance of construction projects. Various studies have been done on risk allocation from the premise that risk allocation is poor, inappropriate, unbalanced or that misallocation exists. The focus of most studies has been how to allocate risk to achieve more improved risk allocation, achieving balanced, appropriate risk allocation. In a nutshell most of the studies done globally have tried to solve the problem by finding a solution to the resultant misallocation of risks but have rarely investigated why the misallocation exists to begin with. Furthermore, barriers in risk management reported in the literature are attributed to lack of skill and knowledge (Chileshe & Kikwasi, 2014; Choudhry and Iqbal, 2013; Lyons & Skitmore, 2004; Perez, et al., 2016) yet it is unclear what deficiencies there are in skill and knowledge of the involved parties. It is also unclear from the current contextual Zambian body of knowledge what risks do affect building projects and what practices are used for risk management and in particular, risk allocation. It is also unclear how contracts are selected in the ZCI to reduce or eliminate risks. All the aforementioned are gaps that need to be addressed to be able to formulate an intervention for risk allocation/management in the construction building sector.

1.5 Statement of the problem

Risk misallocation is a major problem in the construction industry and various reasons for this weakness might be proffered in different jurisdictions, in the Zambian construction industry it is currently unclear why risk misallocation is a recurrent problem contributing to poor project delivery.

1.6 Research Motivation and Justification

Various risks impact poor delivery in the Zambian construction industry, leading to quality shortfalls, cost and time overruns (Kaliba, et al., 2013). In addition, claims in the industry are rampant, mainly caused by poor risk sharing and incomplete and incomprehensive contract documentation (Sibanyama, et al., 2012). Alsalman and Sillars (2013); Love et al (2008) and Mead (2007) indicated that unbalanced or unfair allocation leads to cost overruns, time overruns, quality concerns and disputes. Meng (2012) blamed unbalanced risk allocation to the unavailability of contract clauses and to ambiguous stipulations or queries about the objectivity of risk allocation in traditional contracts. Mukumbwa and Muya (2013) cited one-sided contracts, where risk is wantonly transferred to the contractor, and the insertion of unfair clauses in the standard contracts, among other practices. Project delivery challenges leads one to deduce that among other causes such as inadequate risk management knowledge, risk allocation is poor and unbalanced in the forms of contracts currently in use in the ZCI. Therefore, a mechanism for aiding risk allocation in a project may be useful to develop for the building sector. This study is justified and motivated by the need to discover why risk misallocation in the ZCI is recurrent thereby providing a basis for formulating corrective measures. This was done by identifying and understanding why misallocation persists, and recommending how it may be improved.

1.7 Research aim, objectives and questions

1.7.1 Aim

The aim of the research was to investigate why risk misallocation is recurrent in the ZCI with a goal of developing amechanism to aid risk allocation in the building sector.

1.7.2 Research objectives

1. To investigate how the selection of contract forms used in the ZCI influence risk allocation
2. To assess the risk allocation practices used by contracting parties in the ZCI
3. To establish how risks perceived to be pertinent by contracting parties are allocated in the contract forms used in the ZCI
4. To devise and validate a mechanism for aiding risk allocation in the ZCI

1.7.3 Research Questions

Why is risk misallocation recurrently contributing to project failure in the Zambian construction industry and what mechanism can aid risk allocation?

Sub-questions

1. What factors influence the choices of contract forms on building projects to influence risk allocation?
2. What are the risk allocation practices used by contracting parties in the ZCI?
3. How are risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?
4. What mechanism can be devised and validated to aid risk allocation in the ZCI?

1.7.4 Statement of Hypotheses

In order to determine the significant contract selection factors (CSF: 1-15 for research question 1) and risk factors (RF: 1-55 for research question 3) influencing contract selection and performance respectively in the ZCI, various hypotheses were asserted in the research. The null hypotheses tested the equality of responses for the rating of each CSF: 1-15 and RF: 1-55 to "4" from a 5-point Likert scale that was utilized in the questionnaire. The "4" represented the high importance or highly considered for RF: 1-55 and CSF: 1-15 respectively. The statements of null hypotheses were as follows:

• H_1: The Median of (CSF):1-15 equals 4 (Research question 1)

• H_2: The Median of risk factors (RF):1-15 equals 4 (Research question 3)

In summary, the conducted survey was designed to rate the contract selection factors and risk factors by their degree of consideration or importance. The three possible ratings are low (1-2), moderate (3), and high (4-5). In addition, the survey was utilized to see if different groups of respondents have similar perceptions on factors used for contract selection (Research question 1) and risk factor influence on performance (research question 3). The statement of null hypotheses was as follows:

H_3: The perceptions of consultants with regard to contract selection factors are similar across the different roles (Research question 1)

H_4: The perceptions of consultants with regard to contract selection factors are similar across the different years in experience (Research question 1)

H_5: The perceptions of consultants and contractors with regard to risk factors are similar for risks influencing performance (Research question 3)

H_6 The perceptions of consultants and contractors with regard to risk factors are similar across the different years in experience for risks influencing performance

Furthermore, correlations were computed to determine if there were associations among the risk factors and contract selection factors. The following null hypotheses were formulated

H_7: *There* is no (moderate to high) relationship between Contract selection factors (CSF1-15) (Research question 1)

H_8: There is no (moderate to high) relationship between risk factors (RF1-55) (Research question

1.8 Assumptions of the Research

The assumptions of the research are as follows:

A) That the information provided is reflective of current practice.
B) Standard forms of contract in the ZCI are generally modified to address pertinent exigencies.
C) Informal risk management protocols are widespread, and this existing, sporadic and limited risk management does somehow have a positive impact on project delivery.
D) Incomprehensive contracts and unprofessional shirking by contracting parties result in quality shortfalls, cost and time overruns and claims.
E) Risks perceived to be pertinent are given particular attention in risk allocation
F) Risks are priced based on information available at the time of tender.

1.9 Scope and Limitation of the Study

1. Private (including non-governmental organisations) and public sector (including parastals) clients and consultants engaged in the building sector were part of the study. Building construction is usually further divided into residential and non-residential (commercial/institutional/industrial) (ZDA, 2013, NCC, 2014).

2.Building projects carried out by category B-Building grade 1-3 contractors were used in the study as the remaining grades of contractors (grades 4-6) are either labour only contractors, normally subcontracted by the higher grades or are engaged in specialised works.

3. Risk misallocation in terms of its recurrent nature in this study is based on misallocation reported from project to project with different (professionals, contractors and clients) project teams rather than misallocation resulting from repetitive business with the same project team.

1.9.1 **Delimitation**

1. Relational practices fostered by current risk allocation and performance resulting from risk allocation will not be part of the study as they will make the scope too large
2. Practices for risk allocation were investigated at a firm/enterprise level focusing on individual practice because individual capabilities give a more clear understanding of what is applied.
3. Only contracts used for the building sector by both private and public clients in the last 5 years were used for document analysis to ensure issues are relatively current, allowing generalisation to building projects only.

1.10 Methodology Summary

The study used a pragmatic philosophy with the aid of structuration theory and Gilberts Management theory lenses as frameworks for the study (see Chapter 5). These are used to determine the environmental/structural and agency/personal repository factors contributing to risk misallocation in the ZCI building sector. The research design is divided into three stages as depicted by Figure 1.1. The first stage is the literature review, the second deals with research tools development, tools implementation and model/framework development and the last stage covers the writing of findings, discussion and conclusions.

Stage 1

During the literature review phase, literature relevant to the Zambian construction industry, contracts types and selection process was reviewed. Followed by literature on risk, specifically risk management, risk allocation theories and risk factors faced by contracting parties. Relevant literature was gathered in primary and secondary literature sources such as unpublished articles, published articles, journals, books, and the world- wide-web and construction magazines (Potter, 2006). The literature review led to the identification of the research gap, formulation of research aim, objectives and questions, theoretical framework and conceptual model.

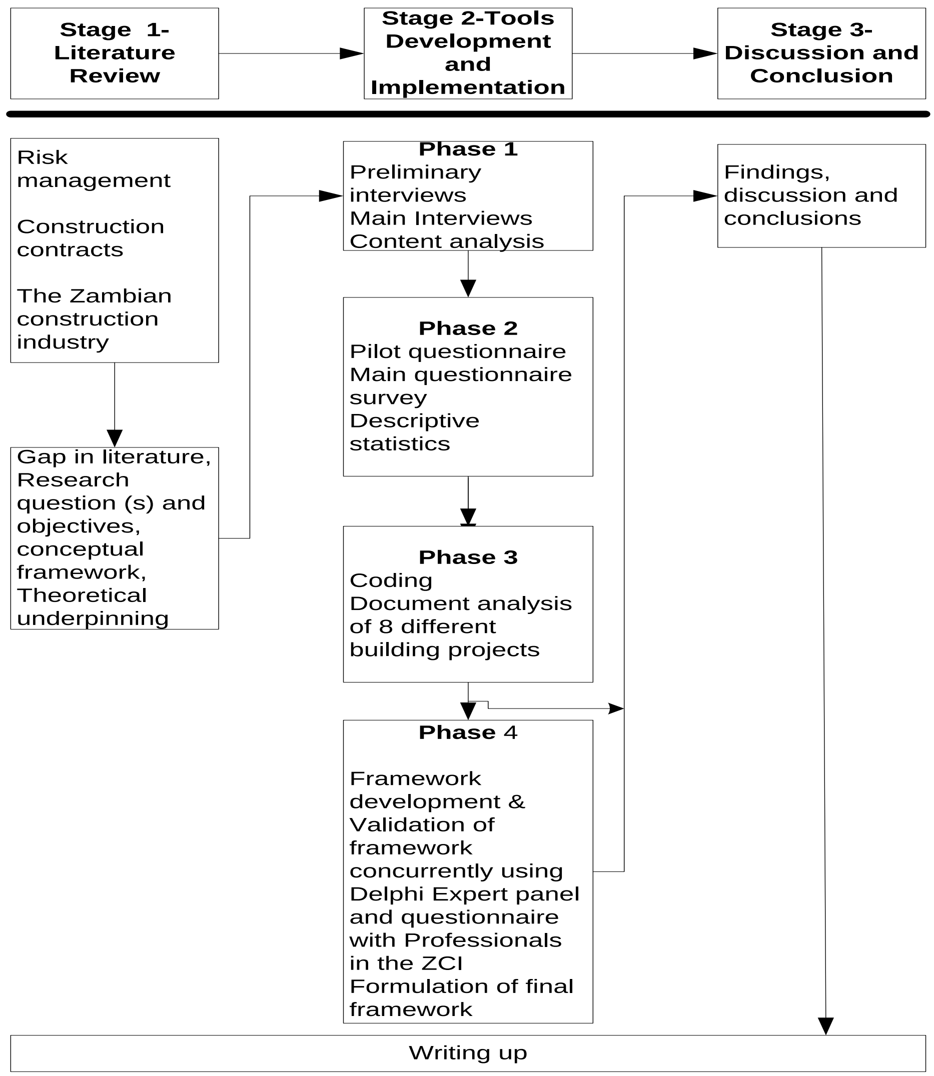


Figure 1.1 Research flow diagram

Stage 2

Stage two of the research covered the development of data collection tools and protocols; and implementation stage. The data collection tools were developed and preliminary and pilot studies were done for semi- structured interviews and questionnaire survey respectively. A mixed method approach was used. The interviews were the main method of data collection but what was uncovered in the interviews needed to be understood in terms of what was happening and to what extent. Furthermore, documents were used to verify findings from the interviews.

Strategies included semi-structured interview, questionnaire survey and document analysis. For verification of the mechanism, purposive questionnaire and Expert Delphi technique were used. The reason for using different strategies and data collection methods was mainly to increase the quality of the research and facilitate diverse results both qualitative and quantitative in nature. The quantitative approach provided the overall picture of the phenomenon (Leedy & Ormrod, 2010) and the qualitative aspect provided support for interpreting the findings to give holistic understanding of risk allocation (Gray, 2009). This is because different types of research questions require different strategies and methods (Yin, 2003).

The populations of interest were from public and private sector as follows: consultants (civil engineers, quantity surveyors, project managers, architects), clients, and contractors in the construction industry from Building category Grade 1-3. Consultants were considered because they prepare contractual documents and make the key decisions on behalf of clients (Hackett et al, 2007). Contractors were included as they are the one who execute the contract in the construction phase. Clients were considered because they initiate the projects (Ashworth, 2006) and project managers as they manage the project (Lester, 2006; Project Management Institute, 2008).

Stage 3

This was the final stage of the research. It involved mostly writing up of findings, the discussion, conclusions and recommendations of this research. A final literature search was carried-out at the stage of writing up the discussion.

1.11 Summary of findings

The summaries of findings are based on the research questions for the study as follows:

1.The empirical phase revealed that contract selection factors that could influence risk allocation such as method of price determination, procurement method, and status of design, incentives, and complexity of requirements (Section 7.4.8 and Table 7.23 in chapter 7) are not considered as highly important selection factors for contracts. Consequently, this results in risk allocation not being fully addressed. This results in use of inappropriate contracts (section

7.7.6) and modifications resulting in incomprehensive allocation (section 7.7.6 /7.1.5 and Table 7.11), resource misallocation and inappropriate allocation (due to deficient contract portfolio) if, modifications are not carefully done. Additionally, there is a difference in perception of consideration of some selection factors among consultants as shown in Appendix 10B-10D.

2.The practice of risk allocation in the ZCI is marred with several issues that are contributing to risk misallocation namely lack of risk monitoring (Sections 7.2, 7.6.13 and Tables 7.7 and 7.19 in Chapter 7), lack of quantitative risk management (Table 7.6 and Section 7.5.2 in Chapter 7), lack of incentives (Section 7.6.6), inadequate information (Section 7.1.4, and 7.3.3), inadequate training in risk management (Section 7.2.2 and 7.4.3) and unjustified contract modifications (Section 7.1.3). Some differences in perception of risk factors influencing performance among project team members (Section 7.7) are also contributing to risk misallocation.

3.How risks perceived to be important in the ZCI are allocated by contracting parties is largely affected by differences in perception of risks affecting performance (Section 7.7). This results in incomprehensive allocation (project 3 section 7.7), use of imperfect mechanisms or non – implementation of mechanisms (monitoring and supervision Section 7.2.9 and 7.6.13 in Chapter 7) and non-carrying out of obligations contributes to risk misallocation (See Section 7.7 and Table 7.39). Various forms of misallocation occur in the ZCI such as inappropriate allocation, resource misallocation and use of imperfect mechanisms (Section 7.2.2). The most common methods used to allocate pertinent risks are transfer and acceptance by the client (Table 7.37). Since some risks are not contractual but are implied non mitigation of these risks adds to risk consequently adding to resource misallocation. Waiving of clauses unbalances the allocation so contributing to risk misallocation (Section 7.1.5 and Table 7.38).

4.A risk allocation process in form of a process model was developed (See Figure 9.35) and validated (Section 9.5.) to alleviate current risk misallocations in the ZCI in Chapter 9. The intervention can be used on new building projects by client or contractor from pre-contract to construction stage on medium to large-scale projects.

1. 12 Contribution to knowledge

A contribution to knowledge refers to an original contribution to knowledge, which can be made in several ways according to Phillips and Pugh (2005:62). A brief list is given below and a more detailed explanation is given in Chapter 10 section 10.5. The following contributions are made by this thesis using an outline by Phillips and Pugh (2005:62) as a guide.it should also be noted that many of the contributions claimed here are published in the *Journal of Construction Engineering and Management* volume 144 issue 5 which is a double blind review in a paper entitled Identification of enablers and constraints of risk allocation using structuration theory in the Construction Industry. Other publications as were this work is published are shown on page XX and XXI of this thesis.

1 *Original empirical work*: This is one of the few studies in construction management field to use structuration theory and Gilberts' Management Theory. The focus was to investigate structural/environmental and agency/personal repository factors constraining risk allocation. This study is based on empirical evidence using the two lenses (See Chapter 8 and Tembo-Silungwe and Khatleli, 2018).

2 *An original synthesis*: This thesis presents a process model (Figure 9.35 in Chapter 9) that integrates contract practice, risk management and the project cycle. This is further achieved by integrating views of an expert panel and professionals in the Zambian construction industry in formulating the risk allocation model. This is an original synthesis as it has never been done before.

3 *Offering a new interpretation based on existing knowledge*: The problem of risk allocation is not new in the construction industry. This thesis provides a new interpretation of risk allocation by identifying how current agency/personal repository factors and environmental/structural states influence risk allocation (Tembo-Silungwe and Khatleli, 2018). . These are modelled to show how they result in risk misallocation (Section 8.5 Chapter 8).

4 *Different contexts*: The majority of risk allocation studies have been conducted in developing context (Appendix 1). The implication is that structures in these contexts are developed while agents are skilled. Therefore carrying out this study in a developing context is original (Tembo-Silungwe and Khatleli, 2018).

5 *New Technique in a new area*: Structuration theory and Gilbert management theories are hardly applied to the construction industry much less to explain risk allocation. This thesis makes an original contribution to knowledge by actualising this.

6 *New evidence on an old issue*; The thesis has uncovered how structure/environmental factors and agency and personal repository factors influence risk allocation on the debate of inappropriate risk allocation in the construction industry. Past theoretical perspectives in section 3.7 in Chapter 3 use the facets in these two theories differently.

7 *Using different methodologies*; This thesis has utilised several methodologies drawing from different strategies (interviews and survey) and methodologies of data collection namely semi-structured interviews, questionnaire survey, document analysis and Delphi expert panel as discussed in Chapter 6.

8 *Unique areas in the discipline*: The majority of studies on risk allocation focus on who a risk should be allocated to. This study in addition to this, examines mechanisms used for risk allocation. This is common in financial studies. Additionally, the focus is on why misallocation occurs focusing on the environmental/structural and agency/person repository issues.

1.13 Chapter synthesis

- **Chapter One: Introduction**: This chapter introduces the study and gives an overview of its aim, its objectives, the research questions and the justification for the research with a synopsis of methodology, the scope, summary of findings, contribution to knowledge and the chapter ends by giving the organisation of the thesis.
- **Chapter Two: The Zambian construction Industry: This chapter reviews literature on the Zambian construction industry. A**n overview of the country and its construction industry are given, the current infrastructure needs are outlined, the main actors in the industry are briefly described, the contracts used are outlined, the procurement methods pointed out and a conclusion is drawn on the industry's state.
- **Chapter Four: Risk allocation in the construction Industry**: This chapter reviews literature on risk allocation in the construction industry. It defines risk, discusses the risk management process, the various models for risk allocation, the theoretical perspectives used for risk allocation in past studies and the relationship between risk and procurement.
- **Chapter Three: Building Contracts used in the Construction Industry**: This is a review of contracts: their history, the use of contracts generally, contract types, factors affecting the selection of various contract types, the relationship between risk and contract types.
- **Chapter Five: Conceptual Model and Theoretical Framework:** This chapter presents the conceptual model developed from literature. It gives the operationalization of the application of structuration theory and Gilbert's management theory to the study.

- **Chapter Six: Methodology:** This chapter discusses the research philosophy adopted and methods of data collection, sample selection and data analysis employed in the study. It also includes a discussion on validity, reliability and ethics.
- **Chapter Seven: Results and Analysis from the Interview Survey, Questionnaire Survey and document analysis:** This chapter consists of an introduction, results, from the semi-structured interviews, questionnaire survey and the document analysis. It offers a summary of results and findings based on each research question.
- **Chapter Eight: Discussion:** This chapter discusses the results using a question-by-question approach. It integrates the issues contributing to risk misallocation into a cause and effect diagram later decomposed into causal networks.
- **Chapter Nine**: Development and Validation of Model: This chapter documents the development and the validation of the process model through concurrent purposive heterogeneous questionnaire and Delphi expert panel. Benefits and shortcomings of the model are also outlined.
- **Chapter Ten: Conclusions and Recommendations:** This chapter concludes the study based on results and analyses. It then highlights implications for practice, theory, and methodology. The limitations and the validation issues of the study are given. Recommendations are offered for further research.

1.14 Chapter summary

This chapter has provided an overview on the subject of risk allocation in the Zambian construction industry and has identified the central question of research for the study, outlined the aim, objectives, questions to be answered and the methodology to be employed in conducting the research. The next chapter reviews the literature on the Zambian construction Industry.

CHAPTER 2 –AN OVERVIEW OF THE ZAMBIAN CONSTRUCTION INDUSTRY (ZCI)

2. Introduction

The construction industry is customarily divided into construction of buildings; Infrastructure (roads, highway, bridges etc.) and specialty trades (plumbing, air-conditioning etc.) (Szymanski, online). This chapter gives an overview of the Zambian construction industry (ZCI). To appreciate the ZCI an overview of the following are given, Zambia, the construction industry and the current infrastructure needs. Additionally, the main actors in the industry, the contracts used and the applicable procurement methods are briefly described. Lastly, a conclusion is drawn on the industry's current state in relation to risk allocation and the need for an intervention.

2. 1 An overview of the Zambian Construction industry

The construction industry of any nation is fundamental to its development as it provides critical infrastructure to the functioning of other sectors of the economy. This contributes to Gross Domestic Product (GDP) and provides employment. Therefore, the organisation, efficiency, capacity and cost effectiveness of the construction industry is of vital importance if the industry is to play its role (Muya, et al, 2003). It is desirable that the ZCI should be able to play its role as demonstrated above. Unfortunately, the ZCI is characterised by cost overruns, time overruns; shortfalls in quality and widespread project abandonment (Mang'elele & Muya, 2008; Kaliba et al., 2013; Kaliba et al., 2009; Auditor Generals' Office, 2006-2015).

2.1.1 An overview of Zambia

Zambia is a landlocked country with eight immediate neighbours namely: Mozambique, Malawi, Zimbabwe, Botswana, Tanzania, Angola, Zaire, and Namibia. Its total population is approximately 16.87 million (Countrymeters, 2016). Zambia is classified as a lower-level middle income country (BOZ, 2013). This status was attained in 2011. Lower middle-income countries have an average gross national income per capita of between U$1,026 and U$ 4,035 per year (World Bank, 2016).

The country has an open market economy. This means that players in the market largely have an influence on the economy. This economic status came about in 1991 when the country moved from being a one party state under the United Nation Independent Party (UNIP) government led by President Dr Kenneth Kaunda to a democracy under the Movement for Multi-party MMD headed by President Frederick Chiluba. Zambia gained independence from her British colonial masters in 1964. Prior to this Northern Rhodesia as it was then known, was a colony and then a protectorate of the British Crown from 1888 to 1963 (Chalwe, 1990). Before 1888, Zambia was characterised by tribal life. In 1902 lead and zinc were discovered in Kabwe and in 1909 while under the governance of the British South Africa Company (BSAC), copper was discovered near the border with the Belgian Congo (current day Zaire) In 1924 the BSAC handed over the administration of Northern Rhodesia to the British government, but the company was allowed to retain the mineral rights in the colony (Chalwe, 1990; Simson, 1985).

During the governance of Dr Kaunda in the 1970s Zambia enjoyed a strong economy due to high copper prices, the main national extractive commodity (Chalwe, 1990). Until the present day, the country still depends on copper for most of its foreign exchange. During the MMD regime, the economy was liberalised and most of the state assets were privatised. This was not sufficient to modernise the economy. In 2001, Patrick Levy Mwanawasa (MMD) came into power after Presidents Chiluba was forced out for alleged misuse of state funds. By this time, corruption had taken its toll, which President Mwanawasa attempted to root out. When he died in 2008 Rupiah Banda (MMD) ruled until 2011 when the Patriotic Front (PF) came to power under the leadership of Michael Chilufya Sata succeeded in October 2014 by Edgar Changwa Lungu still under the PF. The PF has continued to make efforts in infrastructure development. However, the country continues to face economic challenges and is in a hurry to recover through the improvement of infrastructure (Vision 2030, 2011).

2.1.2 An Overview of the Zambian Built Environment

According to the World Bank (2014), Zambia has had over 10,000 construction projects between 1947 and 2014. Formal construction projects of note using a recognised contract in Zambia can be traced to October 1970 with the construction of the Zambia railways system currently consisting of approximately 2,100 Km of track (ZDA, 2014). The initial length at the time of construction was 1,860 km linking Dar es Salaam in Tanzania and Kapiri-Mphoshi in Zambia, north of Lusaka. Only 860km of this was in Zambia. The main intention of this project was to lessen Zambian dependence on the then white minority regimes in South Africa and present-day Zimbabwe (then Southern Rhodesia) (InfoPlease, 2014). The infrastructures to be discussed in turn are roads, airports, energy, water and basic infrastructure such as housing.

A. Roads: In terms of the road network, Zambia currently has 67,523 km of road (Raballand & Whitworth, 2014). The Road Development Agency (RDA) is responsible for trunk (Motorway standard for long distance travel) (3,116 km), main (intercity/inter-province/inter-territorial roads) (3,701 km), district roads (13,707 km), urban roads (local authority roads) (5,597 km) and primary feeder roads (a secondary road used to bring traffic to a major road) (15,311km). The Ministry of local Government and Housing (MLGH) is responsible for secondary feeder (a road used to bring traffic to a primary feeder road) (10,060), tertiary feeder roads (linking rural areas to secondary roads (4,424 km) and community roads (providing access to residential properties) (5,000km). Lastly, the Zambia Wildlife authority is responsible for roads in the national parks (6,607 km). Of all these various road types only 9,403km is paved. However, the agencies of Link Zambia 8000, Lusaka 400 and Pave Zambia 2000 (Zambia Development Agency, 2013) are changing this situation, being currently engaged in projects.

B. *Airport Infrastructure:* Airports are essential in promoting air transport. In 2004, Zambia had an estimated 109-earmarked airports, with only 10 having paved runways. There are four international airports; five secondary airfields and five airstrips serving international and domestic flights (ZDA, 2013).

C. *Energy infrastructure:* The Zambia Development Agency (2011) stated that energy infrastructure is mainly state owned by the Zambia Electricity Supply Corporation (ZESCO) as the main producer and distributor of electricity in the country. The agency adds that the current transmission system is estimated at 4,638 kilometres. The total transformer installed capacity is 3000 Mega Volt-Amps and unexploited hydropower potential of 6,000 MW still awaits development. This needs to be developed as power demand in various sectors of the economy is on the increase (Ibid).

D. *Water infrastructure:* Water is vital for human survival and daily activities. This, therefore, implies that its adequate supply is necessary. However, by 2010 only about 34 % of

Zambia's population had access to utility water, whether from private taps or stand-posts (Foster and Dominguez, 2010). It is unlikely that the situation has improved much since then.

E. *Basic infrastructure:* Basic sector infrastructure exists for both domestic and foreign investors such as industrial land, road and railway linkage, electricity, water, telecommunications, executive/high cost housing, schools, hotels and medical facilities in the form of hospitals and clinics (Zambia Development Agency, 2011). In addition to this, four zones have been earmarked by the government for development, being Chambeshi Multi-facility economic zone (MFEZ) in Kitwe district, Lumwana MFEZ in Solwezi, Lusaka East MFEZ, and Lusaka south MFEZ. Furthermore, two industrial parks have been earmarked for development namely the Roma industrial park and Ndola Gemstone Exchange Park. Apart from the Lusaka South MFEZ these zones are privately owned. The housing shortage stands at 1.5 Million units (Zambia Development Agency, 2013). This is presumably measured in relation to available housing units against the population. Government Recommends an annual delivery rate of 150 000 units to meet the demand in the next 10 years (Ibid).

2.2 An overview of the Zambian Construction Industry (ZCI)

The ZCI is an important sector of the country's economy. It has steadily improved over the years and this is evidenced by its contribution to Gross National product (GDP) demonstrated in Figure 2.1 below. Clearly, from 2011 to 2013 the contribution has continued to be a double-digit percentage in contrast with the period 2000-2010 when it was less than 5%. However, in 2014 the contribution was 7.5% (ZDA, 2014).

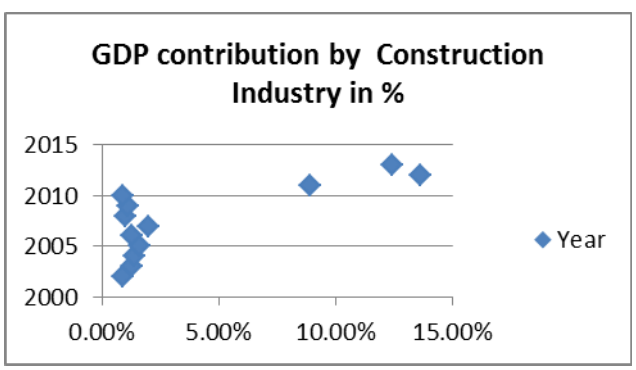


Figure 2.1 GDP contribution data from Bank of Zambia Reports from 2004-2013)

In addition to improved contribution by the sector to the national economy, the ZCI has experience a noticeable growth (see Figure 2.2). The construction industry recorded an average growth rate of about 15% from 1999 ($US65M) to 2005 ($US150M). Notable construction and construction related activities from 2005 include continued construction of Kansanshi mine and related facilities such as shopping malls, offices, houses, entertainment facilities and rehabilitation of roads (Bank of Zambia, 2006), increased production of cement by Lafarge, oriental quarries and Zambezi Portland Cement which was necessitated by an upsurge in public and private construction activities across the country (Bank of Zambia, 2012) and roads construction, stadia, residential and commercial property across the country (Bank of Zambia, 2013). Along with this growth of the sector, employment levels have been seen to increase also (Statistics Zambia, 2014) and as of 2014, the industry accounted for 21% of total employment in the country (ZDA, 2014).

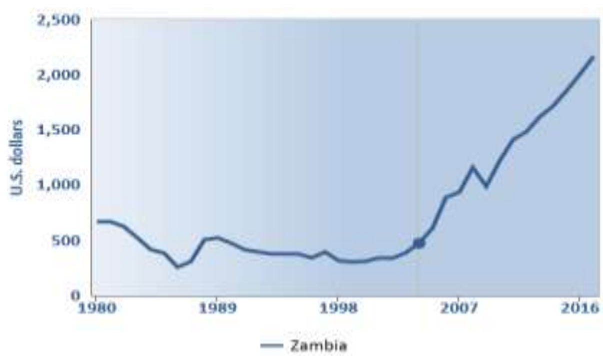


Figure 2.2 Source: World Economic Outlook, October 2012 showing GDP

While the construction sector has been recording improvements in GDP contribution, sector growth and increased employment since 2010, on the other side the industry continues to face problems (see Appendix 1C for examples of poorly performing projects/agencies). Firstly, capacity constraints result in local contractors not being generally preferred for big projects. Consequently, a large proportion of construction projects are awarded to foreign contractors resulting in the externalisation of the country’s foreign exchange (Mashamba, 2006). Mashamba (2009) attributes the preference for foreign contractors to shoddy workmanship by local contractors and poor supervision by consultants, the latter being affirmed by Kaliba, et al., (2013) and by Auditor General reports for 2006- 2015. Mashamba (2009) added that the local industry is characterised by a lack of skills, poor contract management skills, lack of management skills (technical, managerial and business) and poor ability to price work.

2.2.1 Composition of the ZCI

The Zambian construction industry comprises of five main sub-sectors namely: assembly, manufacturing, supply, clientele and design (Shakantu, Zulu, & Matipa, 2000). The construction process which drives the industry involves official and structured relationships with clients, architects, engineers, surveyors, planners, contractors, manufacturers and material suppliers (Muya, et al., 2003; Shakantu, Zulu, & Matipa, 2000). These sub-sectors will now be explained in detail.

2.2.1.1 Assembly

The assembly sub-sector comprises the contractors. They determine the sum at which a design will be constructed through tendering. This can either be negotiated or decided through a competitive process. Contractors act as intermediaries between manufacturing subsector and the design sector (Ibid). Contractors are engaged in various construction activities and are categorised according to construction activity as stated below by the National Council for Construction (NCC, 2013):

1. Category M- general Building
2. Category C general civil engineering works
3. Category R- general roads and earthworks
4. Category M Mining services -
5. Category E General Electrical & telecommunications
6. Category ME General Mechanical Engineering works
7. Category Sa-Su Specialist contractors in various trades

The total number of registered contractors as at March 2016 was 2,598 including 242 Large scale contractors, 63 medium scale and 2294 small scale contractors across all categories (NCC, 2016). These are arranged in groups 1-6 (See Table 2.1) where 1-2 are large scale, 3 are medium scale and 4-6 are small scale. It should be taken into account that though the list has 2294 number of contractors, in reality, the number of firms are smaller because the tabulation was based on the number of categories a contractor is able to offer contracting services in.

Thus if a contracting organisation has expertise in all 7 categories it would therefore appear on the NCC contractor list 7 times with varying corresponding scales of ability (Large to Small scale), according to the NCC contractor list (2016). The distinction in the groups is in the value of work each grade can undertake. Group 1 contracts greater than K25 million, Group 2 contracts between K25 million and K5 million, Group 3 contracts between K10Millon and K15Million, Group 4 contracts between K2 million and K10 million, Group 5 contracts between K0.5 million to K1 million and lastly it may be assumed that Group 6 contracts below K0.5M as no figure is indicated by NCC for this category.

Table 2.1 Contractors Grouping in the Zambian Construction Industry

Contractor group

1	2	3	4S	5S	
			4L	5L	6L

S – Small Contractor
L – Labour-Based Contractor

Source Uriyo , Mwila and Jensen (2004)

The majority (over 90% in number) of players in this sector are small scale contractors locally-owned. However as mentioned earlier, large-scale contractors who execute about 80% of work load are mostly foreign owned according to the NCC list of registered contractors as of 14 August 2014. The professional qualifications of the owners are diverse surveyors, engineers, architects and non-technical individuals from different backgrounds. The category of interest is general building**.** The general contractors are engaged in the construction of residential, farm, industrial, commercial, or other buildings classified as building by NCC. The main challenge in this sector mainly affecting quality is the shortage of artisans (Kaoma and Muya, 2016)

2.2.1.2 Manufacturing

This sub-sector is engaged in the manufacturing of building materials and building components. These manufacture materials and components such as cement, roofing sheets, poly-pipes, Harvey tiles, doors, bricks, blocks etc. According to Opeit (n.d.) building materials and components accounts for 50 to 60% of the value of the total construction. Output

Measures have been put in place to support growth within the sector including the creation of Multi Facility Economic Zones (MFEZs), credit provision and industrial skills training (Ministry of Tourism Environment and Natural Resources, 2011).

2.2.1.3 Supply

This is the subsector which links the manufacturing sector and assembly (Shakantu, Zulu & Matipa, 2000).The sector is basically in charge of ensuring that materials and components stipulated in contract documents such as drawings, schedules and/or bills of qualities are available. Some of the suppliers also aid contractors by providing them with credit facilities (Mashamba, 2009). This involves the supply of materials without the initial upfront payment by contractors with special arrangements on future payments.

2.2.1.4 Clientele

This in the most important subsector as it initiates projects for the design, manufacturing, supply and assembly sectors to be involved in. It is also the sector that usually finances the undertaking (Ashworth, 2006). Other roles of the client include appointing consultants and project team, responding to request for information, providing timely and authoritative decisions, appointing the contractor and deciding on the commitment of resources (Hughes & Murdock, 2001). The largest client for the construction industry is the government, commissioning over 70% work value in the industry followed by the private sector (NCC, 2013). The government fulfils this client role through government ministries and parastatals. Government clients in the main comprise the Ministry of Health (construction unit), Ministry of Education (construction unit), Ministry of Local Government and Housing, Road Development Agency, Rural Electrification Agency, Ministry of Works and Supply, Transport and Communication, Ministry of Water Affairs and Natural Resources and Ministry of Agriculture (Phiri, 2015).

2.2.1.5 Design Sector

This sector comprises architects, engineers and quantity surveyors. The principal function for engineers and architects is to design and prepare technical specifications of engineering and architectural drawings respectively (Phiri, 2015). The quantity surveyor (QS) gives cost advice for planning, control and management purposes. In addition to this, the QS prepare bills of quantities, which is the document itemizing all the different components of a building. It is the same document that is used by all the bidders to compile their tender for a particular project. The makeup of the design personnel sector is that the majority are from the private sector and are from time to time contracted by the government. Unlike the assembly sector, the design sector is mainly locally owned thanks to a move by the government in 2004 to have all consultancies to be at least 50% locally owned (Ibid). However, due to the scarcity of some specialised expertise and the peculiar nature of some projects, foreign firms on occasion carry out this sector's function. This sector is mainly constituted of professionals with a minimum of a first degree. This condition has been set by Engineering Institute of Zambia (EIZ), Surveyors Institute of Zambia (SIZ) through the quantity surveyors registration board (QSRB) and The Zambia Institute of Architects (ZIA).

2.3 Contract form and Types in Use in the ZCI

The Zambia Public Procurement guidelines (ZPPA part 1-3, 2008) provide for lump sum/fixed price, time-based contracts, percentage contracts and cost plus fee contracts. The type of contracts common to the ZCI is the lump sum or fixed price contract (ZRA, 2012) usually allowing for fluctuations; the cost reimbursement type is rarely is used. In the Zambian construction industry (ZCI) local and international contracts are used. The standard form of contracts used mostly by the public sector are the ZPPA contracts open International, open national and Small works contract based on the General Conditions of Contract (GCC, 2013), Joint Liaison Committee (JLC, 1972), Federation of International Engineers-red book (FIDIC, 1999,) Short form of contract (FIDIC green book), and Institute of Civil engineers (ICE). The local contracts include ZPPA suite based on GCC 2013 and the Joint Liaison Committee contract and JLC (1972) also commonly known as the Zambia Institute of Architects contract (ZIA). The international contracts used include The Federation of International Engineers (FIDIC) construction contract (red book), green book and EPC contract (silver book) and the New Engineering contract (option A/B), African Development Bank (ADB) contracts and rarely, contracts based on the American contracting system. The local contracts are mostly used on building works while the engineering works utilise the international contracts. The silver book and NEC are not widely used. It is unclear what drives the selection of contracts for use on projects in the ZCI. Yet it is clear that the types outlined by the ZPPA (2008) are many nonetheless, the selection seems skewed towards lump-sum or fixed price type of contracts.

2.4 Procurement Methods in the ZCI

Zambian Public sector procurement is governed by the Zambian Public Procurement Authority (ZPPA) while procurement in the private sector mostly depends on the client's procurement choice and preference. The Zambian government accounts for over 80% of construction projects (ZDA, 2013). The procurement methods for works allowable under the Public Procurement Act of 2008 include the following:

1. *Simplified bidding/selection:* this is used for low value works of up to K500 Million under competition of at least three bidders and advertising is not a requirement.
2. *Open bidding/Selection*: this is the preferred method for high value procurement of above K500 Million and advertising is mandatory.
3. *Limited bidding/selection* is used only when open bidding is not justifiable or works can only be supplied by a limited number or in cases of urgency.
4. *Direct bidding* is when only a single source is used under similar circumstances as limited bidding.
5. *Force account* is used when constructing using the procuring entity's own personnel and equipment in cases where quantities of works involved cannot be defined in advance. Works may be small or/and scattered or are in remote locations.
6. *Purchase from other procuring entities*: used when other government agencies are able to meet the need.
7. *Public private partnerships (PPP).* These are used under the directive of PPP Act of 2009 and *Community participation*: mainly used to benefit local communities so that local expertise is improved and
8. *Preferential procurement*: this is used in cases where a target group is preferred to benefit; these could be women, citizens or local bidders according to statutory instrument number 36 of 2011.

2.5 The ZCI in a nutshell

Zambia's first documented project was the Tanzania-Zambia Railway Authority (TAZARA) railway. This was constructed as a turnkey project between 1970 and 1975 through an interest fee loan from China. It started marketable operations in July 1976. The ZCI has been for a long time now been trying to make advances in its infrastructure development. Priority areas in infrastructure investment are roads, energy (hydropower construction and maintenance), sports infrastructure, housing, border posts, water and sewerage disposal infrastructure, and education infrastructure (Fifth national development plan to First national development plan). The above-outlined sub-sectors in the ZCI make project undertaking possible through their coordinated efforts. Any deficiency in one sub-sector affects the performance of the whole, and sub-sectors are affected by various risks such as economic, legal, weather conditions, and financial constraints etc. which may impact on the performance of project delivery.

Kaliba, et al., (2013) using road sector projects, highlighted some of the causes of poor performance (quality shortfalls, cost overruns, and schedule overruns) except for project abandonment. The research cited the insufficient initial analysis of cost, change orders, inflation and schedule overruns, as the causes for cost overruns. While financial difficulties for contractors, change orders, poor sub-contractor performance, changes in drawings or specifications were identified as causes for schedule overruns. The inadequate and inconsistent release of funds by the client, poor financial management by contractors, the long time lapse between feasibility and implementation of projects, inadequate supervision, incompetence or lack of contractor capacity and inconsistent release of funds by a client were identified as causes for quality shortfalls. These factors are risks impacting on project delivery in the ZCI. Similar factors and more have impacted on projects in various sectors of the construction industry operating in other parts of the world (See Kartam & Kartam, 2001; Santoso et al., 2003; Gosh & Jintanapakanout, 2004; Wiguna & Scott, 2005; Tsai et al., 2006; Zou et al., 2007; Enshassi et al., 2007; El-Sayegy, 2008; Turkey, 2011; Xu et al, 2012; Tadayon et al., 2012; Goh & Abdul-Rahman, 2013; Hwang et al., 2013 and Mohamid, 2013). Kaliba (2009) ascribed the aforementioned except for project abandonment, to non-adherence to contracts and inadequate contract administration and administrators. It was also highlighted that the research did not conclusively establish who was to blame for poor delivery and that there are no current methodologies for addressing causes and effect of cost, time overruns, and quality shortfall. There is an implication of structural and agency related shortfalls in risk management practice in the ZCI.

Mang'elele and Muya (2009) identified risks impacting on project delivery through brainstorming method on community-based projects. The risks identified were participation risks, project initiation risks, budget and finance risk, skilled labour risks, and material procurement risks, technical supervision, and quality control risks. This is an indication of the risks impacting on performance in the ZCI. It can be argued that the poor performance is due to poor risk planning in the pre-contract stage and poor management of risks in the construction stage due to low-risk management capabilities among contracting parties in the ZCI. Moreover, there is an overwhelming consensus in literature that risks adversely impact on time, cost and quality (Dey, 2010; Kutsch & Hall, 2010; Medda, 2007; Shen et al., 2006; Wiguna & Scott, 2006; Zavadskas et al., 2008).

Risk planning necessitates the identification, analysis and appropriate allocation of risks in an appropriate contract type resulting in balanced risk allocation and is a basis for managing risks in the construction stage. Appropriate risk sharing is important for positive project delivery (Osipova & Eriksson, 2011; Lehtiranta, 2014). Sibanyama (2012) established poor risk sharing in the contract formation stage.

To curtail cost, time overruns, and quality shortfalls, Kaliba et al., (2013) and Kaliba, et al., (2009a) proposed that adequate and complete documents should be readily available. Further to this, the right skills and expertise should deal with contractors during the construction supervision phase and additionally risk factors should be monitored. According to Sibanyama, et al., (2012), risks result in claims. The claims result from omissions and actions during the pre-tendering and contract formulation phases of projects though they only manifest during the construction and post-construction phases (Sibanyama, Ibid). Therefore, ensuring that contract documentation is complete and comprehensive is vital for both appropriate risk allocation and management of risk through the construction phase. Moreover, Hughes and Shinoda, (1999) argued that contracts used for construction projects are complex and are frequently the cause of dissatisfaction, often failing to provide the level of security and resources expected by those who use them. Given the aforementioned, it can therefore be concluded that there is risk misallocation in the ZCI, however, it is unclear what the causes are, particularly in building projects, since Kaliba et al., (2009a) and Muya et al (2013) established risk factors in the road sector.

Additionally, risks have been identified as negatively influencing projects by Kaliba et al., (2009a); Muya et al (2013) and Mang'elele and Muya (2009) yet risk management is not a prioritised area of study in the ZCI. This is important as Subramanyam and Haridharan (2017) in India, a developing context, found that risk management is needed for effective delivery of construction projects. The poor delivery of project as highlights (Auditor general reports 2006-2015; Kaliba et al, 2013; Kaoma and Muya, 2016) points to inadequate skill and knowledge for eliminating or minimising risks in the ZCI. This could be minimised by a process model.

2.6 Chapter Summary

An account of the Zambian built environment has been given and suggests that a mechanism is needed for risk allocation in the industry to alleviate the resultant effects of risk factors. There is indication that the skill of professionals is not adequate and an absence of systematic structures in managing risk. There is evidence of risk identification yet it is unclear how risks are analysed, and the response mechanisms used in that regard. The focus areas identified by the review on the ZCI suggest risk management focussing on risk allocations and construction contracts used. The next chapter discusses risk allocation in the construction industry in detail.

CHAPTER 3 -RISK ALLOCATION IN THE CONSTRUCTION INDUSTRY

3. Introduction

Projects of any nature or magnitude in the construction industry face risks. Risks are typical reasons for delays and cost overruns in projects (Baghdadi & Kishk, 2015). The allocation of risks determines the performance of a project to a great degree (Serpel et al., 2015a). This chapter discusses risk allocation in the construction industry. It starts by explaining the risk concept, then analyses the risk management process, briefly explains previous theoretical perspective used for risk allocation, discusses the components of risk allocation in detail and gives the relationship of risks to contract and procurement in the construction industry. In achieving this, identification of competing explanations, or searching for shortages of a particular theory or perspective (Easterby-Smith et al, 2015) in existing literature has been used to varying extents. This was done purposively in order to explore and explain risk allocation.

3.1 Risk

The concept of risk is over 2400 years old but as a scientific study it is only 30-40 years old (Aven, 2016). Risk is a significant concept in a number of scientific fields, but there is no consensus on how it is to be defined and interpreted (Aven, 2011). This implies that risk can be viewed from different philosophical positions depending on the problem at hand (Aven and Renn 2009; Holt and Goulding, 2014). Risk is a complex phenomenon that has physical, monetary, cultural and social dimensions (Choudhry & Iqbal, 2013). Consequently, risk is addressed in many fields including finance, safety, engineering, health, transportation, security, and supply chain management (Aven, 2016; Chicken & Posner, 1998).

Risk has been defined in many ways by various sources. Dictionary definitions portray risk in a negative light. For examples, Oxford dictionary (2010) defines risk as a situation involving exposure to danger, the Webster dictionary (2014) defines it as to expose to chance of loss or damage and the Macquarie dictionary (2014) defines risk as the possibility of incurring misfortune or loss; hazard. Various researchers have defined risk in such a way as to show that it can be either positive or negative. Thus, Al-Bahar and Crandall (1990) defined risk as "the exposure to the chance of occurrences of events adversely or favourably affecting project objectives as a consequence of uncertainty"(p.534). Cano and Cruz (2002) defined it as "an uncertain event that, if it occurs, has a positive (opportunities) or negative (threats) effect on a project objective" (p.473). Hilson (2002) defined it as "an umbrella term, with two varieties: 'opportunity', which is a risk with positive effects; 'threat' which is a risk with negative effects" (p.535). However, some researchers define risk as just having an impact on a project, remaining unclear as to whether that impact is positive or negative. An illustration of this is the way in which Zou et al., (2007) defined risk: "it as an event or set of circumstances that, should they occur have an effect on the achievement of the project objectives" (p. 601) and Nasirzadeh et al., (2014) as an exposure to the consequences of uncertainty that will have an impact on project objectives (p.442). Purdis (2010) whose research adopted an interpretation of risk as being either positive or negative supported this by pointing out that a consequence of risk may vary from loss and detriment to gain and benefit.

Generally though, risk in the construction industry is perceived to be a combination of activities which adversely affect the project objectives of time, cost, scope and quality (Ehsan et al., 2010; Zavadskas et al., 2008; Kutsch & Hall 2010; Wiguna & Scott 2006 ; Medda, 2007; Dey, 2010; Shen et al., 2006). Lehtiranta's (2014) research analysed more than 100 papers on risk perception from 2000 to 2012 and found that more than 80% of researchers perceived risk as negative. Nevertheless, the impact of risk on a project can indeed be positive or negative (Khodeir & Mohammed, 2014), and thus it can present an opportunity or a threat, respectively. Effectively, opportunities associated with risk work in theory but fail in practice (Simu, 2007) and Lehtiranta (2014) added that opportunities resulting from risk are rarely seen in project teams. This could be why the traditional view of risk is negative, representing loss, hazard, harm and adverse consequences (KarimiAzari et al., 2011; Ehsan et al., 2010; Zavadskas et al., 2008; Kutsch & Hall, 2010; Wiguna & Scott, 2006 ; Medda, 2007; Dey, 2010; Shen et al., 2006). On the contrary, Andersen (2014); Hilson (2002); and Pritchard (2005) contested that it is easier in risk management practice to look for potential pitfalls and problems than to look for hidden advantages or upsides. Overall there currently seems to be no acceptable definition for risk (Aven & Renn, 2009; Chicken & Posner, 1998; Giannakis & Papadopoulos, 2016; Lehtiranta, 2014). In this research the adopted definition of risk is from the one postulated by Mark et al. (2004, p. 11) which is "the potential for difficulties and problems with respect to completion of a project and achievement of a project objective". This definition focuses on threats as they negatively affect projects and gives clear direction for identifying improvements.

The mathematical representation of risk can now be discussed. While the dimensions of probability multiplied by impact are commonly used, William, (1996) argued that this is misleading when used to rank risks due to the limitation of certain risks treatment in contract stipulations that are based on impact only without considering probability.

Risk = Hazard X Exposure or Risk [or] Probability (or Uncertainty or Likelihood) x Impact (or consequence)

Having defined risk, it is important to know its characteristics. According to Nieto-Morote and Roz-Vila (2011) these include:

1. A future event that may or may not occur,
2. Risk must also be an uncertain event or condition that, if it occurs has an effect on at least one of the project objectives such as time, cost, quality and lastly,
3. The impact or consequence of the future event must be unexpected or unplanned for. The impact of risk can be measured as the likelihood of a specific unwanted event and its unwanted consequence or loss (Mills 2001).

RI= L x C where RI=risk impact, L= likelihood and C=consequence or

Impact or exposure = Likelihood of risk x Consequence of risk

Risks in the construction business are high (Tamosaitience, et al., 2013) and quite common (Sharma, 2006; Dutta, 2014; Taroun, 2014). This state of affairs is attributed to complexity and the strategic nature of its products (Taroun, 2014) further exacerbated by numerous stakeholders, designers, contractors, sub-contractors and suppliers (El-sayegy, 2008; Khazaeni et al., 2014; Taroun, 2014; Zavadskas et al., 2008). Risk can be reduced by careful risk planning (Goh & Abdul-Rahman, 2013) and detailed specification of the project's various components (Olsen & Osmudesen 2005). Risk planning entails mechanisms to decide how to approach, plan and execute the risk management activities of a project (Project Management Institute, 2004: p.40) in the pre-contract stage and mechanisms for the management of risk during the contract stage (KarimiAzari et al., 2011).

3.1.1 Risk and Uncertainty

Risks can be known (recognised during risk identification) or unknown (Ward & Chapman, 2003). Unknown risks are referred to as uncertainties. Jafari (2001) defined uncertainty in a project context as "an unknown probability of impact of a project variable on its objective function" (p.89). Sometimes a different differentiation is promulgated in that events that are certain have a 100% probability of occurrence while totally uncertain events have 0% probability of occurrence (Jafari, 2001). According to Serpella et al. (2014) the relationship between risk and uncertainty is that risk is uncertainty that can be measured and managed, while uncertainty is the risk that cannot be measured and is uncontrollable. In risk the possibility of an outcome can be predicted while in uncertainty it cannot (Smith et al, 2014). Therefore, the probability of occurrence for a risk can be assigned while for in uncertainty probabilities cannot be assigned (Jafari, 2001). Nonetheless, risk and uncertainty affect project delivery if unmanaged (Hilson, 2002). In this research, the focus is on known risk and not uncertainties.

Lewis (2010) cited in Ping et al. (2015) concluded that although uncertainties can negatively influence project objectives, contracts can reduce uncertainties by providing a clear specification of what is allowed and what is not, and can minimise the risk of opportunism by enforcing legal rules and standards. Risks are common in the construction industry (Dutta, 2014; Zou, et al., 2007) and completely eliminating risk from a project is impossible (El-Sayegy, 2008; Dutta, 2014; Lehtiranta, 2014); risks can only be minimised (Kutsch & Hall 2010). Choudhry et al., (2014) agreed that every project has risks. This makes the use of risk management strategies/mechanisms essential in the construction industry.

3.2 Risk Management

Risk Management (RM) is the logical method of establishing the context, identifying, analysing, evaluating, treating, monitoring and communicating the risk association within any activity, function or process in a way that enables losses to be minimised and opportunities to be maximised (Australian/New Zealand standard AS/NZ 4360 1999: p. 4). Alternatively, risk management may be defined as a formal and orderly process of systematically identifying, analysing and responding to risks throughout the lifecycle of a project to obtain the optimum degree of risk elimination, mitigation and /or control (Wang et al., 2004). See Figure 3.1 for processes in the RM process.

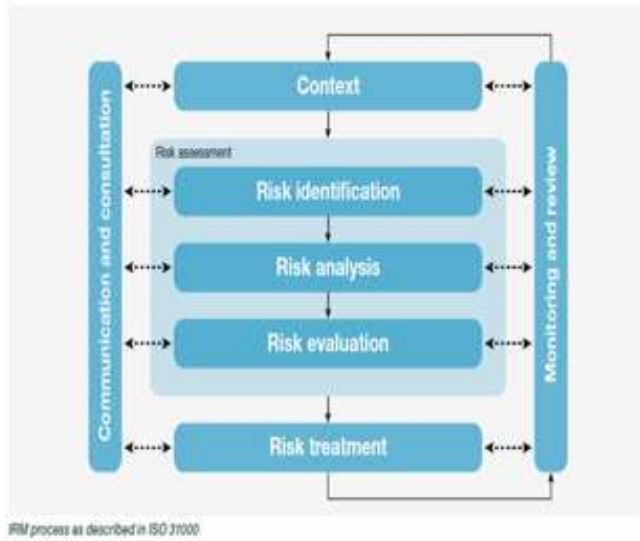


Figure 3.1 Risk Management Process

The underlying goal of risk management is to manage risk effectively (Thevendran & Maudesley, 2004). This is made possible if risk management capabilities of contracting parties are sufficient. Risk management capability (RMC) is the process, data, tools and culture in the organisation that enables the organisation to manage risk (Mu et al., 2014). At appears as if the risk management capabilities in the ZCI are not adequate resulting in the current performance shortfalls. This research sought to clarify this through the gathering of empirical evidence.

Risk management capabilities studies have mainly focused on enterprise risk or the firm (Andersen, 2014; Hopkinson, 2011) rather than the professions involved. Andersen, (2014), showed that very few empirical studies have been done on firms. Using a case study approach Anderson (Ibid) found that firms with more risk management capabilities and better processes have a basis for updating methods and restructuring resources to mitigate risk and are able to mitigate risks better. Yet Edwards and Bowen, (2005) argued that when it comes to project organisations what really matters are the capabilities of those involved. Given that in the ZCI both client and contractor are deficient in certain skills (Kaliba, et al., 2013; Mashamba, 2009), this impliedly affects the way risk allocation is done.

Risk management fundamentally uses three strategies (Aven, 2016):

1. Risk informed strategies (treatment of risk e.g. avoidance, reduction, transfer and retention)
2. Cautionary or precautionary strategies (consequence based action e.g. containment, development of substitutes, safety factors, redundancy in design and safety devices) and
3. Discursive strategies (use measures to build confidence and trustworthiness)

However Ostrowska and Mazur, (2015) identified just two strategies; mitigation and prevention strategies.

Risk management in the construction industry is nationally significant as it eases the development of infrastructure thereby boosting business in various industries hence increasing gross domestic product (Ehsan et al., 2010). Risk management also aids in identifying and analysing risks, improving construction project management processes and effective use of resources, which is much desired (Banaitiene & Benaitis, 2012). Risk management is done because it helps to measure what could happen and helps to prevent it from happening (McGrew & Bilotta 2000). It is unknown the extent to which risk management is used to aid the effective use of resources and prevent risk from happening in the ZCI. Risk management is strongly linked to the production phase with contractors being the most active group (Osipova 2007) but it appears the effectiveness of risk management is determined in the intial phases of a project before construction. RM can improve overall cost and schedule performance (Hwang et al.,2014) yet cost and schedule overruns are a norm in the ZCI. According to Mills (2001) and Lam et al. (2007) the merits of risk management are:-

- Enabling systematic and less subjective decision making
- Making the relative importance of each risk apparent
- Alleviating risks by planning
- Assessing and ascertaining project viability by analysing and controlling risks
- Giving improved understanding of the project through identifying the risks and thinking through response scenarios
- Having a powerful impact on management by forcing the realisation that there is a range of possible outcomes for a project hence enhancing profit margin and minimising losses.

According to the PMBOK (2008) and Zacharias et al. (2008) the following are the stages of the Risk management process: Risk identification, Risk analysis, Risk Response, monitoring and control; and communication. The International Risk Management Institute (IRM, 2004) identified the following processes in the RM process: risk assessment, risk response, risk monitoring and review and reporting while Shen (1997) and others (Perera et al., 2009; Banaitience et al., 2010; Uher & Toakley, 1998 and Irimia-Dieguez et al., 2014) identified risk identification, risk analysis and risk response as distinct risk management processes;. Other risk management processes or frameworks exist namely:

- Project uncertainty (See Cano & Cruz, 2002; Chapman & Ward, 2003; Perminova, 2011)
- Risk Analysis and Management for projects – RAMP (The institute of Civil Engineers and Institute of Actuaries, 2005)
- Threat and Opportunity management (Hilson & Simon, 2007)
- Risk analysis in international markets -MOCRA (Method of construction risk assessment) (Skorupka, 2005)
- Multi-organisation RM process (MORM) (Letiranta, 2014).
- Project risk time management (Gładysz, et al (2015)

In addition to various models listed above other models have been formulated such as the HMSO Model (2004), ISO 10006, Advanced Programmatic risk analysis and management model (APRAM) (Choudhry et al., 2014) and the model developed by the Project Management Institute (PMI) 2004. Appendix 1 lists models in existing literature with their noted application areas and observed limitations. Most frameworks have in common risk identification, risk analysis and risk response. There currently exists no risk management framework in use in the ZCI. Conceivably, this could be contributing to its poor performance, as it is clearly a shortfall in instrumentation.

Risk management requires tools and their choice depends on the nature of information available and the nature, size, complexity and degree of innovation and phases of a project (Cagliano e t al., 2015). It can be argued that techniques used also depend on the maturity level of risk management in an organisation (Hilson, 1997). Hilson (1997) distinguished the levels of maturity as naïve (no need to manage risk), novice (identified need to manage but does so unsystematically), normalised (formalised risk process) and natural (completely aware and proactive management of risk). Novice level management applies simple techniques unsystematically while natural level applies complex techniques systematically (See Appendix 3B). The research by examining the techniques used might provide evidence for determining maturity levels of risk management practice in the ZCI. Table 3.1 gives a summary of the risk management process by the CIBD document. It is followed by a discussion of risk management processes mainly focussing on process relevant to risk allocation.

Table 3.1 The main elements of the Risk Management Process

Element	Consideration
Establish the context	Establish the strategic, organisational and risk management context in which the rest of the process will take place. Criteria against which risk will be evaluated should be established and the structure of analysis defined
Identify risks	Identify, what, why and how things can arise as the basis for further analysis
Analyse risks	Determine the existing controls and analyse risks in terms of consequences and likelihood in the context of those controls. The analysis should consider the range of potential risks and how likely they are to occur. Consequences and likelihood may combine to produce an estimated level of risk
Evaluate risks	Compare estimated levels of risk against the pre-established criteria. This enables risks to be ranked so as to identify management priorities. If the levels of risk established are low, then risks may fall into an acceptable category and treatment may not be required
Treat risks	Accept and monitor low-priority risks. For other risks, develop and implement a specific management plan which includes consideration of funding
Monitor and Review	Monitor and review the performance of the risk management system and changes, which might affect it.
Communicate and consult	Communicate and consult with internal and external stakeholders as appropriate at each stage of the risk management process and concerning the process as a whole

Source: CIDB document 1005 (2004)

3.3 Risk allocation

Lam et al. (2007) define risk allocation as the partitioning of accountability connected with a likely loss or gain and the practice of allotting recognised risks to project members. Alsalman and Sillars (2013) define it as the designation of management accountability and risk responsibility. Risk allocation can also be understood dynamic risk management within an obligatory temporal schedule of changing cirmustances risk(s) (Bedenekoff & Steven, 2011). It is argued that risk allocation tactics are more than just determining which party should take the risk (Hwang, et al., 2013). It is for this reason that risk allocation should consider mechanisms used and resources. Therefore, control and organisation of management responsibility is vital in realising success. For risks to be allotted the following have to be done identification, analysis and treatment methods determined then allocation (Toakley & Ling, 1991; Bajaj et al., 2010). Furthermore, risk monitoring and risk communication/reporting need to be conducted during the entire construction process (Project Management Institute, 2004; 1SO 10006; 21500). Clearly, this proves that allocation of risk is much more than determining which party is to take a given the risk.

Balanced risk allocation is a topic that has received attention in recent years, attracting extensive research on risk allocation in an event to attain balanced risk allocation. This features prominently in the work of Khazaeni et al. (2012), Mead (2007), Ng & Loosemore (2006) and El-sayegy (2008, 2015).This has been so because risk allocation methods have been found to be variable, intuitive, subjective and unsophisticated (Khazaeni et al., 2012; Ng & Loosemore, 2006). Notwithstanding, appropriate risk allocation positively affects project performance (Ping et al., 2015); this is an aspect that is currently the weakest link in the RM process in the construction industry (Alsalman & Sillars, 2013; Banaitience et al., 2011; Touroun, 2014). In addition risk allocation of certain factors seem to be conflicting, for example risk allocation of site conditions was allocated to the client/ owner by Kangari (1995) while Benson (2005) allocated this to the design consultant and Wang and Chou (2003) allocated it to the primary contractor. Another example of conflicting risk allocation is that of the allocating the risk of financial failure. Kangari (1995), and Wang and Chou (2003) allocated this risk to the client or primary contractor while Benson (2005) allocated it to designer/ consultants. This difference in allocation could be attributed to various variants of risk allocation evidenced in the standard forms of contract using different procurement routes in different industries. Given that traditional procurement method is used for varying project sizes, types and complexities in the ZCI. Can the allocation of risk be said to be the same across projects?

While risk allocation could be described as poor, unbalanced, unfair, misallocated, and inappropriate (Alsalman & Sillars, 2013; Baloi & Price, 2003; KarimiAzari et al., 2011; Mead,

2007) very few researchers define these concepts (e.g. Hanna et al., 2013; Mead, 2007; Meng, 2012). Misallocation refers to the practice of allocating risk without separately considering which party may be in the best position to evaluate, control, bear the cost or benefit from the assumption of risk (Hanna et al., 2013). While inappropriate risk allocation refers to contractual shifting of risk to the contracting party with the least amount of bargaining power, this is also misallocation (Hanna et al., 2013). Poor risk allocation refers to any instance of misallocation including incomprehensive allocation of risks (Meng, 2012; Mead, 2007). Allocation is unbalanced if most of the risks are allocated to one party (Alsalman & Sillars, 2013; Bakr et al., 2012; Lam et al., 2007). Unbalanced risk allocation has been described as industry practice in the ZCI (Mukumbwa and Muya, 2013. Sibanyama et al, 2012). Nonetheless, why this occurs is uncertain as projects in the industry are procured using mainly standard forms of contract, which are assumed to allocate risks in a balanced manner. To recap, risk misallocation for this study refers to imperfect or inappropriate allocation of risks (Hanna, et al., 2013). This is with regards to the utilization of a wrong method of allocation and/or wrong response method and/or allocation to the wrong party between client and contractor and/or allocation of wrong resources or lack of allocation.

Peckiene, et al. (2013) reviewed literature on risk allocation in contracts over a period of 22 years starting from 1990. The study concluded that previous research on risk allocation in the construction industry has mainly been quantitative, using questionnaires (55%), followed by game theory (18 %), Delphi surveys (9%), fuzzy AHP (9%) and fuzzy TopSIS AHP (9%). This suggests that the study of risk and how risk allocation is perceived is mainly through real external quantifiable measurement based on observable phenomena which is independent of the researcher.

Prior research did not investigate why risk allocation is poor, inappropriate or unbalanced, yet it concluded that risk allocation is unbalanced (Alsalman & Sillars, 2013; Hanna, et al, 2013). The following section presents brief details of activities in the risk allocation process, recalling that risk allocation constitutes identification, analysis/assessment, risk treatment, monitoring; and communicating/reporting.

3.3.1 Risk identification

To effectively manage risk in the construction industry, it is crucial to accurately identify important risks (Andi, 2006; Banaitiene et al., 2011; Turkiset et al., 2012). Al-Bahar and

Crandall (1990) defined risk identification as the process of systematically and continuously identifying, categorising and assessing the initial significance of risks associated with a construction project. Risk identification determines which risks might affect the project and documents their characteristics in an iterative process because new risks may become known as the project progresses (Bakr et al., 2012). Risk identification is crucial for project success (KarimiAzari et al., 2011). It consists of the most significant uncertainty factors and their description (Kangari, 1988). Risk identification applies to contractors, designers and risk owners though it could also include external risks. Grubisic et al., (2011) distinguished risk identification approaches as analogical (based on experience/ management of similar projects); Heuristic (use of project team creativity and/or expertise) and analytical (based on failure mode and effects criticality analysis). In the ZCI some form of risk identication occurs (Kaliba, et al., 2009; Mang'elele & Muya, 2008) whether analogically or heuristically is a matter that needs to be investigated. Clearly, brainstorming is used (Manenele and Muya, 2009) but other risk identification methods used need to be investigated .

From the risk identification methods shown in Table 3.2, it is obvious that methods for risk identification are many and mainly qualitative in nature based on intuition; these are unsuited for complex projects (KarimiAzari et al., 2011). The most common methods it seems are brainstorming and the use of checklists. The use of a checklist is affirmed by Elkington and Smallman (2002). Both techniques could be considered subjective as they are dependent on the experience of the participants. Eypbpoosh, Dikmen & Birgonol (2011) argued that the checklist method ignores multiple risk occurrences, and it ignores interdependencies. According to a review of 78 Journal papers by Irimia-Dieguez et al., (2014) risk identification studies mainly focus on a single case study. This suggests actual empirical evidence of knowledge that is experience driven is the acceptable risk identification method. It is therefore important to consider either several cases and/or surveys to improve risk identification in projects. Table 3.2 shows the methods/techniques used to identify risks. This study is concerned with both contractual and non-contractual risk.

The construction contract deals with project risks (Osipova & Apleberger 2007) and these are the risks that affect the project during the construction phase and are of interest in the contract documentation. Project risks are uncertain events or conditions which if they occur have a positive or negative effect on at least one project objective (PMBOK, 2008). Project risks cause delays, excessive spending, unsatisfactory project results or eventual failure (Banaitiene & Benaitis 2012). Project risks are similar for local and international projects (Zhi, 1995). This study will uncover risks impacting the Zambian building sector. The correct identification of risks ensures risk management effectiveness. Further to this once risks are identified they have to be understood. Lack of understanding of the risks leads to inefficiency where each party may end up paying more and could make less out of the venture (Dutta et al., 2014). An unidentified risk cannot be controlled, transferred or managed (Toakley & Ling 1991; Henriod & Lantran, 2000). Various risk factors exist in the construction industry and various risk factors have been identified by various authors in the construction industry. Anything that increases risk or susceptibility is a risk factor (www.learnersdictionary.com). Risk factors usually have measurable features or components, a change in which can affect the value of an asset or project (www.Businessdictionary.com) such as exchange rate, interest rate, labour shortage or market price. The following section will discuss risk factors.

Table 3.2 Risk identification methods

Author	**Risk Identification method**
Sharma (2006)	Brain storming, Delphi technique, interview, expert judgment, checklist, flowchart, cause and effect diagram, influence diagram
Bajaj, Oluwoye & Leonard (2010)	Checklist , experience and brain storming, historical data
Osipova & Eriksson (2011)	Checklist, brain storming
Ebrahimnejad , Mousavi & Seyrafianpour (2010)	Interview groups or individuals, brain storming, check lists, pin card, gallery, nominal group technique, battle-Bermudan-brain writing
Kansal & Sharma, (2012)	Brainstorming, Delphi Technique, Interview/expert judgment, checklist, influence diagram, flowchart, cause and effect diagrams
Barlish, Marco, & Thaheem, (2013)	Brainstorming, interviews, specialists, SWOT analysis, feedback, workshops, prompt list, questionnaires, Delphi group, normal group techniques and various diagrammatic techniques (cause and effect, influence diagrams)

3.3.1.1 Risks factors in the construction Industry

Risks are triggered by risk factors; furthermore the risk factors in the construction industry are very high (Tamosaitience et al., 2013). Risk factors can be associated with many risks and form a causal network with the risks (Tah & Carr, 2000). The pioneers of general research in the area of risk in construction industry were Edward and Bowen who did their research from the 1970s to 1997 and identified political, economic, financial and cultural environments as risk factors on construction projects. Various follow-up studies have been done on the risk factors in the construction industry including Kartam and Kartam (2001); Santoso et al. (2003); Gosh and Jintanapakanout (2004); Wiguna and Scott (2005); Tsai et al. (2006); Zou et al. (2007); Enshassi et al. (2007); El-sayegh (2008); Turkey (2011); Xu et al. (2012); Tadayon et al. (2012); Goh and Abdul-Rahman (2013); Hwang et al. (2013) and Mahamid (2013) .

Risk factors are important as each specific risk factor needs a particular risk response and/or risk allocation strategy. Previous studies have shown that different construction industries have experienced different risk factors. However, the most common are economic and financial; productivity and design-related risk factors. It remains to be established if the afforementioned risk category are the ones accounting for poor performance in the building sector.

3.3.1.2 Categorising of risks

Categorisation of risk has been another area of interest and research in the area of risk management over the years. Categorisation has been done by Al-Bahar (1990); Abdon (1996); Shen (1997); Tah and Carr (2000); Shen (2001); Chapman (2001); Lam et al. (2007); Enshassi et al. (2007); Ehsan et al. (2010) Rezakhani (2012); Zuofa and Ochjen (2011); Tadayon et al. (2012); Barlish et al (2013); Rafindadi, et al. (2013) and Cekic (2014). Different industries face different risks. The construction industry is no exception, so risk management is an important aspect of the construction industry. The management of risk is also greatly influenced by the uniqueness of the construction industry and the country’s specifics (Andi, 2006). It is therefore, important practice to classify risk as this helps to identify the possible root cause for a risk factor. For instance political risk may indicate instability in a particular region and help ensure that other contracts in the region should cover also political risks. Risk has various classifications or categorisations, some are source related such as political, economic, social and technological while others are impact related such as insurable or uninsurable, acceptable or unacceptable or yet again risks could be classified as positive or negative (Ebrahimnejad et al., 2010). However, the general classification of risk are internal and external (Rezakhani, 2012).

Internal risks are those that are attributed to the parties: owner, designer, contractors sub-contractors and suppliers while external risks are attributed to external issues usually due to other characteristics in the environment such as political, social cultural, economic, natural, technological and others. (see Barlish et al (2013) for examples of internal and external risk).

Internal risks are inherent in all projects whether local or international **(**Banaitiene & Benaitis, 2012)**.** It is undistinguishable the nature of risks having the highest impact on performance in the ZCI whether external or internal. Notably**,** to effectively manage risk in the construction industry, it is crucial to correctly identify important risks and properly allocate them to the contracting parties. This can only be done through risk management.

Contract clauses are also a basis for risk allocation (Andi, 2006) but risks have to be known. To have efficient, useful and enforceable risk allocation in contract, the contract has got to be conspicuous, reasonable in light of the parties' resources and control; and clearly integrated with all contractual aspects of the project (Allenworth, 1996). This simply means that the risk allocation in the contract should have a means of being enforced, parties should have the resources and control over the risk allocated to them and all contractual documents should reflect the risk allocation as necessary.

From prior studies classifications of risk factors do not seem to be consistent and it appears there will always be some category to add. For instance Zou et al (2007) classified them as cost related, time related and quality related risks. Jarkas and Haupt (2015) classified them as client related, contractor related, consultant related and external risks. Evidently construction project risks can be classified in many ways and the choice of method must serve the purpose of the research or task (Khodeir & Mohammed, 2014). For more on categorisation on risk see Kartam and Kartam (2000), Santoso et al. (2003); Gosh & Jintanapakanout (2004); Wiguna Scott (2005); Tsai et al. (2006); Zou et al. (2007); Enshassi et al. (2007); El-sayegh (2008); Turkey (2011); Xu et al. (2012); Tadayon et al. (2012); Goh and Abdul-Rahman (2013); Hwang et al. (2013) and Mahamid (2013).

3.3.2 Assessment of risks

Once risk classification and risk identification are done the next step is assessment of risks (Hassanein & Afify, 2007). Risk assessment refers to examining the identified risks, refining their description and estimating their probability of impact(s) (Zhang & Fan, 2014). Risk assessment can also be understood as a wider process in which in addition to risk analysis results in evaluation of risk resulting in a decision context (Johansen & Rausand, 2014b). Risk estimation is done to determine the importance of each risk based on its likelihood and impact (Elkington & Smallman, 2002). Risk assessment methods include subjective judgment, intuition and experience (Osipiva & Eriksson, 2011). The methods used to assess risk can be seen as purely based on perception (Lu & Yan, 2013). This is supported by Wang and Yuan (2011) who stated that decision makers perceive risk differently due to their experiences, education background, beliefs and culture. This subjectivity may pose a danger to this step in the RM process. Lu and Yan (2013) also argued that using subjective methods such as gut feeling may result in paying attention to risks with potentially serious effects while ignoring those that have a higher probability of occurrence. Consequently, Ward (1999) argued that quantification of risks is less subjective. Mousavi et al. (2011) however still argued that data used in quantification and modelling is usually subjective. This debate does not give clear directions as to which methods of risk assessment are less subjective nor does it promote appropriate risk allocation. Moreover, professionals in the ZCI could be using subjective risk analysis methods like most professionals around the globe (Jin et al, 2017).

Methods used in the risk assessment process can be classified as qualitative and quantitative (Figure 3.2). Qualitative methods include qualitative estimating and weighting, ABC analysis while quantitative methods include key performance indicators, probable maximum loss risk matrix and risk mapping (Schieg 2006). Qualitative assessment involves the identification of a risk hierarchy based on the probability of particular risk occurrence and their impact on the project and employees. It includes risk scope and occurrence factors while quantitative assessment numerically estimates the probability that a project will succeed in meeting the planned budget and time schedule (Ward & Chapman 1997). Risk management is a scalable activity and should be proportional with the size and complexity of the project under consideration (Simu, 2007). This means that small projects use simple qualitative approaches for risk assessment while complex projects use quantitative methods such as Monte-Carlo simulation (Al-shibly et al., 2013). For the ZCI, it is unclear if a scalable approach is used or it is a one size fits all scenario. Additionally, risks should also be assessed in consideration of their interdependencies (Yildiz et al. , 2012; Lee et al., 2009). If interdependencies are ignored the impact associated with the risk(s) may be distorted as a result of the project dynamics. Some of the methods used to show interdependencies include influence diagrams, flow charts, cause and effect diagrams, risk paths and maps (Yildiz et al., 2012) and structural equation modelling (Eybpoosh et al., 2011). Taroun’s (2014) review of journals papers on risk analysis in the last five decades up to 2014 concluded that there is no perfect method for risk assessment as a consequence there is a proliferation of various models in literature based on different types of logic such as fuzzy and Bayesian probability. Impact models are the most common and risk analysis is strongly related to risk modelling. This posits that risk analysis is conducted based on internal or external observations mostly from that which can in most cases be quantified. Nevertheless, the quantification can be based on data collected subjectively. Once a thorough risk assessment is done, it paves way for risk analysis.

Risk analysis sets out to quantify the effects of major risks that have been identified (Mills, 2001) and sets out to understand the risks (Mead, 2007). Fan , et al (2008) defined risk analysis as a process that examines each identified risk, refines the description of the risk and assesses the associated impact. Risk analysis methods can be classified as either qualitative or quantitative. Quantitative risk analysis attempts to estimate the frequency of risks and the magnitude of their consequence (Banaitience et al., 2011). These include error, possibility and influence analysis; risk portfolio and risk team analysis (Schieg, 2006); decision trees, expected monetary value, simulation or intuitive approaches, expert judgment (Chege & Rwelamila, 2000); and code optimisation (based on subjective estimation), Monte Carlo simulation, kinetic tree analysis (Mills, 2001); expected utility theorem; individual knowledge; intuitive judgement; experience; rules of thumb (Lu & Yan, 2013); and sensitivity testing and risk adjusted discount rate (Choudhry & Iqbal, 2013). Qualitative risk analysis attempts to rank risks into high, medium and low based on; 1. The severity of the impact and 2. The probability of the event occurring.

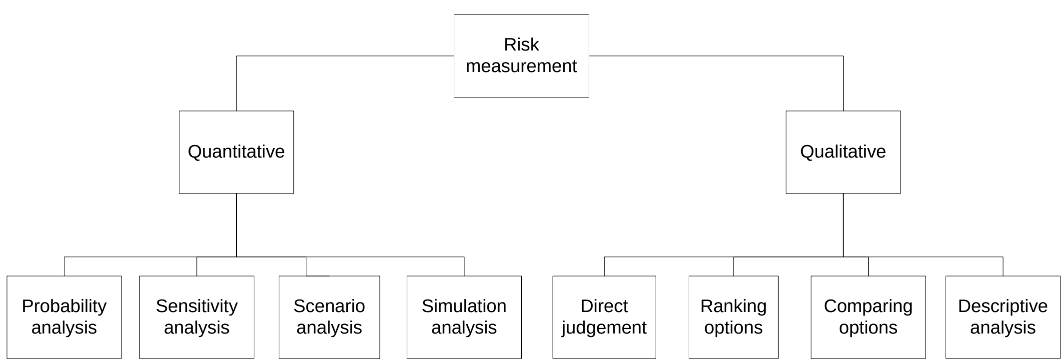


Figure 3.2 Risk Analysis Methods

Risk analysis techniques have been mainly developed to address the project deliverables of schedule (time), budget (cost) and quality (Imbeah and Guikema, 2009). The majority of techniques address the parameter of schedule and these include Computer aided simulation for project appraisal and review (CASPAR), Schedule risk system, Judgement Risk Analysis Process (JRAP), Estimating project and Activity duration, Failure modes and Effect Analysis (FMEA) and Programme Evaluation and Review Technique (PERT). Those addressing budget include CASPAR, Schedule Risk System, Data Driven Analysis of corporate risk using historical cost-control data, Estimating using Risk Analysis ERA and FMEA only Utility functions in Engineering performance and FMEA address quality. The only technique that addresses all parameters of schedule, budget and quality is the advanced programmatic risk analysis and management (APRAM) model. It is however surprising that although most of the techniques of risk analysis have the parameter of schedule yet time overruns continue to affect the construction industry (Odeh & Battaineh, 2002; Hamzah, et al., 2011; Dikmen, Birgonol, & Eybpoosh, 2011; Aziz, 2013 ; Sweis, Sweis, Hammad, & Shboul, 2008; Doloi, Sawhney, Iyer, & Rentala, 2012; Kaliba, Muya, Shakantu, & Sichombo, 2013 and Chan & Kumaraswamy, 2002.) Risk assessment needs to be done to formulate an effective response.

3.3.3 Risk response mechanisms

Risk response is a process that allows for formulating choices and deciding on actions to be used to increase opportunities and decrease threats to the project goals (Smith, et al., 2014). Risk response includes selecting amid different response approaches, instigating a contingency plan, taking remedial activities, re-planning the project (Bakr, et al., 2012). Within the area of risk response lies the relationship between risk allocation and construction contracts (Chege & Rwelamila, 2000). It is during the risk response stage that risks are allocated. Risk allocation always occurs in any situation where there is more than one party responsible for the execution of a project (Zaghoul & Hartman, 2002). Risk allocation is the assigning of management responsibility and accountability for risk(s) (Alsalman & Sillars, 2013) and can be defined as the process of identifying project risks and determining how they may be equitably and realistically shared by all parties in a construction project (Nasirzadeh et al., 2014; El-sayegy & Mansour, 2015). It is normally done through contractual aspects of procurement (Ling & Hoi, 2006).

It has been noted in literature that poor risk management results in poor quality, cost and time overruns, so risk allocation as a distinct process in risk management has a significant association with cost and price certainty (Meng, 2012). Sometimes risks will inevitably be allocated to the party least able to refuse them rather than the party best able to manage them, especially when maximum competition exits (Jin & Zhang, 2011). Since the public sector client is the biggest employer in the ZCI normally relying on competitive bids as the most common mode of procurement, it is possible that risks are allocated to the party least able to refuse. Though balanced or appropriate risk allocation is desired; it is not uncommon for the client to allocate greater risks to contractors (Baloi & Price 2003). In turn, contractors are reluctant to transfer risks since they wish to preserve a relationship with clients as a way of staying in business (Perera et al., 2009).

Risks in the construction industry are usually allocated prior to occurrence, in contrast to the medical field and transportation industry (Chicken & Posner, 1998), or in law and economics (Oudot, 2005), where allotment is done after the occurrence of a risk. In sports, it is an individual choice to agree to a possible risk or not (Chicken & Posner, 1998). Risk allocation can be categorised as qualitative and quantitative. Qualitative refers to risk allocation matrix, what risk is allocated to whom is the qualitative aspect while the optimal allocation of risk between the parties if parties behave rationally is the quantitative aspect (Oudot, 2005).

Previous scholars such as Carter and Doherty (1974), Flanagan and Norman (1993) and Akintoye and MacLeod (1997) classified risk acceptance or retention, risk mitigation/reduction, risk elimination/avoidance and risk transfer as risk response techniques. This is congruent with the categorisation made by Mead (2007) whereas Ehsan, Mirza and Alam (2010) added monitoring. Smith et al. (2006); and Kutsch and Hall (2010) added doing nothing as a separate response. Lu and Yan (2013), Osipova & Eriksson (2011) and Lehtiranta (2014) risk sharing. Additionally PMI (2008) and Hilson (2000) outlined exploit, share, enhance and accept as response mechanism for risks presenting opportunities. Nonetheless, these are beyond the scope of this research as the focus was on negative risks or threats.

The most common method of risk allocation in the contraction industry is transfer, mainly contractually (Choudhry & Iqbal, 2013; Loosemore & McCarthy, 2008 and Akintoye & MacLeod, 1997). Ehsan et al., (2010) claimed that the most utilised risk response measures in the construction industry are risk elimination and risk transfer. Other studies have shown that project participants allocate risks by aversion: owners tend to shift risks to the primary contractor who in turn transfers them to the subcontractors (Alsalman & Sillars, 2013; Baloi & Price, 2003). In contrast Osipova and Eriksson (2011) and Lyons and Skitmore (2004) found risk reduction as a common method of risk allocation while Chung et al., (2010) found risk sharing and transfer. While a study by Jarkas and Haupt (2015) found risk retention and transfer. There seems to be a difference in preferred allocation method perhaps owing to different procurement methods and sectors within the construction industry. The result of poor allocation is usually poor project performance characterised by cost overruns, poor quality, late completion and tensions (Alsalman & Sillars, 2013; Shen, et al., 2006; Wiguna & Scott 2006). This reinforces the need to achieve appropriate risk allocation. This raises a debate as to whether poor project performance in the ZCI is due to inappropriate risk allocation. The noted methods of risk allocation will now be discussed in detail.

3.3.3.1 Transfer of Risk

The foundation of this approach is the allocation of risks to another party *(*Mead, 2007) typically a third party (Redja and McNamara, 2014). Risk transfer is the changing of the burden of loss to another party by legislation, contract, insurance or other means or shifting a physical risk or part of it (Rybka & Bondar-Nowakowska, 2013; Murdock & Hughes 2007). Other vehicles include performance bonds, warranties or guarantees (Project Management Institute, 2008) or collaboration (Kardes et al., 2013). It is generally accepted that the party to bear the risk should be the best suited to control that risk (Mead, 2007; Uff, 2010; Murdock & Hughes 2007; Lehtiranta, 2014; Akintoye & Macleod, 1997). This mode of allocation is used mainly for financial risk (Project Management Institute, 2008). For instance an employer can avoid the risk of non-performance by the contractor by including a performance bond in the contract. The employer would be entitled to some form of compensation from the bond providers. In a contract, transfer can be done through appropriate phrasing of clauses in a contract so as to identify the insurer who is to bear the specified risks (Mead, 2007).

Another way in which a risk can be transferred is through use of insurance policy. In an insurance policy, the effect is that the costs and losses resulting from the occurrence of certain defined risks will be met by the insurance company rather than the policyholder (Uff, 2010). The purchase of an insurance policy is often described as a ‘transfer of risk’; this is seeing that the risk has been transferred from the contractor to the insurance company or from the client to the insurance company depending on the risk. Technically the buyer of the contract generally retains legal responsibility for the losses transferred, meaning that the insurance may be described more accurately as a post-event-compensatory-mechanism e.g. personal injury insurance During estimation and tendering the risk could be transferred through the contract by sub-contracting a part of the work (Uher, 1991) however, it is possible for the main contractor to evade his own direct responsibility to the client for the errors and omissions on the part of his sub-contractors. Common ways of transferring risk are hedging pure risks and incorporation of a business firm.

- *Hedging pure risks*: This is transferring the risk of unfavourable price fluctuations to a speculator by purchasing and selling future contracts on an organized exchange such as the Lusaka stock exchange. A business can exchange transaction by purchasing a forward contract that guarantees the exchange rate for a future date. It is not formal insurance but is a risk transfer technique that provides considerable protection against a decline in stock prices. This technique is also called portfolio insurance (www.businessdictionary.com).
- *Incorporation of a business firm*: Contracting firms can also reduce their risk liability in a business by forming a corporation or a limited liability company, thus preventing the extension of the company's liabilities to its investors.

Though risk transfer is attractive, it has disadvantages. Risk transfer increases the cost of goods and services and at times, the transfer may not be absolute as it may return to the source of transfer (Allenworth, 1996). It also initiates further contracts, which may be complicated e.g. insurance contracts or bonds. It is argued that risk transfer which may be the main method of risk allocation in construction contracts has a potential to increase risk rather than reduce it (Loosemore & McCarthy, 2008). However, an evaluation of the use of insurance in managing construction risks concluded that risk transfer is effective (Odeyinka, 2000)

3.3.3.2 Acceptance or Retention

This is when both parties accept that certain risks can be handled and the necessary steps are taken to ensure that the risks are mitigated or shared *(*Mead, 2007: Ehsan et al., 2010). In risk acceptance an informed decision to accept the consequences and the likelihood of a particular risk are made. On the other hand risks that are unpredictable and are poorly defined such as invasions should be dealt with by the client.

The acceptance of loss or benefit of gain, from a risk when it occurs is the norm in risk acceptance. True self-insurance falls in this category. Risk retention is suitable for small risks whose cost of insurance is greater than the anticipated loss (Odeyinka, 2000). Therefore it is common practice that unavoidable or un-transferrable risks are accepted by default (Smith, et al., 2014). This includes risks that are so great or disastrous that they also cannot be insured against or the premiums would be uneconomical. War is an example since most property and risks are not insured against war, so the loss attributed by war is retained by the insured. This may also be acceptable if the chance of a very large loss is small or if the cost to insure for greater coverage amounts is so great it would greatly hinder the goals of the organization.

Risk retention may be a result of failure to avoid the identified risk consequently; an organization decides to return the risk if it is quantified in advance (Redja and McNamara, 2014). It is done when the probability of loss is so high that to transfer the risk, would cost almost as much as the cost of the worst loss that could occur, that is, if there is a high probability of loss, it may be best to retain the risk in lieu of transferring it. Risk retention can either be passive or active.

(a) *Active risk retention:* This is when risk is intentionally retained in part or as a whole in a planned manner. This strategy is utilised as a money saving strategy or when commercial insurance is unobtainable or can only be obtained by the payment of exorbitant premiums (Redja and McNamara, 2014). The use of a contingency sum is the most common method of active risk retention (Rybka & Bondar-Nowakowska, 2013).

(b) *Passive risk retention*: This method is used to retain unknown risk or the risk that does not present much of a threat because the worst imaginable is not severe or when losses are expected. Lastly, the strategy could be used when no other methods exist to treat a particular risk. Redja and McNamara (2014) posit that certain risks can be unintentionally taken due to ignorance, irrelevance or idleness. Merits of retention are that it saves money, lessens cost, inspires loss prevention, and adds to cash flow (Flanagan & Norman, 1993; Smith, et al., 2014). Demerits include the likelihood of greater losses, expenses and taxes (Redja and McNamara, 2014). A practical example of when risks are retained is through a retention fund, the clients' Quantity surveyor will prepare an interim certificate after valuation of works done by the contractor and will retain a percentage of the money due so that in the defects liability period the money can be used to cover any damages or unsatisfactory work. The percentage is usually not more than 10% of the contract sum.

3.3.3.3 Risk Avoidance

Risk avoidance is an informed choice to avert risky circumstances (Flanagan & Norman, 1993; Mead, 2007; Smith, et al., 2014). Kardes et al., (2013); and Rybka and Bondar-Nowakowska, (2013) advocate for use of the strategy for an unacceptable risk level. Strategies for risk avoidance consists of: adding to the schedule, modifying strategy, decreasing scope, simplifying requirements, acquiring information, improving communication or gaining skill (Project Management Institute, 2008). Risk avoidance can be understood in the sense that risks that can be handled are dealt with and those that cannot are assessed further. The assessment is to the extent to which the project can be affected if the effects are found to be fundamental to the success of the project then the project can be abandoned all together (Flanagan & Norman,1993; Smith et al 2014). This includes not performing an activity that could carry risk, or deciding not to enter into a new way of working because of the inherit risks that would be introduced. Individuals or organizations can avoid the risk involved in a particular venture by not undertaking that venture at all. In the Construction, industry some risks can simply be avoided altogether as a matter of policy for instance a fixed price tunnelling or trenching contract in an area where the ground conditions are known to be difficult is bound to involve very considerable risks even if the contractor is able to secure apparently generous unit rates. Here the contractor must either have very strong financial reserves and complete confidence in his ability to deal with the technical and operational problems that will arise, or avoid such a contract.

Risk avoidance is appealing choice, yet avoiding risks entails missing out on the potential benefit of shouldering a risk (Sichone, 2002). Not entering a project to avoid the risk of loss also avoids the possibility of earning profits (Doufman, 2007). The main benefit of risk avoidance is the elimination or reduction of a possible loss. In the field of physical accidents, prevention is the best way to stop people falling down a deep trench and foundation excavation. This can be achieved by completing the work and backfilling to ground levels as soon as possible so that such an accident simply cannot occur (Sichone, 2002). Risk avoidance is strictly a business decision and is mostly used if construction documents are unclear, ambiguous or incomplete (Flanagan & Norman, 1993).

3.3.3.4 Risk reduction or Elimination

Risk reduction is a process of combining loss prevention or loss control to minimize a risk, so that the risk is effectively ignored in an arbitrary way (Redja and McNamara, 2014). For instance, adding a percentage of 10% contingency sum on the cost of a project. Risk reduction or abatement or "optimization" involves reducing the severity of the loss or the likelihood of the loss from occurring (Ashworth, 2004). For example, sprinklers are designed to put out a fire to reduce the risk of loss by fire although this method may cause a greater loss by water damage and therefore may not be suitable. Fire suppression systems may mitigate that risk, but the cost may be too expensive as a strategy (Sichone, 2002). However with some contracts (NEC 2005, FIDIC 1999) are drafted to place some responsibility on the contractor for the safety works, and most require that the contractor should specifically insure against serious although hopefully unlikely risks which could endanger the works by taking the 'contractors all risk policy'. Notably, the risks which normally remain to be covered by the insurance company are wide; they may include fire, weather risk, theft, vandalism, accidental damage or collapse.

Contractors who identify the risk and further note that it is not in the all- risk policy of the contract and decide to deal with it based on gambling instincts is like 'a man who is sleeping soundly in the midst of a war.' Sibanyama et al (2012) observed that frivolous claims are made by contractors when risks materialise because they under estimate the sufficiency of their working capital. Risk abatement is preferably used in conjunction with other risk management strategies such as adopting complex processes, conducting more tests or choosing a more stable supplier. Using this risk management method alone will not totally eliminate the risk. Proactive risk elimination is necessitated by risk identification and analysis *(*Mead, 2007; Ehsan et al., 2010).

3.3.3.5 Risk sharing

Risk sharing is achieved by the distribution of the cost of the consequences of a risk among numerous partakers in a venture. (http://www.businessdictionary.com/definition/risk-sharing.html#ixzz398D89B2S). This indicates the collaboration among those involved to realise risk pooling (Giannakis & Papadopoulos, 2016). This is normally achieved by a planned method among contracting parties (Chungdong et al., 2012). Lehtiranta (2014); and Groton and Smith (2010) argued that risk sharing makes sense as largely risks may affect project participants directly or indirectly. Partnering, alliancing (Lehtiranta, 2014); and target cost contracting (Wamuziri & Seywright, 2005) have unlocked possibilities for risk sharing. This viewpoint is upheld by Osipova & Eriksson (2011). Practically, this method of risk allocation is only utilised when other alternative methods of risk allocation are unsuitable. This mode of risk allocation is less common in traditional arrangement but preferred in Public Private Partnership arrangements (Chung et al., 2010).

3.3.3.6 Doing nothing about the risk

According to Smith et al. (2006), doing nothing about a risk or ignoring the risk should never be done. This view was also expressed by Ashworth (2004) who stated that it is not recommended to ignore risks. However, Hughes and Murdock (2008) argued that at times it is perfectly in order to ignore an existential risk. Others argue that their own intuition has been sufficient in the past to assess the risks involved and they see no point in attempting to quantify risk (Smith et al., 2014). This can only be done when a risk is not clear as to its occurrence and who is best to manage it (Flanagan & Norman, 1993).

3.3.4 Variations in Risk Allocation

Other project types allocate risk differently. Risk allocation in Public Private Partnership (PPP) arrangements is fundamentally different from other types of projects (Jin & Zhang, 2011). In these arrangements risk allocation usually is the outcome of direct participants' negotiation (Chung, et al., 2010) as opposed to standard forms of contracts allocating the risks. Methods of risk allocation in PPPs solely depend on the private and public actors' negotiations and final agreements (Roumboutsusand & Anagnostopoulos, 2008; Hwang, et al., 2013). Wang (2008) observed that the nature of some risks makes it difficult to determine who to allocate them to. Risk allocation differs in different procurement systems e.g. integrated system and separated system (Hackett et al., 2007) due to the differences in the roles of the contracting parties Table 3.3 shows various risk allocated methods associated with threats.

Table 3.3 Risk Allocation Methods and strategies Employed

Risk response	Internal risks	External risks	Method commonly used
Risk avoidance/mitigation	X		Procurement method, contract, use of other materials/construction methods
Risk elimination	X		construction methods
Risk retention	X	X	Contingency, bonds
Risk transfer	X	X	Insurance , contract
Risk sharing		X	Joint Insurance , procurement method, payment method
Risk ignorance	X	X	N/A

3.3.5 Risk Monitoring and Control

This is the continuous operative control over the effectiveness of the risk control measures (Schieg, 2006). Katja, et al., (2010) defined monitoring and control as the process of implementing risk response plans (risk mitigation strategies), tracking identified risks, monitoring residual risks, identifying new risks and evaluating risk process effectiveness throughout the project life time. Control can be employed by a predictive indicator to watch the project as it approaches a risky point. Active control averts the risky point by having a contingency plan in place before the risky events occur for (Smith et al, 2014). The most common contingency plan is to set aside extra money in form of a contingency fund, to draw on in the event of unforeseen cost overruns. Risks handled through contingencies (money) or float (time) need to be subjected to comprehensive analysis of the risks that could affect a particular project to ensure that measures are adequate to cover the risks once they have occurred (Serpella et al., 2014). Occurrence of risks in ZCI may be an indicator of poor project monitoring as Tengan and Aigbavbo (2016) posit that monitoring and evaluation of risk have an enormous role in project deliverables of safety ,cost, quality and time. Besides, Kaliba et al (2015) argue that availability of monitoring and evaluation systems is a key indicator for knowledge creation.

A risk management register needs to be set up for risk monitoring to be effective (Lester, 2006). Monitoring and control are important as they help to check the validity of assumptions about a given risk (Soepriyono, 2013). This process should therefore be continuous. In addition to the aforementioned measures, Dziadosz and Rejment (2015) added as control and monitoring mechanisms market observations, response of team leader to all forms of conflict, workers to work overtime, alternative designs, applications for extension of time due to incorrect information.

3.3.6 Communication

Communication is a vital process in any kind of human activity. As a consequence, risk management decisions need to be communicated to ensure that all the parties involved understand and are aware of the risk management decisions made, so that risk management is a continuous cycle. Risk communication is an interactive process of the exchange of information and opinions among risk assessors, managers and other concerned parties, including various individuals, groups and institutions interested in risk issues and methodologies (Mullai, 2006). Common communication modes include meetings, reports, letters hardcopy/electronic (PMI, 2004). According to Serpella et al., (2014), communication of project risk is poor, incomplete and inconsistent in the construction industry yet Zulch, (2014) showed that communication is key to project success. To reinforce, Choudhry (2013) echoed that effective communication is essential to effective risk management, from top to bottom and bottom to top. Could it therefore be that communication in the ZCI of project risk is poor? In as much as RM is beneficial in project delivery by ensuring that projects are delivered with time, cost, in a safe environment and to the required quality, various barriers have been noted in literature that have impacted on its successful utility.

3.4 Barriers to the utilization and success of RM

Various studies have identified barriers to RM. A study done by Akintoye and Macleod (1997) revealed that RM was not used at the time due to the following reasons;

- Lack of familiarity with the techniques in RM by practitioners,
- Inadequate time and lack of information and the sophistication of the process,
- doubts resulting from applicability,
- Projects were not normally large therefore, not justifying the use of RM
- Vast majority of risks are contractual or construction related hence are subjective;,
- Benefits of RM not evident.

Uher and Toakley (1998) identified culture, lack of knowledge, negative attitude and mistrust as barriers to RM. Lyons and Skitmore (2004) identified the following hindrances to RM: lack of time; lack of familiarity with techniques to use and lack of resources; lack of expertise in techniques; difficulties in seeing the benefits; lack of information and cost effectiveness being unclear. Choudhry and Iqbal (2013) suggested that RM is not utilised because;

- Organisations lack formal risk management systems,
- Lack of joint risk management system by parties,
- Shortage of knowledge on techniques,
- Complexity of RM,
- RM is reactive rather than proactive,
- RM centralised rather than decentralised,
- Risk analysis is done rather than risk identification,
- RM periodic rather than continuous,
- Lack of historical data for risk trend analysis and;
- Consciousness of risk is simply absent.

Chileshe and Kikwasi, (2014a) cited: lack of knowledge on RM process by contractors and client; lack of familiarity with RM process concepts and methods and lack of information as barriers to risk management. Lack of knowledge about and familiarity with the techniques, lack of information/historical data and difficulty in seeing the benefits of RM are common reasons advanced for its non-utilisation. Dey (2010) added that formal risk analysis and risk management techniques are rarely used due to lack of knowledge and doubts about the suitability of techniques. It is unclear what the knowledge gaps are. Various researches highlighted here have documented techniques and the benefits of RM. Could it be that the methods of disseminating the information are inappropriate or that the practice and theory of RM differ hence documentation on the subject is seen as irrelevant? It could be that the risk management capabilities of practitioners in the construction industry are generally low. Mu et al (2014) argued that the application of RM is dependant of the risk management capabilities of organisations. Dikmen et al., (2008) however advocated for learning from risks in past projects as a way of enhancing knowledge. Tserng et al., (2009) advocated for knowledge reuse from past projects while Serpella et al., (2014) proposed a knowledge based approach to bridge the gap of lack of knowledge.

Another reason advanced is that the vast majority of risks are found to be contractual (Akintoye and Macleod; 1997). It is advantageous to reinforce risk allocation in contract as contracts regulate the risks and responsibilities between parties to the contract. The contract also determines the methods by which a contractor is being paid and also govern the relations which the client aspires to promote with the contractor (Watermeyer, 2012). This is done in the contract strategy. Nevertheless, not all risks are contractual. Risks in construction contracts will be discussed in the following section.

3.5 Risks in construction Contracts

Contract clauses are a basis of transferring or sharing risks (Andi, 2006; Sharma, 2006; Chung et al., 2010). Efficiency and effectiveness of contract clauses can only be comprehended when both contracting parties understand risk allocation and management (Andi, 2006). Contract risks include construction risks, design risks, project risks, client's specific risks, cost and time overruns (Saito, 1999). When risks are not clearly assigned in contract documents or addressed comprehensively, they lead to conflict (Mitkus & Mitkus, 2014) and raise the costs of infrastructure (Marques & Berg, 2011). In construction the question of who bears the risks depends on the type of agreement the contracting parties have signed. The attitudes to be expected in risk apportionment are typically risk averse (make efforts to avoid risk), risk taker/gambler (will endeavour to take risk) and risk neural (indifferent about taking risk) (Barnes, 1983; Flanagan & Norman, 1993). It is of utmost importance to carry out risk identification, risk classification and risk analysis before allocating risk in construction contracts (Chege & Rwelamila 2000). Different types of contracts allocate risks to parties differently but consideration of who bears which risk should be based on the following (Mead, 2007); -

- The risk is within the party's control
- When the risk can be dealt with beneficially by transferring it
- The economic benefit of a risk lies with the party to bear it and they can adequately plan for it
- If the party is the one likely to lose when the risk is transferred.

The risk factors common to the construction industry in general have been identified and a list of what may be encountered in construction contracts is shown in Table 3.4. The allocation of risks between owner and contractor has a significant impact on the total cost of construction (See section 3.8.1) and can lead to defensive strategies. In principle, it suffices that risk within a party's control should not be transferred nor should risks beyond one's control be assumed (Marques & Berg, 2011). It would be better to share risks that are beyond the control of either party. All the items in shown in Table 3.4 are potential risk(s) on a construction project; the biggest issue is to foresee the possibility/potential of a given risk in a particular environment. It is unusual to allocate a risk which is not foreseeable let alone price it. This research is aimed at identifying risks in the Zambia Construction Industry and evaluating the allocation of risks perceived to be pertinent. This is from a view point that while all contracts allocate risks, not all do so equitably (Zaghloul & Hartman, 2003).

Table 3.4 Contractual Risk

Physical works	physical conditions of the ground; artificial conditions causing obstruction; defective materials or workmanship; costs of test and samples; weather; site preparation; inadequacy of staff, labour, plant, materials, time or finance
Delay and Disputes	possession of site; lateness in the supply of information; inefficient execution of works; delay outside both parties control; layout disputes
Direction & supervision	greed, incompetence; inefficiency; unreasonableness; partiality; lack of communication, mistakes in documentation; defective design; ensuring compliance with requirements; lack of clarity in specifying requirements; inappropriate choice of contractors and consultants; changes in requirements
Damage & injury to persons & property	negligence/breach of warranty; uninsurable matters outside parties' control; accidents; uninsurable risks such as war, usurped power; consequential losses arising from the aforementioned; exclusions, gaps and time limits in insurance cover.
External factors	government policy on taxes, labour, safety, or other laws, delay or refusal of planning approval; financial constraints; energy and pay restraints; cost of war or civil commotion; malicious damage; intimidation; labour demands and unrest; strikes; lockouts; pickets
Payment	devaluation; delay in settling claims and certifying; delay in paying certificates; legal limits in recovery of interest; insolvency of contractor, sub-contractor or employer; funding constraints; shortcomings in the measure and value process; exchange rate fluctuations; inflation; any of this not covered by a fluctuation clause; replacement cost of plant and equipment
Law and arbitration	delay in resolving disputes; injustice; uncertainty due to lack of records or ambiguity of contract; cost of obtaining decision; enforcing decision; changes in statutes, new interpretations in common law
Technology	New technology, provisions for change in existing technology, develop costs, need for research and development

Adapted from Murdock and Hughes, (2007), Uff, (2007) and Zou et al., (2007)

3.5.1 Risk Allocation in Engineering and Construction Contracts

During contract selection, the capacity of contract parties to assume the risk outcomes of the cost risk or any other risk and the ability of the contract parties to manage risk has to be account for (Berends, 2000). This suggests that risk management abilities of parties have to be known. Essentially risks have to be appropriately allocated in the contract (Hanna et al., 2014).

Hanna et al., (ibid) contents that it is problematic to forecast responsibility by the courts if no clause exists in the contract that clearly allocates a given risk. Moreover, Hartman (1996) argued that one gauge of a contract's effectiveness is its power to plainly allot risks between contracting parties (. As a result, risks need to be predictable to be managed through contract (Subramanyan et al., 2012).

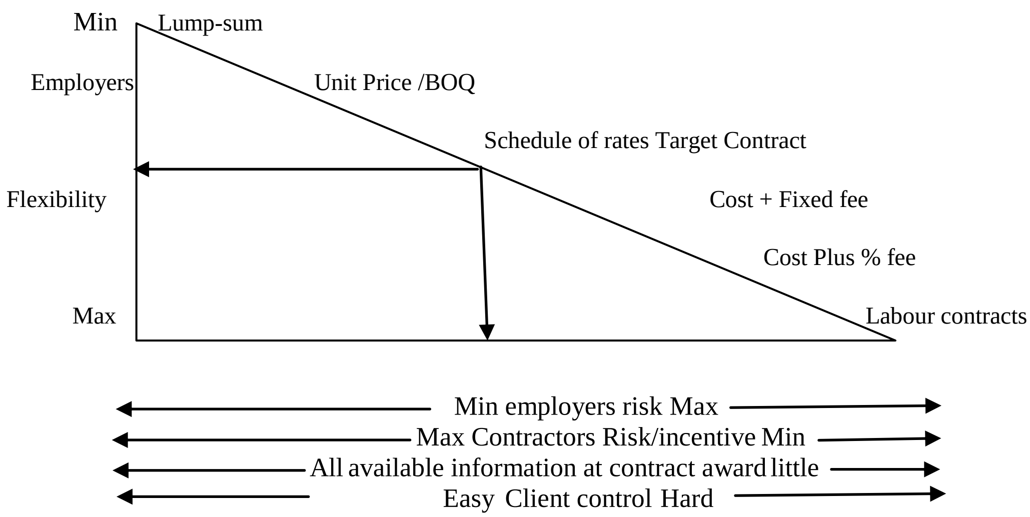


Figure 3.3 Risk allocation by payment method adapted from CIDB document 1005

Oztas and Okmen (2004) argue that the method of payment defined in a contract influences risk. The form of payment defines who takes a risk if the final cost of construction activities is higher than the estimated cost (Osipova & Eriksson, 2011). The form of payment is achieved by using an appropriate contract type that needs to be chosen with the possible risks allocated appropriately (Figure 3.3). A construction contract is a warranty that the executed job will receive the specific amount of compensation and how the compensation will be distributed (Mouse, 2010; Ke et al., 2010). Contract types are used to distribute risk (see Figure 3.5). It is therefore important to determine the extent to which in practice the fixed price contract is used in comparison to other methods of pricing as it has been recognised that types of contract can be utilised in combination (Hackett, et al., 2007).

The next section briefly discusses the individual types of contracts used in the construction industry and their implications regarding risk allocation. This is important as some are in use in the ZCI as shown under section 1.1.1 and 2.6.1:-

3.5.1.1. Lump-sum contract/fixed price contracts

A lump-sum or fixed price contract is one with fixed price items paid on the basis of a predetermined estimate of the cost of work (Ashworth, 2006). This includes an allowance for the risk involved and the market situation in relation to the contractor's workload (Hany, 2011). This contract type is quite often used in the private sector and almost always in the public sector (Dzliadosz, et al., 2015).The scope of the work should be clear to both parties (Kaplanogu & Arditi, 2008). The implication is that the final price is paid by the client irrespective of the cost incurred by the contractor. This could apply to a unit rate, a section of work or equally to a complete contract (Hackett et al., 2007). A schedule of fixed rates without quantities suffices to form the basis of a lump-sum contract (Ashworth, 2006). The contractors take the risk of the estimate. Fixed price contracts are mainly used for building contracts and this type is suited for a client on a fixed budget (Badenfelt, 2010). This is useful for construction works that can be accurately and completely described at the time of bidding such as residential and building construction (Hany, 2011).Traditionally this type of contract has been restricted to projects involving relatively few technological and economic uncertainties (Badenfelt, 2010). It has been argued that the frequent use of fixed price contract has made the construction industry conflict-prone (Eriksson & Nilson, 2007). However, Osipova and Eriksson (2011) postulated that the fixed-price contract is associated with poor-quality projects while Olsen and Osmundesen, (2005) suggested that fixed price contracts provide a strong incentive for cost control. Tadelis, (2012) points out that fixed price contracts are unsuitable for complex projects that have incomplete designs and specifications yet in the USA public sector they are applied under these conditions.

Variations are limited and in lump-sum contracts the expected level of risk is low and quantifiable and management of the project is left up to the contractor (Dzliadosz, et al., 2015). This contract type gives more incentive for the contractor to reduce his price to increase profit and to complete as quickly as possible to minimize overheads, maximize profit and move to the next project (Hackett, et al., 2007). As a consequence, the client specifications must be clear and comprehensive to ensure the desired quality is obtained. The contract type normally results in price increases and liquidity problems during execution often resulting in quality issues (Dzliadosz, et al, 2015). Lump sum contracting is commonly used on Design Bid Build, Design, and Build, Turnkey, and Construction Management procurement routes typically on a competitive or negotiated basis (Hany, 2011). Any variations introduced to alter the tender sum may be the source of a dispute. Variants of the lump -sum exist including the firm fixed price and the fixed price with economic price adjustment. A contractor under a fixed price contract is usually unwilling to perform duties beyond those to which they are contractually bound (Bajari & Tadellis, 2001).

3.5.1.2 Cost-plus contract

A cost-plus contract is based on priced items paid on the basis of the actual cost of the work (Aqua Group, 1990; Hackett, et al., 2007). The contractor is reimbursed actual cost plus a fee to cover overheads and profit. The fee may be designated as a fixed percentage of the cost of work, fixed fee or fixed fee with a guaranteed maximum price, fixed fee with the bonus or a fixed fee with an arrangement for sharing any cost saving (Federal Acquisition Requirements, 2005). The sum is only ascertained at the end of the project hence this contract type is not suitable for a client on a fixed budget. The employer will automatically pay for extra costs or will gain from the actual cost of the works and consequently, the contractor is not contractually obligated to carry out the work as economically as possible (Chan, et al., 2011). It is therefore imperative that the client and consultants ascertain the competence levels of contractors before they are engaged. The contractor must make all his records and accounts available for inspection by the client or any agreed third party (Hany, 2011). The client carries all the risk associated with inflation, management efficiency, effective supervision, resource availability and productivity (Hackett, et al., 2007). This method of contracting is suitable when the client’s requirements are vague, when it is desirable for design to proceed at the same time as construction, for emergency projects, repair, maintenance works and alterations and perhaps where some construction knowledge is needed. In addition, cost-plus contracts are suitable for projects with unknown technologies or which involve changes (Hany, 2011). This is usually in instances where a contractor possesses a special ability. Cost control is not a contractual objective of the contractor. However, the expertise of the contractor may be utilised during design (Ashworth, 2006).

3.5.1.3 Unit price

Here the contract price is based on specified quantities in the Bill of Quantities (BOQ) priced by a contractor based on work items and unit prices. Marginal errors result from unit price or quantities for materials and labour; however, errors in bills of quantities occur 50% of the time (Dzliadosz, et al., 2015). Payment is based on work actually done and measured. This is useful on projects where the nature is well defined but the quantities cannot be accurately defined in advance of construction such as highways, dams, and airports (Hany, 2011). The contract type imposes lower risks on a contractor compared to the lump-sum and changes can be easily made by the owner. However, re-determination of unit prices when substantial quantity deviations occur needs to be stipulated in contract documents. The final price of the project may remain unknown until the completion of the project. The documentation process for the client is not as thorough as in lump-sum contract hence there is a saving on the heavy cost of preparing a BOQ (Hackett, et al., 2007). This contract type is popularly used in the Design-Bid-build context and design-build procurement systems normally awarded on a competitive or negotiated basis (Ibid).

3.5.1.4 Target Cost Contract and Guaranteed Maximum Price

Target cost contracts (TCC) specify the best estimate of the cost of the work to be carried out (Kaplanogu & Arditi, 2008). Trench (1991), went further to explain that as the actual cost of completing the work is evaluated and compared with an estimate or target cost of the work and differences within a cost band are shared between the employer and the contractor. Target Cost Contract is the combination of a cost plus and fixed price contract. The contractor and client agree to a target estimate of construction. A bonus or penalty arrangement is tied to this target figure. To necessitate the use of this particular contract type the nature of the work must be definite to some extent. All the drawings and specifications must be sufficiently developed to enable reasonable costing. Savings are shared and there is an incentive to carry out the work as quickly and as economically as possible (Kaplanogu & Arditi, 2008).

The contractor in the Guaranteed Maximum Price (GMP) contract guarantees that he will construct the project in full accordance with the drawings and specifications, that the price to the owner will not exceed some total set price. Anything in excess is borne by the contractor. Cost savings are shared between the client and the contractor (Simeau, 1992). A GMP contract is usually used to encourage the contractor to execute the work as cheaply as possible. As with lump-sum contracts, GMP contracts are competitively bid but they are managed as cost plus

(Chan, et al., 2011). A successful bidder is determined on the combined basis of his quoted maximum price, what price the project is expected not to exceed and a fixed fee as per the cost estimate. It should, however, be noted that it is quite difficult to establish a guaranteed maximum price (Hany, 2011). This type of contract offers the sharing of financial risk in a sense. Given the foregoing it can be concluded that GMP is a form of TCC (Chan, et al., 2011). TCC generally help to reduce project duration by allowing the construction to start before design is fully developed. This type of contract is deemed the least risky as there is a collaboration between contractor and client to optimise cost (Dzliadosz, et al., 2015).

3.5.1.5 Incentives Contract

These are contracts where there is motivation to achieve and are used particularly where there is a prospect of the contractor making reductions in the cost of carrying out the work (Aqua Group, 1990). The variant for incentive contracts are performance incentives based on the award for satisfactory performance 1.*Delivery Incentives:* Multiple Incentives: incentive may be awarded based on both delivery and performance such as early completion and having some cost savings on completion of a project. 2. *Fixed Price Incentive* which is a fixed price contract that provides for adjusting profit and establishing the final contract price by a formula based on the relationship of final negotiated total cost to total target cost (Federal Acquisition Requirements, 2005). It is assumed that a variable to use as basis for the incentive is chosen. 3. *Cost Reimbursement Incentive:* This makes provision for adjusting the fee either upward or downward using a predetermined formula based on the total allowable costs in relation to total targeted costs.

3.5.1.6 Admeasurement contracts

In admeasurement contracts, the value of the work executed is determined by measurement. Bill of Quantities and Schedule of Rates are the most common types of ad measurement contracts (Elbeltagi, 2009). Payment under such a contract can be fixed price or price adjustment usually made periodically based on measured work (Hany, 2011). Variations and claims usually increase the contract price (Elbeltagi, 2009; Hany, 2011). This type of contract is suitable for civil engineering work, work that has little or no change, and work that is repetitive when risk expectations are low and quantifiable, and when construction and design need to be overlapped.

3.5.1.7 Indefinite Delivery Contracts

These contracts provide for delivery of goods or services upon the issuance of a delivery or task order as need arises. The following variants of indefinite delivery contracts have been identified: Definite Quantity, Requirements, Indefinite Quantity and Ordering. The most common form of this type in the construction industry is Serial Contracting (Federal Acquisition Requirements, 2005; Hackett, et al., 2007).This is used when multiple facilities of the same design are to be constructed such as schools, or health centres. It ensures continuity with construction of preceding facilities without having to enter into a new contract.

3.5.1..8 Letter Contracts

This type is where a contractor is permitted to start work when all of the contract terms and conditions have not been agreed upon. This type of contract is only used in circumstances of unusual and compelling urgency (Federal Acquisition Requirements, 2005).

3.5.1.9 Time and Material Contracts

This type of contract is used when the project scope is not clear or undefined (Rodriguez, 2004). In a Time and Materials contract the contractor is paid a fixed hourly rate for direct labour expended during the contracts performance such as wages, overhead, general and administrative expenses, profit as well as actual cost of materials (Federal Acquisition Requirements, 2005). The materials covered can include direct materials, subcontracts for supplies or incidental services on other direct costs and applicable indirect costs.

3.5.1.10 Labour hour contracts

This is when the contractor supplies direct labour only. This includes a ceiling price, which could be exceeded by the contractor. It is considered that this is the only suitable contract where the parties cannot accurately estimate the extent or duration of the contracts work and the cost of the contract cannot be reasonably made (Elbeltagi, 2009).

3.6 Risk allocation and procurement method

The choice of a standard form of contract is reliant on the nature of the project and the procurement method to be used. Procurement methods have a bearing on risk allocation as shown in Table 3.5. A contract designed for a Design and Build can barely be used for a Design-Bid-Build project without alteration. Procurement systems are important tools for risk management and allocation. In addition to this, the relationship between risk and procurement lies within the risk response stage, were risks are allocated (Chege & Rwelamila 2000).

From Table 3.5 it is indicative that the allotment of risk for variety procurement modes varies considerably between client and contractor. The maximum risks to the contractor are in the design and build mode while the minimum risk is in the construction management mode and vice versa for the client. It is uncommon to decrease contract sums and costs if the service delivered is not to the specified standard (Jin & Zhang, 2011).

Table 3.5 Retention/transfer balance between client and contractor

Procurement method	Risk Allocation	
	Client	Contractor
Design and Build (complete package deal by supplier)		
Design & Build design input by contractor		
Traditional Pre-planned Fixed Price/Lump sum		
Traditional measurement-Fluctuations		
Traditional measurement- BOQ quantities		
Traditional measurement fixed fee prime cost		
Traditional measurement fixed % fee prime cost		
Traditional Pre-planned re-measurement		
Management contracting		
Construction Management		

Source Adapted from Saito (1999) and (Smith, et al., 2014)

3.7 Theories used in past studies on risk allocation

A theory is an organised body of concepts and principles intended to explain a particular phenomenon (Leedy & Ormorod, 2010). Unlike 'theory' that refers to ideas and assumptions we carry around in our heads to make sense of everyday observations, academic theory tends to look for higher levels of generalisations (Easterby-Smith, et al., 2015). In academic circles theories are classified as middle-range theories (these are generalizable propositions that can be tested empirically) and grand theories (usually more abstract and contain whole structure of assumptions that are not often testable) whose distinction is a matter of scale and formality (Easterby-Smith, et al., 2015).

Several theoretical underpinnings have been used to study risk allocation in the construction industry. These include: transaction cost economics; principal agency theory; the resource based view; fuzzy theory; contingency; theory of remuneration; game theory; expectancy theory and real options theory. Appendix 8A identifies research where these have been applied in the existent literature. The following section discusses briefly the application of the theories mentioned above.

3.7.1 Transaction Cost Economics theory (TCE)

Transaction costs are costs of running the economic system, principally with asset specificity, uncertainty and frequency as the main dimensions (Williamson, 1996). The aim of appropriate risk allocation is to reduce transaction cost. The argument for allocating risk according to the TCE model is that improperly allocated risk results in transaction costs. TCE holds that governance (contracts) chosen in a cost effective manner should infuse order to mitigate conflict and realise mutual gain. It also recognises that some governance structures are better than others (Macher & Richman, 2008; Chan et al., 2011). In addition, TCE maintains that there are rational economic reasons for organising some transactions one way and others in a different way (Jin, 2010a). It is mainly concerned with opportunistic behaviour eventuation, which may be caused by an organisation's actions being driven by self-interest and an ambition to minimise costs (Biesenthal & Wilden, 2014). The main drivers of transaction cost are contractual agreements, behavioural factors and contingency factors (Ibid.). The implication is that organisations adopt their governance structure to achieve the lowest possible transaction costs (Chan, et al, 2011). This reinforces the supposition that contract choice is important and should foster the minimisation of transaction costs. It is implied that the higher the risks the higher the transaction costs and vice versa (Biesenthal & Wilden, 2014) while Ryan (1998) postulates that simple transactions have low transaction costs while complex transactions have high transaction costs. TCE holds that an optimal contract is one which has been crafted with minimal cost but delivers quantity, price and quality (Kwawu & Hughes, 2007).This approach is suitable as it integrates economics, organisational theory, contract law and behavioural assumptions in a multidisciplinary study (Jin, 2010a). While this theory has been widely applied in Public-Private Partnerships (PPP) it is unclear on the costs that accrue from different procurement methods (Li et al., 2013). Jin (2010a) uses TCE in the risk allocation of PPPs where an exchange of risk management responsibilities takes place between the government and the project company.

Chang (2013) points out that while TCE is a viable lens for viewing risk allocation, studies should: 1. Identify the appropriate unit of analysis, 2. Operationalize the transaction attributes and 3. Consider the nature of the governance structure in question. Transaction cost can be viewed in the pre-contract stage (market research, exploring financing opportunities, conducting a feasibility study, bidding/negotiation and day-to-day pre-contract project management) and the post-contract stage (set-up/running cost of the governance structure, day-to-day contract administration, administering claims and dispute resolution and change orders) (Li et al., 2013). The following costs accrue due to inappropriate risk allocation (Jin, 2010a: Nasirzadeh et al., 2014): 1. Extra costs for client of high contingency in bidding (premium); 2. Extra costs for clients of more resources for monitoring the risk management; 3. Extra costs for client (and/or contractors) of recovering lower quality work for a given price; 4. Extra cost for contractor of the resources dedicated to lodging claims related to misallocated risk; and 5. Extra costs for both parties dealing with disputes or litigation related to misallocated risks.

3.7.2 Principal agency theory

This theory looks at how to ensure that agents (professionals- project managers, engineers, quantity surveyors, architects, contractors etc.) act in the best interests of the principal (owners, shareholders) of an organization. A ‘mismatch’ in this respect usually occurs because there is a separation of control and ownership resulting from information asymmetry (Weihua, 2014). The theory deals with the study of decisions in transactions where one party has more or better information than the other. It is normally assumed that the agent is more knowledgeable than the principal. Two main problems normally occur in this relationship: firstly, how to align the conflicting goals of the principal and the agent (congruency); and secondly, how to ensure that agents perform in the way principals expect them to (Luhman & Cunliffe, 2012). Most importantly, when it comes to risk allocation agency problems can also occur when agent(s) have a different attitude toward risk from that of the principal. The theory suggests that the optimal risk-sharing ratio be set at the level where total surplus from the transaction can be maximized under the constraints of participation and incentive compatibility

(Chang, 2013). Drivers of principal agency theory include issues of moral hazard, adverse selection and opportunistic behaviour.

Various researchers have stated this theory in various formats. Abrahamson (1984) holds that a party should bear a risk where : 1.the risk is within the party's control; 2. the party can transfer the risk, e.g. through insurance, and it is most economically beneficial to deal with the risk in this fashion; and 3. the preponderant economic benefit of controlling the risk lies with the party in question. It follows that when the above conditions are satisfied; placing the risk upon the party in question is in the interests of efficiency. The efficiency includes planning, incentive and innovation efficiency. When the risk eventuates, the loss then falls on that party in the first instance and especially when it is not practicable, or there is no reason under the above principles, to cause expense and uncertainty by attempting to transfer the loss to another. Bunni (1997) stresses the importance of apportioning risks to the party with the ability to best manage or mitigate their occurrence. Bunni further outlines how this can be best achieved by answering the following questions (Bunni, 2009) 1. Which party can best control the risk and/or its associated consequences? 2. Which party can best foresee the risk? 3. Which party can best bear the risk? and 4. Which party ultimately most benefits or suffers when the risk eventuates? Latham (1994) states it as a selection of allocation of risks, to be determined as suitable to each project but then allocated to the party most competent to manage, estimate and bear the risk. Oudot (2005) summaries the theory as follows: 1. the risk should be allocated to the Agent to the extent he does manage the risk (internal risks) 2. Risk should be allocated to the least risk averse partner to minimize the overall risk-bearing cost (external risk) 3. The Principal should support risk to minimize the overall risk-bearing cost (shared risks). Other researchers such as Xiang et al. (2012) have created an information model of construction project management after establishing that asymmetric information is the essential cause of construction project risk.

3.7.3 Resource based view

This theory focuses on internal resources, the firm's or organisation's strengths and weaknesses, in contrast to the positional or environmental models of competitive advantage which focus on opportunities and threats (Barney, 1991). While this theory enables an organisation such as a project organisation in apportioning risks based on the internal resources, this necessitates the internal risks being covered. However, project organisations are affected by external risks, which may not be completely catered for using the resources of the project organisation. This application in allocating risk was used by Jin and Zhang (2011) in a PPP.

3.7.4 Fuzzy Set theory

Fuzzy Set Logic was founded by Lotfi in 1965. This theory is a body of concepts and techniques that gives a form of mathematical precision to human cognitive processes that in many ways are imprecise and ambiguous (Kaufmann & Gupta, 1988, cited in Nasirzadeh et al., 2014). This approach is helpful for quantifiable risks and in tackling ill-defined real-world problems resulting from partial and imprecise information (Lam et al., 2007). Research using fuzzy sets includes that of Lam et al. (2007), who modelled risk allocation decisions in construction contracts from a background that tailor-made contract strategy allocating risk among contracting parties based on acceptable allocation principles is more desirable. Nasirzadeh et al. (2014) modelled a quantitative risk allocation dynamic model in construction projects. Likewise, Khazaeni, et al. (2012) formulated an adaptive fuzzy decision-making model for risk allocation with the introduction of a balance allocation index. Shi et al. (2014) proposed the use of risk analysis in programme management, using principles of project management and partner contracting.

3.7.5 Contingency theory

Contingency theory is an organizational theory that claims that there is no best way to organize a corporation, to lead a company, or to make decisions. Instead, the optimal course of action is dependent upon the internal and external situation. Osipova and Eriksson (2013) propose this approach in order to manage risk jointly for uncertain events that occur in the course of a project, by investigating how mechanistic and organic management systems influence successful joint risk management (JRM). While this approach helps to allocate uncertain events, it can successfully be implemented in an integrated approach rather than in separated procurement. However, the practice thrives on collaboration.

3.7.6 Theory of Remuneration

This theory could be described as a descendant of Henry Fayol's management principles. Remuneration means to pay an equivalent for a service, loss or expense (Miriam-Webster Dictionary, 2004). Its application in the construction industry for risk allocation could be said to be limited; however Barnes (1983) points out that it is better for the owner to pay for what eventuates rather than for what the contractor thought might happen in those areas of uncertainty over which the contractor has no authority. This approach without doubt would ensure that the client only pays for what happens and would avoid the practice of the contractor pricing risks that have not occurred. While this could be a desirable practice, it would not necessarily be practical for the construction industry, as risks are inevitable and the client may not be able to use certain types of contracts like the firm fixed price contract, which are widespread. In addition, this method of allocation could be viable where the client's budget and financial standing is not an issue, which is rarely the case, as financial constraints are one of the major contributors to poor performance of projects, especially in developing countries.

3.7.7 Game theory

Game theory is the formal study of decision-making, where several players must make choices that potentially affect the interests of the other players (Theodore & Stengel, 2001). These players may be individuals, groups, firms, or any combination of these. Cooperative game theory is used if decision- makers in a joint activity work together by forming a coalition to achieve more benefits than individual activities might achieve (Peckiene, et al., 2013). Medda (2007) allocates risk in the transportation sector using game theory with an objective of determining the process of risk allocation between the public sector and private sector in PPP transportation agreements. However, though this approach was used, the criteria used for allocation could also be likened to the criteria for both principal agency theory (the agent that should bear the risk is best able to influence and control the risky outcome (Medda, 2007:214)) and transaction cost economics (the risk should be borne by the agent able to bear the risks at the lowest cost (Medda, 2007: 214).

3.7.8 Expectancy theory

Expectancy theory proposes that an individual will decide to behave or act in a certain way because they are motivated to select a specific behaviour over other behaviours due to what they expect the result of that selected behaviour will be. Ward et al. (1991), using expectancy theory reasoning states that: 1. Risks should be borne out of willingness if there is adequate perception of risk/return trade-offs risk assessment, ability to bear eventuating consequences and real ability to manage the associated uncertainty and thereby mitigate project risks. 2. Risk should not be willingly borne if there is inadequate perception, need to obtain work and false perception of the risk/return trade-offs of transferring risk to another party.

3.7.9 Real Options theory

Real options theory refers to the “right, but not the obligation, to take different courses of action with respect to real assets as opposed to an option on financial securities or commodities” (CIMA, 2005:95). This mode of risk allocation is widely applied in the transport sector of PPP (Carbonara, 2013) when making investment decisions. It is mainly used to account for managerial flexibility on uncertainties that occur in transport PPPs, e.g. toll roads (Rakić & Rađenović, 2014). It is unclear how this theory could be adopted for other procurement routes.

3.7.10 Synopsis of theories used on past research

The focus on previous research has fallen mainly on how allocation of risks impacts on the transaction (Transaction cost economic theory); how agency problems such as information asymmetry, opportunistic behaviour, and moral hazard considerations influence risk allocation (principal agency theory); how available resources influence risk allocation (Resource based view); and the use of fuzzy logic to cater for subjectivity and uncertainty in risk allocation. Most past studies are also theoretical and conducted in developed context within developed markets and governance structures as shown in Appendix 3. There is therefore a gap to be filled by using different theoretical underpinning to give a fresh interpretation in a developing context. This might give a different interpretation and explanation. Few of the theoretical lenses consider the environment or structure and personal repository factors or agency related attributes that influence risk allocation and management. There is need to use such theoretical underpinnings to understand and explain risk allocation.

3.8 Risk Practice in the Construction industry

The risk management process and its link to construction contracts have been discussed, which needs to be followed by analysis of current risk management practice in the construction industry. The literature on risks has identified several deficiencies which have impacted on the risk management in the construction industry. Jin et al (2017) point out that experience and intuition govern risk management practice in the construction industry in relation to risk management approaches.

Risk management in construction projects is full of deficiencies that affect its effectiveness as a management function and in the end project performance is affected negatively (See Akintoye & Macleod, 1997; Choudhry & Iqbal, 2013; Chileshe & Kikwasi, 2014a; Dey, 2010; Lyons & Skitmore, 2004; Uher & Toakley, 1998). Hanna et al., (2013) in agreement pointed out that various studies have been done each providing a small portion of the solution (e.g. Diekman et al., 2011; Mitkus & Mitkus, 2014; Serpella et al., 2014; Tserng et al., 2009) but the construction industry lacks a comprehensive widely accepted risk allocation model. Appropriate risk allocation is important in the success of any project. It cannot be overemphasised that effective risk management in which risk allocation is a component must permeate all areas, functions and processes of the project (Schieng, 2006). Ehsan et al., (2010) points out that there seems to be differences in preferred allocation method ranging from balanced to inappropriate allocation. The result is usually poor project performance characterised by cost overruns, poor quality, late completion and tensions (Sillars & Alsalman, 2013; Ehsan et al., 2010; Zavadskas, Turskis & Tamosaitience, 2008, Kutsch & Hall 2010; Wiguna & Scott 2006; Medda, 2007 and Shen et al., 2006). However construction companies that manage risks effectively and efficiently enjoy financial savings, greater productivity, improved success rates on new projects and better decision making (Banaitience & Banaitis, 2012). It is believed that this inference can also be made for the client. Mead (2007) summarised risk allocation in the construction industry as follows:

- Risks are not allocated to the party best suited to manage them
- Risks assessments are rarely done and
- Contractors are usually afraid to cost risk in the tender stage due to the fact that it would raise the tender sum
- Most of the disputes arise from unjust risk allocation
- Cost calculations do not factor in risk

In particular, there is a need in the ZCI to establish why risk misallocation is recurrent in order to identify deficiencies in the risk allocation applied in the industry and so develop an mechanism to alleviate the misallocation. The need for an mechanism tailored to the ZCI is supported by findings of other researchers such as Liu et al., (2014), who stated that the same risk is perceived differently under different host cultures, and this influences the response. Risk management is not a one-size-fits-all practice (Walke & Topkar, 2012). Issues pertaining to project risks are subjective and highly sensitive to the unique political, economic, environmental and social and cultural conditions of a country (Andi, 2003; El-Sayegy, 2008). Therefore, a mechanism needs to be formulated for the ZCI context.

The use of a mechanism could provide the certainty that the project is in full compliance with the risk allocation requirements, using a structured approach that is both maintainable and upgradable. Existent literature points to the absence of mechanisms for optimal risk allocation (Alsalman & Sillars, 2013; Tauron et al., 2011) which absence can be partly attributed to complexity of contracts, static risk allocation, the practice of risk aversion and imbalance and abuse of power among other things (Sillars & Alsalman, 2013). In addition risk response, in particular the stage in risk management where risk allocation is done, remains the weakest part of risk management in the construction industry (Alsalman & Sillars, 2013; Banaitience et al., 2011; Hilson, 2000; Perera et al., 2009; Taroun, 2014). This is because risk allocation practices in the construction industry projects have been found to be inconsistent, intuitive, biased and simple (Ng & Loosemore, 2007). This has been a driver to this study to contribute to how contracting parties can improve risk allocation.

3.9 Chapter Summary

Risk in the construction industry has been an area of interest in the construction industry for many decades. Risk management practices have been developed and continue to evolve. Risk practices used in the ZCI are unclear nor their impact on risk allocation. A link between risks and construction contracts has been established while understanding that risks may be contractual or non-contractual. Further to this it has been established that risk in construction projects leads to cost, budget overruns, poor quality and disputes among the main players more so if practiced in an un-formalised and unsystematic manner. It has also been noted that the risk management and allocation capabilities of contracting parties influences risk management and allocation hence these have a significant impact on the project performance. The key processes in risk allocation are identification, analysis, risk treatment, monitoring and communication/reporting. Risk allocation has two key foundations' *management responsibility* and *risk liability*. Therefore, risk allocation is much more than assigning risk liability but what is paramount is the management responsibility at each stage of a project. It is also conclusive that there is no universally accepted mechanism for risk allocation due to nuanced differences in political, cultural and economic circumstances. There also seem to be differences in methods of risk identification, analysis and response in various construction industries yet there clearly seem to be a preference for subjective methods.

The chapter explains theories used in past studies as a lens for risk allocation. It has been noted that though theories used in past studies are vast; they are mostly theoretical hence deficient in empirical explanation. To add, most are applied in developed contexts were organisations are perceived to be established and the agents skilled. In addition, there is need to expand the explanatory power for risk allocation by investigating the interaction of environment/structure and personal repository factors/agency in a single study. The next chapter discusses the building contracts used in the construction industry.

CHAPTER 4 -BUILDING CONTRACTS USED IN THE CONSTRUCTION INDUSTRY

4. Introduction

Modern day businesses are characterized by agreements of various types mostly to supply certain goods and services of a given quality at a given time and price. Such agreements are often legitimised by a formal contract, principally in a written format (Vitez, 2014, Murdock & Hughes, 2008). It is in these agreements that the risk allocation is presented and the signing of agreements signify acceptance of risk liability. It is therefore important to briefly outline historical evolution of the contract with specific emphasis of what each era contributed to present day as a basis for positioning contract practices in the Zambian context which is the focus of this study. This will assist in highlighting any areas that might be overlooked. The history of modern day standard construction contracts according to the Joint Contracts Tribunal (JCT) dates back to 1931 when the JCT formulated their first contract (Spiers, 1980). It could, however, be argued that the first attempt at a standard contract was in 1870 (Ibid). Nonetheless, contract use especially business contracts have ancient origins going back to ancient Egypt as discussed in section 4.2.

A contract is defined as an agreement which is binding in law (Uff, 2009; Ramus, Birchall, & Griffith, 2006; Quail, 1978). Uher and Davenport (2009) defined a contract as an agreement made between two or more parties whereby rights and obligations are created which the law will enforce. This view was supported by Peel, (2007) who defined a contract as an agreement giving rise to obligations which are enforced or recognized by law. All the definitions insist on an agreement. Uff (2009) explained that an agreement is used to denote a mutual understanding between parties where the meeting of the minds is a critical element. From this point of view, a contract can simply be defined as a mutual agreement between two or more parties that something shall be done, and it is fundamentally an agreement enforceable at law (Hany, 2011). The construction industry like other industries utilizes contracts to deliver projects (Smith, 2005). This chapter discusses contracts in the construction industry and ends with the current practice in the Zambian Construction Industry (ZCI).

4.1 Contracts Generally

According to Ramus, et al. (2006) there are two types of contracts, simple contracts and complex ones. A simple contract may be an oral agreement or could be set out in a simple letter or other brief document stating the essential matters agreed upon (Ibid) or it could be as simple as a handshake (Ward, 1903). A complex contract is one made by deed and it binds its maker without form of consideration e.g. transfer of property or rights. In practice, building and engineering contracts are generally executed through standard forms (Ashworth, 2006). Contracts can be standard or bespoke in nature (Ibid). In any given form of documented contract four preconditions should exist: an offer, an acceptance of the offer, intentions to create legal relations and an exchange-- “something for something” --commonly referred to as consideration (Hartmann, 2008).

Contract practice is understood at different levels in the construction industry (RICS, 2015):
***At level 1**:* the demonstration of knowledge and understanding of the various forms of contract used in the construction and/or your area of business;
At level 2**:** Application of the knowledge in the use of the various standard forms of contract at project level, including the implications and obligations that apply to the parties to the contract and
At level 3: Provision of evidence of reasoned advice, preparation and presentation of reports on the selection of the appropriate form of contract and warranties for a chosen procurement route. This includes advising on the most appropriate contractual procedure at the various stages of a construction or other contract.

Different contract types should be matched with specific project types and owner requirements (Hackett et al., 2007; Puddicombe, 2009). Construction contracts could be used for a new building, road, bridge, and railway on unused land or for alterations to be made on an already existing structure which could involve demolition, rebuilding, refurbishing and/or extensions (Ramus et al., 2006). Picha, et al. (2015) and Loch (2004) highlighted eight business levers of a contract as shown in Figure 4.1 reduced to four by Mooi and Gilliland (2013) namely relational safeguards (protect parties interests e.g. intellectual property rights); transactional safeguards (protect specific transaction e.g. arbitration clause); service and warranty safeguards (protect buyer from faulty service e.g. defects liability clause) and product and price safeguards (determines technical specifications and price and its changes). In most construction contracts there are two parties; the client and the contractor. The fundamental utility of the contract in the construction industry is to ensure the supply of work and materials for the erection of a defined building or other works for the benefit of the employer (Uff, 2009). This is usually done to ensure that the project deliverables of time, cost and quality are met (Hackett, et al., 2007). The risk dimension of construction projects differ; Kardes, et al. (2013) distinguished them as shown in Table 4.1 where number of teams, project value, project complexity and duration are seen to add to the risk profile.

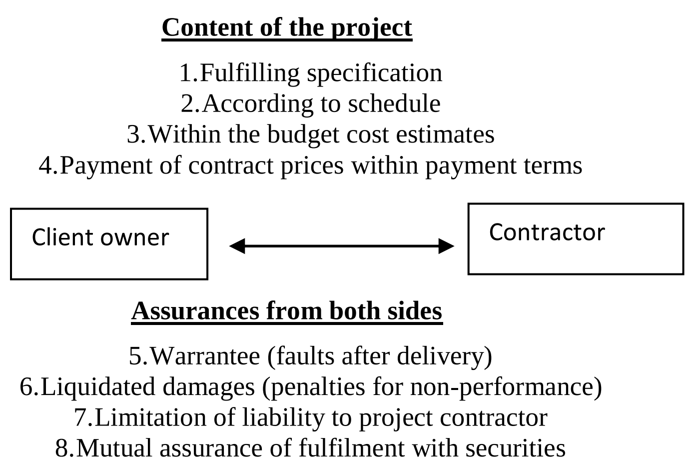


Figure 4.1 Elements of a contract

Table 4.1 Risk Profile and Project Characteristics

Risk Profile	Project	Project Value (US$)	Project Duration	Members in Team
Low risk	Simple Projects	< 250K	3 Months	3-4
Moderate risk	Moderately Complex	Value 250-1M	3-6 months	5-10
High Risk	Highly Complex	>1M	6-12 Month	>10
Very high risk	Very Highly Complex	Multiple millions	Over 12 Months	Multiple Teams

Various contract types and forms are suitable for use on different dimensions of a project (Hackett, et al., 2007; Hany, 2011). Therefore, contract selection should consider the risk level as low, moderate, high and very high to ensure that the appropriate contract is chosen. The history of contracts demonstrates their evolution and it is important and as such will be discussed in the section below.

4.2 History of Contracts

The birth of the contract and contract law as we know it today has its origin from the Greek empire and through to the Roman Empire (Redmond, 2007). The Roman law of contracts of the 6th century CE reflected a long prior economic, social, and legal evolution. It recognized various types of contracts and agreements, some of them enforceable while others were not. Only at its final stage of development did the Roman law enforce, in general terms, informal executory contracts (Mehren, 2013). Executory contracts are contracts that come into force after they have been performed—i.e. the act necessitating them has been executed beforehand (Elliot & Quinn, 2007). The discussion on the development of contract law has been divided into eras; ancient contract law era, medieval contract law era, industrial revolution contract law era and the 20th-century contract law which is still current practice. These eras will be discussed pursuant to the significant landmarks in the evolution in the law of contract.

4.2.1 Ancient contract law

Ancient contract law can be examined through the Roman and Greek ancient laws (Maine, 1901). In addition, earlier ancient civilizations such as the Egyptians and Babylonians contributed in their own way. A brief account of contract law is given through the, Babylonian, Egyptian, Greek and Roman civilizations.

Contract practice in ancient Babylon had unique characteristics. The ancient Babylonian model contracts were not functional documents. They were simple instructive tools, which followed common patterns for what was considered acceptable (Spada, 2014). These models represented a comprehensive assortment of all possible transactions that the ancient Mesopotamian administration might have been required to draw up in everyday economic life: these included for instance barley and silver loans, deeds of real estate or slave sales, lease of fields, marriage contracts, adoptions, manumission of slaves, and other agreements. In comparing such model contracts with real modern administrative and legal contracts, one notes the absence of a list of witnesses and of a date, both considered essential for the legal validity of a document (Spada, 2014). This defect could be seen to be a deterrent to contracting law development in ancient Babylon.

Development of contract law can also be viewed through ancient Egypt where the judicial system was not separate from the government (www.crystalinks.com/egyptlegalsystem.html). However, no judges were used; instead a council of elders called Kenbet used a common sense approach to deciding cases. The marriage contract could be viewed as the oldest form of contract in ancient Egypt. This was normally sealed with a handshake or an oral contract which was legitimized by the presence of a few witnesses. However, people became aware of the limitations of verbal agreements specifically those concluded in the presence of a witness, who could later renege on having witnessed the incident. This resulted in the evolution of written contract (Berlin cited in http://www.reshafilm.org.il/ad/egypt/law_abd_order/contracts.htm).

Roman law signifies the legal system of ancient Rome and its legal developments before the 7th century AD - when the Roman-Byzantine state adopted Greek as the language of government (Ibid). The Roman Empire lasted in the West between 27BC-497AD (Peter, 2005). It can, however, be argued that it continued through the Byzantine empire for another 1000 years (Andrews, 2014). Roman law developed over a thousand years of jurisprudence - from the Twelve Tables (439 BC) to the Corpus Juris Civilis (AD 529) directed by Emperor Justinian I. This Roman law, the Justinian Code, was operational in the Eastern Roman (Byzantine) Empire (331-1453), and served as a foundation for the legal system on the European continent, including Ethiopia, and most former colonies of European countries (www.crystalinks.com/romelaw.html). The standard types of contract (sale, labour, hire, services) regulated in most continental codes and the characteristics of each of these contracts were developed by Roman jurisprudence. *Stipulatio* was the basic form of contract in Roman law (Maine, 1901). It was created in form of a question and answer (www.crystalinks.com/romelaw.html). It was the duty of the courts then to enforce such contract. The nature of early courts could be assumed to be tribal (Plato, n.d.). This stage of development was lost with the breakup of the Roman Empire (Cheilik, 2007) as a consequence, the English law developed beyond Roman or Greek law.

The Greek philosopher Plato summed up law of contract in the ancient times as:

> *"If a man fails to fulfil an agreed contract - unless he had contracted to do something forbidden by law or decree, or gave his consent under some iniquitous pressure, or was involuntarily prevented from fulfilling his contract because of some unlooked-for accident -*

an action for such an unfulfilled agreement should be brought in the tribal courts, if the parties have not previously been able to reconcile their differences before arbitrators (their neighbours, that is)." From his book- The Laws (Plato, 1921).

It seems that Roman, Egyptian, Babylonian and Greek law respected the private law instituted by individuals and specifically in the Greek context; it would however appear that non-performance of a contract could have some excusable circumstances. It is clear that even in that era the courts would still enforce what was agreed between parties.

4.2.2 Medieval contract law

The medieval or middle ages between 5th and 15th centuries evidenced the birth of "freedom of contract." Blackwell's law dictionary (2014) defined freedom of contract as being able to enter into whatever type of a legally binding agreement one wishes to with no legal limitations other than being of legal age to do so. The principle allows parties to provide for the terms and conditions that will govern their relationship. This principle presupposed that men and women had an inalienable right to make their own contracts (Atiyah, 1979). However, freedom to contract was firmly suppressed among the peasantry (Goldthwaite, 1980). The law or courts of this era enforced such agreements. The concept rested on two pillars: Firstly, that contract was based on mutual agreement and secondly, a contract was considered the result of a free choice of the parties to a contract (Ibid). This concept of freedom of contract only became a developed legal principle in the later industrial revolution (Atiyah, 1979).

When Western Europe decayed from an urbanized, commercial domain of the Greco-Roman evolution into a localized, farming medieval society, the Roman courts and administrators were replaced by moderately frail and imperfect institutions (Mehren, 2013). It is believed that after the decline of the Roman civilization, European civilization began to develop its own contract law from common law (Barbour, 2010). Mehren's (2013) account indicated that merchants developed idiomatic and adaptable practices appropriate specifically for their line of business. Merchants' courts had been launched at international trade fairs by the 13th century. The merchant courts were run by merchants and they provided speedy procedures and timely justice as they were aware of mercantile problems and customs. In the 12th and 13th centuries, the growth of contract law on the European Continent and in England started to differ. In England, the common law of contracts developed rationally through the courts. In

Europe as a whole, hesitant and meticulous thinkers played a much larger role (Ibid). This development progressed further into the industrial revolution era.

4.2.3 Industrial Revolution era and contract law

The industrial revolution was the transition to new manufacturing processes in the period from about 1760 to sometime between 1820 and 1840 (Spiers, 1980). During this period major changes in agriculture, manufacturing, mining, transport, and technology had a profound effect on social economic and cultural conditions (Nardinelli, 1993; Goldthwaite, 1980). This started in the United Kingdom and spread throughout Europe, North America, and eventually over the world. During the industrial revolution, English courts became devoted to the principle of freedom of contract and this principle of contract became entrenched (Anson, 1984).

Growth of contract law was part of the economic, political, and intellectual rebirth of Western Europe. Both in England and on the European Continent, the customary arrangements were found to be unsuited to the emerging commercial and industrial activities such as the shipping trade among merchants (Mehren, 2013). The unofficial agreement, so essential for trade and commerce in market economies, were unenforceable legally (Barbour, 2010). The economic life of England and the Continent flowed, even after a trading economy began to develop, within the framework of the already fully performed formal contract. The new contract law began to grow throughout Europe through the practices of merchants (Mehren, 2013).

According to Goldthwaite (1980) the uplifting of the poor to the middle class during the industrial revolution gave most in the society some prospect for the construction of houses and related infrastructure. The industrial revolution relocated farmers from the rural areas to cities which in turn created a demand for houses and related infrastructure. This brought with it a demand for various expertises such as design and construction (Spiers, 1980) in the birth of modern urbanization. Architects, builders, carpenters and other related trades were engaged in the booming construction industry and each was paid a fee for their services and contracted freely in the market (Ibid). This could be said to be the foundation of labour-only contracts used in present day, although in current practice these are normally for professional services and the actual construction contracts while in earlier times each employee had their own separate contract. It was not until 1870 that recognized commercial business contracting was established (Spiers, 1980; Goldthwaite, 1980). It was during this time that the construction contract came into existence with the first publication of a standard form of contract for use in

London with Thomas Cubitt as the pioneer. He was the founder of the first general contracting company (Spiers, 1980). Freedom of contract was exercised in this era and continued into the 20th century.

4.2.4 The 20th Century and the 21st Century contract law

Legislation and changes in court attitudes effected reforms of 20th-century contract law (Atiyah, 1979). One of the changes was that commercial contracts were given special protection where "freedom of contract" appeared far more to apply to large businesses. This was because large businesses exhibited high bargaining power. Consumer contracts came to be regarded as "contracts of Adhesion/devotion" (Kessler, 1943). Simply put consumers contracted simply because they had no other avenue for obtaining the necessary basic goods. This resulted from a lack of bargaining power in which "freedom of contract" became restricted so that consumers entered contracts that were clearly disadvantageous. It appears that most commercial contracts did not really give a consumer freedom to contract and most people were offered terms that they could either take or leave (Ibid). Consequently the courts began to require entirely clear information concerning the contract before clauses could be enforced. Further, the circumstances of the formation of contracts had to be verified to rule out misrepresentation. In the Misrepresentation Act of 1967 in the UK, the burden of proof was placed on businesses to show that misleading statements were not negligent. Over time, this lead to the Unfair Contract Terms Act (1977) in the UK (Elliot & Quinn, 2007) which created the jurisdiction to eliminate unreasonable contract terms. This was done with due consideration of the parties' relative bargaining power. Nevertheless, classical contract law based on private law remained at the foundation of specific contracts unless particular rights were given by the courts or Parliament (Kessler, 1943).

Clearly the task of developing contracts was difficult. Consequently, legal systems flourished in creating what was required: a body of contract code by which conventional business agreements, involving a future exchange of values, could be made enforceable. The laws of contract have continued to evolve until the present day (Mehren, 2013). Currently, most businesses use contracts of various types. In the international space there have been new interventions and developments such as international arbitration which has made contracting possible between different nationals and/or nations. Additionally, this century is characterized by important electronic advances e.g. internet and software packages which reduce the time and effort in contract negotiation and formulation between distant parties. The next section discusses modern uses of contracts in business.

4.3 Uses of Contract in Business

Contracts in business have various main usages. They are principally used to show that an agreement was reached between the parties signing the contract (Elliot & Quinn, 2007; Hughes & Greenwood, 1996). Roxenhall and Ghauri (1997) identify three major reasons for using contracts; firstly to transmit information to another where they act as a means of communication; secondly they reduce uncertainty and in this regard the task of the contract is therefore to function as a means of mitigating uncertainty and proof that an agreement was indeed made; and lastly contracts are used as a customary way to formalise an agreement. In the construction industry contracts are used firstly to specifically allocate the duties between the parties, secondly to recognize and allocate the risk to the different parties (Adriaanse, 2007), and lastly to reduce the uncertainty surrounding the project and allow the parties to plan for the project and the future (Fortney, 2009; Murdock & Hughes, 2008). Hughes and Greenwood, (1996) further, stated that a contract is a management procedure manual. It basically lays out a procedure of what is to be done in given circumstances and identifies the responsible parties. The clauses are implemented under conditions of risk (Kaplinski, 2013). This entails that contracts are a governance mechanism for courses of action which are implemented when risk occur (Ping, et al., 2014). This view is affirmed by Puddicombe (2009) who pointed out that a contract should be viewed as a managerial tool that provides a structure within which project tasks are accomplished.

Contracts specify each party's obligation in an exchange, including the price, qualities and quantities of the product (Brown, et al., 2010; Usher, 1991). A contract would underscore remedies in the event of failing to achieve such obligations (Iyer, Chaphallar, & Joshi, 2008; Mouzas & Blois, 2013; Mooi & Gilliland, 2013) Traditionally, responsibilities of selected contracts' parties are these: the client to initiate the project, finance it and make strategic decisions when the need arises; the project manager to manage the project to ensure project deliverables are achieved; architects and engineers to design and supervise the design team; the contractor to construct as per design; quantity surveyor to give cost advice (Hughes & Murdock, 2001). All modern contracts are directly concerned with providing clear risk allocations between the parties, and good contracts assign risk to the party who can best manage it (Latham, 1994; Mead, 2007; Shnookal & Charrett, 2010). This is done by including penalty, disclaimer, escalation clauses etc. in the contract (Furmston, 2001). Appropriate risk allocation significantly reduces transaction costs (Jin & Zhang, 2011) and reduces disputes (Alsalman & Sillars, 2013; Mead, 2007). Risk allocation is considered appropriate when it is adequate. Adequacy is achieved when the contract clauses are fair, clear and comprehensive (Meng, 2012). Yet from previous research it is unclear who between the client and contractor determines that clauses are fair, clear and comprehensive notwithstanding the fact that the standard forms are usually contracts of adhesion in nature (Kanamugire, 2013). This research looked at the comprehensiveness of risk allocation by comparing risks impacting on project delivery to the risks provided for in the contracts. This was considered from the premise that appropriate risk allocation significantly reduces transaction costs (Jin & Zhang, 2011) and reduces disputes (Alsalman & Sillars, 2013).

Contract documents consist of clauses and provisions which specify the interests and obligations of contracting parties and assign the risk of contracting parties between them (Cheng, 2014; Rameezdeen & Rodrigo, 2013; Moazzami, et al., 2011). It is often required that contracts are fair, clear and comprehensive in the allocation of risk (Charoemngan & Yeh, 1999). However most standard forms of contracts in the public sector are inclined to the client and allocate most risks to contractors unjustifiably (Choudhry and Iqbal, 2013). This is problematic when the contractors cannot manage the risk as demonstrated by project performance in the ZCI. Further to this, the public sector is not in a position to offer incentives due to the competitive bidding process (Ling, et al., 2014). Consequently, the public sector usually relies on traditional contracts except for exceptional situations. The nature of construction contracts is particularly worth discussing as it gives an understanding of the nature of contracts in use.

4.4 Nature of Contracts in the Construction industry

The construction contract according to Thompson, et al., (1998) comprises of four elements: relationship, responsibilities, risks and reimbursement. The relationship is the one denoted between parties and is dependent on the nature of the contractual relationship. Responsibilities, on the other hand, are the duties of each party within the transaction also influenced by contract relationship (Ibid). While risk apportionment is determined based on actions and events, it is also influenced by the contractual relationship and procurement method (Hackett, et al., 2007). Responsibilities and risks contribute to the nature of reimbursement (Thompson, et al., 1998). This depends on the nature of the contract to be used which can either be traditional or relational (Cheung, et al., 2006).

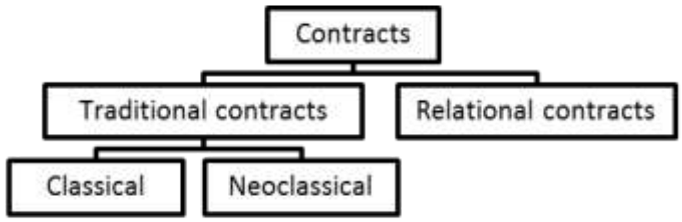


Figure 4.2 Nature of contracts

Some schools of thought argue that traditional and relational classifications substitute each other while others argue that they complement each other (Zhi & Lumineau, 2015). Traditional contracts are a common method of contracting where the client chooses service providers for the design of work and invites bids for the construction phase of the work (Blackwell law dictionary, 2014). The online Business dictionary defines a traditional contract as a customary contracting mode where the employer (client, customer or project owner) choses expert service sources (e.g. Architects and engineers) for the design work and then invites bids for construction work. Under traditional contracts contingencies are included to act as a buffer for unforeseeable spending (Cheung, et al., 2006). Consequently, the contractor is exposed to a high degree of uncertainty and risk. There are two variants of traditional contract; these are the classical and neoclassical contracts. Classical contracts are used for short term once-off activities thereby restricting personal interactions. Consequently, they allow a high level of discreteness. The Classical theory involves the application of clear rules of legal doctrine. Riordan, (2004) suggested that classical contracts are an expression of the joint will of the parties and the contracts are self-imposed obligations. Classical contracts promote the formulation of private law by parties and call upon the state to create a civil structure in which parties are free to contract and to enforce private contracts when called upon to do so (Riordan, 2004). On the other hand, neoclassical contracts are used for a fixed duration or task to be completed with anticipated future cooperative opportunities. Personal interactions are seen to be relevant though the core of self-interest exists (Cheung, et al., 2006; Sarker & Khan, 2013). This approach offers flexibility to cope with unforeseeable matters. Neoclassical contract law is the current status of contract law (Cheung, et al., 2006). It addresses shortcomings of classical law rather than offer a new concept of law (Sarker and Khan, 2013). The distinctions between the two theories are given in Table 4.2.

Table 4.2 Distinction between Classical and Neoclassical approach to contracts

Points of distinction	Classical approach	Neoclassical approach
Focus	Functions and economics demand workers	Emotion and human qualities of workers
Structure	Impersonal and mechanistic	Social system
Application	Autocratic government and strict rules	Democratic process
Emphasize	Discipline and rationality	Personality security and social demand
Work goal of worker	Maximum remuneration and reward	Attainment of organisational goal
Concept about men	Economic being	Social being
Content	Scientific management, administrative and bureaucratic management	Hawthorne experiment, human relation movement and organisational behaviour
Relationship	Formal	Informal
Nature	Mechanistic	Organistic

Adapted from Sarker and Khan (2013)

Relational contracting has emerged due to the shortcomings of traditional contracting arrangements. Relational contracting is somehow regarded as a compliment to traditional contracting (Kwawu & Hughes, 2007; Mouzas & Blois, 2013) yet Lehtiranta (2014) suggested that traditional contracts do not support effective cooperation. However, Doloi (2013), using over 150 participants in a questionnaire survey found trust and communication as relational practices in traditional procurement while Ling, et al., (2014) found information sharing, communication of risks and joint risk solving as approaches used in public projects to aid risk management in traditional contracts. Traditional contracting is the most commonly used in the ZCI (Section 2.3) yet is unclear if it is complimented with relational practices.

The view in relational contracting is that a contract is fundamentally about cooperative social behaviour and that contracts are relational to the extent that the parties are incapable of reducing important terms of the arrangement to well-defined obligations (Cheung, et al., 2006). Riordan (2004) further postulated that relational contracts are a representation of social relationships. Considerations such as whether a party chooses to enforce their rights of entering into an agreement are influenced by external social factors such as trust and reputation. Ling, et al. (2014), Kwawu and Hughes (2005) explained that relational contracting is based on the recognition of shared values and win-win situations attained by cooperative tactics such as partnering, collaborating, alliancing, joint ventures, long-term contracting, joint risk-sharing mechanisms and integrated project delivery. Relational contract theory postulates that through social relationships and the resulting norms of behaviour, relational governance may function to mitigate the precise exchange risks targeted by formal contracts (Kwawu & Hughes, 2005). These are risks such as uncertainty, and difficult performance measurement. Relational contracting may not be justified in the absence of known exchange hazards (Ibid). It is nevertheless noted that relational contracting values are less complicated to employ in the private sector, though some (Ling, et al., 2014; Ning, et al., 2014; Travis, 2011) argued that relational contracting is effective for public projects though these are procured through competitive bidding and have more constraints in application. The next section will discuss how contracts are used in the construction industry and the various types that are available.

4.4.1 Contracts available in the construction iindustry and their Use

Construction contracts are of various types some being contractor friendly while others are designed to protect the client's interests (Shapiro, 2005). Most contracts used in the construction industry are standard (e.g. JCT, NEC, FIDIC, ICE suites of contracts) except for bespoke contracts that are specifically drafted for Public Private Partnerships (PPPs) and management contract types (Picakavance, 2005) such as framework agreements. Standard forms of contracts have been developed to provide uniformity and a level playing field for contracting parties in the construction industry (Rameezdeen & Rodrigo, 2014). Further, to this, they have an established body of case law and are an efficient aid in the production of contract documents (Laryea & Hughes, 2009). On the other hand they are cumbersome, complex; and often difficult to understand; and are often resistant to change (Adriaanse, 2007). Nevertheless, standard contracts are widely used because their terms are familiar to contracting parties in the construction industry (Ramus et al., 2006; and Ryan, 1998). However, they are rarely used without modification (Hughes & Greenwood, 1996; Laryea & Hughes, 2012; Rameezdeen & Rodrigo, 2014; Mooney & Mooney, 2013). It would appear that modifications are made by clients to include their own requirements and project-specific conditions (Rameezdeen & Rodrigo, 2014; Laryea & Hughes, 2009). Mooney and Mooney (2013) however noted that clients modify contracts to alter the balance of risk toward the contractor who in turn shifts the risk to sub-contractors. This view is also affirmed by Alsalman and Sillars (2013). However, it is unclear what criteria are used to modify clauses in relation to appropriate risk allocation; given that most standard forms of contracts in the public sector favour clients and allocate most risks to contractors (Choudhry & Iqbal, 2013; Osipova & Eriksson, 2011).

Bespoke contracts are drafted from scratch to reflect the specific agreement for a particular project. The terms are usually negotiated (Hackett, et al., 2007; Mason, 2016). Generally the choice of the type to use depends on a range of factors, such as the degree of price competition in the procurement process, the type and complexity of the requirements (Uff, 2009) and the method of payment (Hany, 2011), as well as the client's objectives, the type of client, the type of work to be undertaken, the status of the design, the size of the project and the method of price determination (Ashworth & Hogg, 2007). While various studies have focused on selection of procurement methods and contractor selection (Love, et al., 1998; San, 2012) studies on contract selection are relatively few. Gordon, (1998) highlighted that the owner should create an appropriate contracting method for each project; in affirmation Antonious, et al. (2012) used a questionnaire survey to discover the selection criteria used in highway construction projects and found no single viable contract type to be appropriate. Turner, (2004) used a transaction cost economics perspective to design a contract strategy based on who controls the risk. However, this answered the “who” bears the risk, not *how* the risk would be allocated nor did it provide the available response measures. How the contract establishes the price is inherently linked to the procurement strategy and as a result, the choice is made very early as it affects the contract documentation (Hackett, et al., 2007). Separated procurement (mainly using traditional contracts-lump-sum) and integrated procurement (mainly using relational contracts-cost-plus) are the two broad categories of procurement (Aqua Group, 1990). The form of payment determines who takes the risk if the final cost of construction is greater than the anticipated cost (Osipova & Eriksson, 2011). This makes it inevitable to engage in a discussion on the various types of contracts moreover some of these are in used in the ZCI as indicated in section 1.1,1 and 2.3.

The two most common polar contract types available in the construction industry are the fixed-price/lump-sum contract and the cost-plus contract. As highlighted in section 3.5. of chapter 3, contract types determine the risk apportionment for contracting parties. In between the fixed-price/lump-sum contract and the cost-plus contract is a continuum of hybrids which are blueprinted on these two (Hackett, et al., 2007). Carty (1995) identified lump sum, unit price, guaranteed maximum price, incentive and cost reimbursement as contract types in the construction industry; Dzliadosz, et al. (2015) and the Project Management Institute, (2008) identified lump-sum, quantity surveying (unit price) contract and guaranteed maximum price. When it comes to risk allocation, it is unclear which contract type facilitates appropriate risk allocation based on project characteristics as Watermeyer (2012) asserted that pricing methods are associated with risk allocation. Likewise, Turner (2004) suggested that a contract should include an incentive for taking up risk but the public sector usually do not offer incentives. Hackett, et al (2007) argued that reimbursement methods can be used in combination depending on the preferred risk allocation criteria. This implies that with a given contract various risks can be reimbursed differently. It is unclear to what extent this applies in practice. Section 3.5.1 gave an explanation that different contract type's present different risk allocation criterion. Since there seems to be an over reliance of the Lump sum contract in the ZCI It is unclear if this type of contract is chosen in relation to the project characteristics.

4.5 Contract selection

It is common for various construction industries to have a particular set of contracts acceptable for use in that particular industry. Gordon (1994) estimated that choosing the right type of contract could reduce cost by 5%; while Ping, et al., (2015) declared that appropriate contract selection positively affects project performance; provided the risk allocation is appropriate. A choice has to be made because not all contract types are right for every project (Puddicombe, 2009). Cheung et al., (2006) further postulated that inappropriate choices not only affect the relationship between contracting parties but also the progress and the flow of interest, which may ultimately lead to undesirable construction interests.

Zaghoul and Hartman, (2002) argued that the contract choice is dependent on information at the time of tender, and the extent to which the owner wishes to take specific risks. Amongst the types of contracts discussed above, a suitable contract needs to be selected to ensure successful performance of a given project. Therefore, in the ZCI is the lump sum or admeasurement contract always the best choice?

El-sayegy (2008) argued that risks vary among construction industries in different countries as their economic, political, social and cultural conditions vary. It should therefore follow that a contract used should reflect the risks in a given country/geographical location. Murdock and Hughes (2008) added that there are tremendous variations of approach to the apportionment of risk in different projects. Contract selection starts by first identifying the appropriate type of contract, secondly by identifying the suitable main form and ancillary documents within the type (Ibid). This should be done in consideration to the nature of the client, risk attitude, procurement method adopted, clients priorities in terms of time, cost and quality, the size of the project, type of project and type of contract documentation (Ramus, et al., 2006). To these considerations, Ashworth (2006) added risk allocation, the relationship between client and contractor and status of the design. Elbeltagi (2009) outlined the considerations for selecting a contract type as risk sharing, flexibility, and the incentive. Yet from the peculiarity of relational contracting cooperation one may add risk, trust, good faith, flexibility, contract duration and use of alternative dispute resolution (Cheung, et al., 2006). Gordon (1994) categorised the factors for contract selection as client/owner drivers, project drivers, and market drivers.

- Under client drivers the sophistication of the project is considered with the risk aversion, restrictions on methods and laws requiring certain things or restrictions.
- Project drivers include time constraints, flexibility needs, pre-construction service needs from the contractor, design process interactions and financial constraints
- Market drivers include availability of appropriate contracts, current state of competition and package size of the project

Lambropoulos (2013) identified factors to be considered for contract selection as a means to enhance cost, time and quality; - cost, scope, process, value for money, criticality of schedule, performance, availability of extra resources, and claims. It is common practice that the contract type to be used especially for construction public procurement should be part of the contract allowed for use in a particular jurisdiction. Therefore, policy to an extent influences contract choice. This brings a debate as to whether in the ZCI policy positively influences contract selection. Hughes and Maeda (2002) added that any contract operates in the context of its legislation environment and current working practice.

4.6 Types of Clauses Commonly used in construction risk allocation

A clause is a particular and separate article, stipulation, or provision in a treaty, bill, or contract (Oxford Law dictionary, 2009). Clauses are usually numbered consecutively e.g. 1, 2, and 3 (main clause); sub-clauses may follow a clause e.g. 1.1, 2.1 (Ibid). Contract clauses are intended to document the exchanges that are agreed by parties to a construction project (Loosemore & McCarthy, 2008). Different types of contract clauses exist and have different implications for risk allocation. The clause may transfer, accept, minimise or share a particular risk. Dickson, et al., (2002) pointed out the natures of contract clauses as obligation, permission and prohibition. The following are some common types of clauses that may be included in a construction contract to share, reduce, transfer or accept a risk.

Penalty clause: A penalty clause in a contract mandates a financial fine in the event that one party breaches the contract. In construction, a good example of penalty clause is the liquidated and ascertained damages (LAD) clause where contractors are charged for late completion. These are used to protect specific investment and ensure efficient trade (Lyons, 1996). Hughes and Maeda (2002) concluded that penalty/punitive clauses should be avoided in contracts. It would appear though that drafters find such clauses effective and as a consequence have continued to use them.

Exclusion clause or Waiver clause: This type of clause exempts a party to the contract from liability in circumstances outlined by the exclusion clause e.g. indemnification of construction contracts (Oxford law dictionary, 2009). It can sometimes be referred to as *disclaimer or exculpatory* clause. It usually attempts to transfer a party's risk to another contractually. This, in turn, increases the cost of a project (Zaghoul & Hartman, 2002). Notwithstanding, Hanna, et al, (2013) pointed out that it is unwise to use this type of clause when information has been provided because it does not efficiently shift risk. In the construction industry, this could cover delaying events, the uncertainty of work conditions and sufficiency of contract documents (Zaghoul & Hartman, 2002). The exclusion clause may include the following (Furmston, 2001):-

- **True exclusion clause:** A potential breach of contract is acknowledged, and then the liability for the breach is excused. It may also be created in such a way it only includes reasonable care to execute duties by one of the parties (Indemnification).
- **Limitation clause:** This identifies the cap that can be claimed for breach of contract regardless of the real loss.
- **Time limitation:** This type of exclusion clause indicates the timeframe within which a claim must be commenced or the cause of action becomes unsanctionable.

Escalation clauses: These are provisions that make it possible to adjust the price named within the contract, if specified events that are beyond the control of the parties involved in the contract take place (Beal, 2008). The escalator clause helps to ensure that providers of goods and services do not encounter unreasonable financial difficulty such as fluctuation clauses in construction contracts (Ibid).

Force majeure clause may be defined as "risks beyond the reasonable control of a party, incurred not as a product or result of the negligence of the afflicted party, which have a materially adverse effect on the ability of such party to perform its obligations" (World Bank, 2013). Certain events and occurrences, beyond the control of client and their representatives; and contractors and their representatives, may inhibit the parties from fulfilling their duties and obligations under the project agreements; Such events include acts of God (floods, earth quakes, natural disasters, fire); and political and special events (terrorism, riots, civil disturbances). Therefore, a force majeure clause should provide a sophisticated mechanism for dealing with the consequences of events and prescribe a range of remedies available to the parties as a result (Smith, 2012). However, the drafting of force majeure clauses is rarely consistent throughout standard and bespoke forms.

Confidentiality clause or non-disclosure clause: a Confidentiality or non-disclosure clause may be included in a wide range of agreements where the parties disclose or provide access to confidential information. These may be applied in an instance where liability is taken by one party which is necessarily not the norm (Beal, 2008). It may include; (a) whether the obligation is mutual or unilateral; (b) the scope of the information included (and excluded); (c) the exceptions to the obligation covering permitted disclosure to employees and representatives and required disclosure by law; (d) the extent of the obligation covering non-disclosure and optionally affirmative obligations to protect the information; and (e) the term of the obligation, if any.

Severability/savings clause: refers to a provision which states that if parts of the contract are held to be illegal or otherwise unenforceable, the remainder of the contract should still apply (Mason, 2016).

Choice of law or forum clause: a provision in which the parties stipulate that any dispute between them arising from the contract shall be determined in accordance with the law of a particular jurisdiction (Oxford law dictionary, 2009).

Termination clause: this clause allows the termination of a contract under certain circumstances e.g. insolvency or bankruptcy. These could include non-payment for a given duration by the client or non-performance by the contractor (Hackett, Robinson, & Statham, 2007)

Obligation Clauses: state the duties and responsibilities of project participants (Dickson, et al., 2002).

Hughes and Maeda (2002) argued that penalty clauses should be avoided while Zaghoul and Hartman (2003) advocated for the avoidance of disclaimer clauses on the grounds that they promote a high-risk premium of between 8-20% of the total cost of a project as a response by the contractor and discourage trust. This could trigger a debate as to which type of clauses should be used for risk allocation to promote appropriate contractor response and minimise high premiums. Moreover, Kanamugire (2013) stated that exclusion clauses used in standard contracts are usually unfair in nature. Mukubwa and Muya have pointed out that there is unfair contract practice in the ZCI where one-sided contracts mainly shifting risk to the contractor are used. However, it is unclear the extent to which different types of clauses contribute to this lop-sidedness nor the types of clauses used to allocate important risks in the ZCI.

4.7 Chapter Summary

Various contracts exist for use in the construction industry and the selection of the most appropriate type is essential to ensure success on a project. Success on construction projects is based on completing a project on time, within budget and to the required quality requirements rarely achieved in the ZCI. It is, therefore, important that the appropriate contract type is chosen, within the choice of contracts available. In the ZCI it is unclear the contract selection criteria used neither the clauses to influence risk allocation.

Additionally, important considerations on a particular project should be analysed to ensure the project deliverables are operationalized within the chosen contract type so that the necessary obligations and liabilities are communicated appropriately. It is unclear the extent to which this is done in the ZCI. Effective communication of obligations and liabilities ensures that parties are clear on the risks, which accrue to them. Furthermore, it fosters diligence to bear the risk if its allocation is appropriate and equitable. This might result in desired project delivery. The next chapter discusses the conceptual and theoretical framework for the study.

CHAPTER 5 - CONCEPTUAL AND THEORETICAL FRAMEWORK

5. Introduction

The focus of this chapter is to discuss the conceptual and theoretical framework for the study. The conceptual underpinning is discussed first then the theoretical perspective follows. The chapter will end with a summary.

5.1 Conceptual underpinning for the study

Miles and Huberman (1994) and Robson (2011) describe a conceptual framework as an aid in guiding the research insofar as it is a system of concepts, assumptions, expectations, beliefs and theories that support and inform the research. Jabareen (2009: 50) defines it as a "network, or a plan of interlinked concepts that together provide a comphrehensive understanding of a phenomenon or phenomena". Miles and Huberman (1994) add that it can be presented in graphical form or narrative but must contain key concepts or variables and the prescribed relationship. Jabareen (2009:50) outlines the following features of a conceptual framework (although it is unclear whether if any feature is missing a proposed framework is deemed inadequate):

1. It is a construct in which each concept plays an integral role. When variables or factors are used it is ideal to call it a conceptual model.
2. It provides an interpretative approach to social reality rather than a casual/analytical setting.
3. Conceptual frameworks provide understanding while quantitative models offer a theoretical explanation.
4. A conceptual framework provides not knowledge of hard facts but rather soft interpretation of intentions.
5. Conceptual frameworks do not enable the prediction an outcome.
6. Conceptual frameworks can develop through a process of qualitative analysis
7. The sources of data consist of many discipline-oriented theories that become the empirical data of the conceptual framework analysis.

5.1.2 Conceptual model for the study

A conceptual model fundamentally illustrates what one proposes to study and what is happening with these phenomena understudy and why (Robson, 2011). Conceptual models are formulated principally through qualitative evaluation of literature (Jabareen, 2009:50). Thus, the research at hand, which is to investigate why risk misallocation is a recurrent source of project failure in the Zambia Construction industry, entails an understanding of concepts that are critical in risk allocation.

The selection of a suitable contract type though generally based on the attributes of a project influences risk allocation (Dhanushkodi, 2012; Ospova & Eriksson, 2011; Zaghoul & Hartman, 2003). Moazzami et al. (2011) concured that unsuitable contract types result in inappropriate risk allocation. The nature of the contract type selected heavily depends on how soon a contractors' input is needed on a project resulting in either a separated or an integrated approach. It is therefore advantegeous to unpin risk allocation in contracts, as contracts are a management manual for risks and responsibilities between parties to the contract; in turn the ways by which a contractor is remunerated governs the rapport which the employer wishes to nurture with the contractor (Watermeyer, 2012). This determines the internal risks (risk arising from duties of contracting parties) and external risks (risks arising from the project environment). The types of contract chosen determines the allocation principles (Hackett, Robinson, & Statham, 2007; Osipova & Eriksson, 2011). Nevertheless, for every risk taken by a particular party; an incentive should be specified to the person accepting the risk (Hackett, et al, 2007). This is normally reflected in the payment mode (Turner, 2004; Smith, et al., 2014).

Risk treatment is heavily reliant on the nature of a risk; this also determines the method of risk allotment in contracts between a client and a contractor (Smith, et al., 2014; Zagloul & Hartman, 2003; Flanagan & Norman, 1993). Furmston (2001) declares that the nature of a risk may influence the clause type used in a contract. However, Moazzami, et al., (2011) caution that the type of clause used determines the appropriateness of the the risk allocation hence should be chosen with care. To reinforce, Loosemore and McCarthy (2008) propose that contract clauses are intended to document the exchanges agreed between the many parties to a construction contract.

The allotment of risk has a direct effect on project performance (Akintoye & MacLeod, 2001; Alsalman & Sillars, 2013; Hanna, et al, 2013). For instance, when Alsalman and Sillars (2013) modelled the effects of risk misallocation on projects in the USA construction industry using a rational decision-making process based on data from a questionnaire survey, the identified effects were tensions, cost/time overruns, quality issues and disputes. From the analysis of literature, Figure 5.1 is the proposed conceptual model.

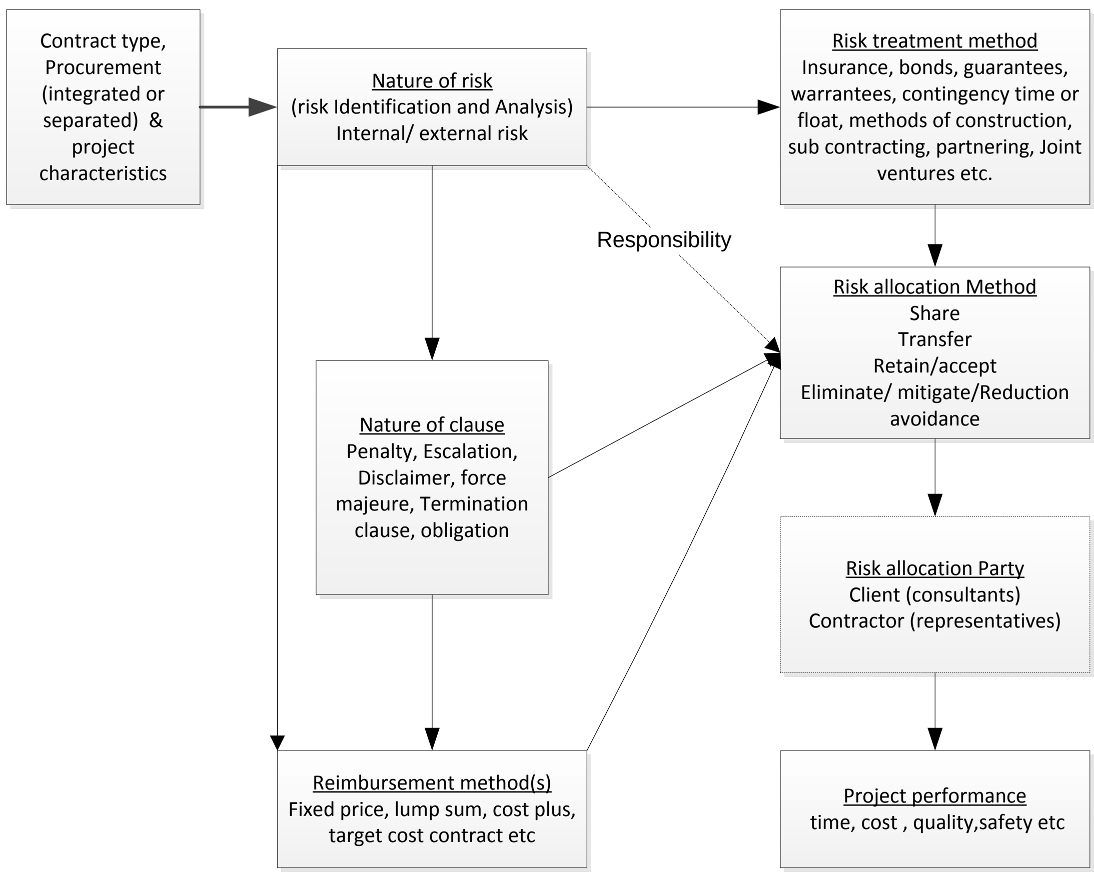


Figure 5.1 Conceptual model for risk allocation

The directions on a model can be interpreted as *causes, requires or contributes to* as explained by Novak and Canas (2006). In this model arrows can be interpreted as *contributes to* except for arrows directly leading to risk allocation method which can be interpreted as *requires*.

The conceptual model is based on threats as only risk allocation methods (share, transfer, accept, eliminate and avoid) used for threats are highlighted. For opportunities allocation methods include exploit, enhance, ignore and share (Hilson, 2001). The conceptualisation from literature data is a true depiction of risk allocation in practice as this model was verified using various risks and contracts (See Tembo-Silungwe and Nthatisi, 2017). The allocation modes may overlap at times and risks, resulting from one party's responsibilities may not always be documented in the contract documents but are implied based on responsibility.

5.2 Theoretical lens for the study

The focus on previous research has fallen mainly on how allocation of risks impacts on the transaction (TCE); how agency problems such as information asymmetry, opportunistic behaviour, and moral hazard considerations influence risk allocation (Agency theory); how available resources influence risk allocation (RBV); and the use of fuzzy logic to cater for subjectivity and uncertainty in risk allocation. Most past studies are also theoretical and conducted in developed context within developed markets and governance structures. The current research problem of why risk misallocation is a recurrent problem impacting on performance is studied using structuration theory (the effect of human agents and social structure {contracts, rules} on risk allocation) and Gilbert's management theory (GMT) (the effect of human performance on risk allocation). The use of the two theories envisions provision of a fresh interpretation in a developing context. Structuration theory enables understanding of how the duality of agency and structure constrain or enable risk allocation, while Gilbert's management theory assists understanding of how personal attributes and environmental characteristics enable or constrain risk allocation. The two theories capture very well the two domains of interest structural (environmental) and agency (personal repository factors) to expand the explanatory power of risk allocation. These are explained in some detail below:

5.2.1Structuration theory

The use of this theory was partly inspired by Floricel et al, (2014) as their aim was to renewing the theoretical bases of project management in order to overcome the problems that stem from the application of methods based on decision-rationality norms. Structuration theory was one of the theories identified and had the two domains of interest in this study: structure and agency. Moreover, risk management is one of the project management areas that heavily depend on decision making.

Giddens (1984) suggests that human agency (individuals or groups) and social structure (rules and resources) are in relationship with each other, and it is the repetition of the acts of individual agents which reproduces the structure. Rules of structure reveal a number of important properties: they are tacitly known, informal, widely sanctioned and frequently invoked and used in conversations, interaction rituals and daily routines (Turner, 1986). Structure involves additionally the use of resources that are the material equipment and organisational capabilities of actors to get work done (Ibid). In this context of human agency are the Client (consultants) and the Contractor. Social actors (client and contractor) are restricted in what they do by the social institutions and social practices that surround them (Ransome, 2010). Under this theory, agents are able to monitor their actions, and so their actions can be evaluated rationally. It is suggested that structures are created and recreated through social action and the agency of individuals; such structure then guides and constrains individual agency (Easterby-Smith, et al., 2015). Further, the agents are critical for both the reproduction and transformation of society.

One of the challenges of using structuration theory is the difficulty of testing it empirically (Phipps, 2001). It can be argued that the theory is constructivist in nature (Easterby-Smith, et al., 2015) and it is also viewed as a critical theory (Hardcstle, et al., 2005; Boland, 1996). Gregson (1989) argued that the theory is abstract and fails to provide empirical utility; nevertheless, it can be applied to a wide range of topics (Layder, 1994). An analysis done by Hond et al. (2012) found interviews to be a dominant method. Other methods employed include documents and cross-sectional surveys or census data (Phipps, 2001). Methodologically, structuration can be applied to a study in two ways: 1. Through the analysis of institutionalised properties of a system in order to identify properties that have been chronically reproduced over the long term; or 2. Through the analysis of the conduct of the actors in order to identify their social practices that regenerate or alter the institutionalised properties of systems for day-to-day life (Phipps, 2001). Only the latter has been applied in this research, in analysing the conduct of the client, consultants and contractors in order to identify social practices (risk practices and contract practices that enable or constrain risk allocation

Structuration theory was thus used as a lens for investigating how contract types are selected and how this impacts risk allocation; also for determining how pertinent risks in the contract types used in the construction industry are allocated; and finally to discover risk allocation tools and process used by contracting parties. The use of structuration was preferred in seeking to understand the role of agency in risk allocation and how constraining and enabling rules and resources influence the agent's ability to allocate risk. Additionally, it has the dimension of structure which helps in giving the risk allocation study an appropriate and powerful explanation. This further helps to contribute to knowledge as the lens gives a fresh interpretation to the existing problem of risk allocation. The strength of the theory is that it has wide application (Phipps, 2001); and it gives a different and insightful understanding of risk allocation in the organisational context (Kort & Ghabi, 2013). In addition, this theory helps us to understand the characteristics of agency that aid or constrain action (Ibid.) and recognizes that environmental forces may impinge on agency processes. Giddens asserts that it is a knowledgeable agent who can influence the change of structure (1984). Floricel (2014:1102) outlines areas where structuration theory can be applied in the project environment as work and effort; materiality, agency and creativity; interest and power; and knowledge.

a) *Work and effort*: While the nature and magnitude of construction projects vary, similar tasks are reproduced and different actions taken as responses to unexpected events. Consequently, reproduction of action patterns can account for the long and complex emergence of project organizations, and for their inertial and unusual response to unexpected events (Floricel, et al., 2014). Different project organization results in different risk allocation therefore different work and efforts made should enable the industry to better understand risk allocation over time, and thus ensure that pitfalls encountered in past project organization are avoided or thoughtfully planned for in terms of risk allocation.

b) *Materiality:* The concept of risk is heavily dependent on perception (Lehtiranta, 2014). Materiality is, basically, the measure of the estimated effect that the presence or absence of an item of information may have on the accuracy or validity of a statement or occurrence (Business Dictionary, 2015). When it comes to risk allocation, what is perceived to occur influences what is allocated. Consequently, imperfect perceptions may account for project variation in similar conditions and for the surprising onslaught of problems resulting from risk allocation (Floricel, et al., 2014).

c) *Agency and creativity:* The theory of structuration positions the role of agency as a cornerstone for practice. As previously mentioned, agency is responsible for the transformation and reproduction of structure (Giddens, 1984).The theory assumes that actors skilfully interpret, select and use past practices, as well as imagining new ones, and thus redefines planning as a social structuring process and the evolution of project organization as a creative network transformation process (Floricel, et al., 2014). This basically implies that based on past risks encountered, agents should be able to apply the skills and understanding thereby gained to future work tasks; that is, they should be able to anticipate risks based on the nature of the project and thereby allocate them appropriately.

d) *Interest and power:* Interest is understood as the feeling or emotion of wanting to give ones attention or wanting to be involved with or discover something while power is the ability to control people or events (Cambirdge, 2016). Project organizations consist of various professionals with diverse interests (Lehtiranta, 2014). Structuration theory places an emphasis on learning that is largely tacit and entrenched in real situations which can explain why practices persist and are so problematic when transferred to new contexts, and why abstract models for action are so hard to implement (Floricel, et al., 2014). Risk allocation is dependent on power structures which depend on contractual arrangements. Turner (1986) argues that those who have resources can mobilize power, although power itself is not a resource but rather a product of the possession of material and organisational facilities. Integrated arrangements promote joint risk sharing while separated arrangements promote risk transfer as a mode of risk allocation. The rules instituted with the aforementioned systems can be constrained or enabled by the situations of interaction, by specifying rights and obligation within a procurement route.

d) *Knowledge:* Serpella, et al. (2014) stresses the role of knowledge in risk management and by implication, in risk allocation. Knowledge to some extent informs the tools and practices for successful risk allocation. It is very important as it is needed to carryout activities such as risk identification, analysis and response (Serpell, Ferrada & Howard, 2015b). In the simplest sense, knowledge is the sum of what is known (Chicken & Posner, 1998). Knowledgeable agents will endeavour to allocate risks appropriately to avoid the shortcomings of inappropriate allocation. For this to be successfully achieved, agents must have access to resources needed for risk allocation. Persisting patterns of differential access to resources and dependence between actors can explain the strategic behaviour in subordinate and contractual relations and the constantly evolving relations with stakeholders (Floricel, et al., 2014). Structuration can help us to understand how consultants use (or should use) risk management to document contracts, allocate risk in contracts and manage risk based on the contracts in relation to the nature of work, tools used, skills and past experience, knowledge, and interest and power. Therefore, the knowledge held by those involved in project organisations influences how risk allocation is executed.

5.2.2Application of Structuration Theory in the study

Structuration theory in the study has been applied as follows on the formulated research objectives:

1.Investigating how contract types are selected, how this impacts risk allocation; and how perceived pertinent risks in the contract types used in the construction industry are allocated: According to Giddens, human agency is responsible for transforming the tools/rules to achieve desired performance. Structuration theory stresses the role of human cognition in generating and reproducing social relations (Floricel, et al., 2014). The performance of the ZCI has been poor for some time (Auditor General's Office, 2009; Auditor Generals' Office, 2013) and projects are characterised by quality shortfalls, cost and time overruns and abandonment. According to structuration theory, it would be beneficial to explore what hinders agency in transforming the situation and what should be considered in selection of contracts in view of pertinent risks, so as to promote appropriate risk allocation and yield the desired results. This will also help us understand why current risk allocation is the way it is; why practices persist and are so difficult to change (Floricel, et al., 2014).

2.Risk allocation practices used by contracting parties: Structuration theory was used to understand tools and process/practices used for risk allocation based on the nature of work, resources used, skills and past experience, knowledge, interest and power, as agents work on different types of building projects (Floricel, et al., 2014). This theoretical lens will be applied both from the client's (consultant's) perspective and also to understand how contractors respond to the allocation, based on the nature of the work measures put in place to mitigate risk, the tools used, skills and past experience, knowledge, interest and power, risk is perceived (its influence in practice). In addition, the theory helped clarify the role of knowledge in risk allocation and the extent to which creativity can be practiced to alleviate risk.

In summary, the five dimensions discussed under structuration could aid appropriate risk allocation; however, certain conflicts could accompany the use of this theory. For instance, agents are only able to reproduce or transform allocation as far as power structures (contracts) allow it. In addition, risk allocation could be limited by lack of materiality (perception) and knowledge; hence agency may not be able to reproduce, anticipate risks or transform risk situations, resulting in ineffective work and effort.

5.3. Management theory of Thomas Gilbert

The management theory of Thomas Gilbert was debuted in 1978. He is known as the father of performance improvement and pioneer of Human Performance Technology (HPT). Gilbert clearly differentiated between behaviour and an accomplishment that is an outcome of the behaviour. He explained that accomplishment and behaviour are two aspects of human performance, that is, “in performance, behaviour is a means; it is a consequence to the end” (Gilbert, 1988, p. 49 cited in Chyund, 2005). Gilbert’s business management ideas concern changing the behaviour of organizations and/or employees, which in this case refers to the temporary multi-organization created by the client. The theory is aimed at identifying deficiencies in management within a project organization and identifying areas that need improvement (Gilbert, 1978). In this case, performance gaps related to risk allocation from both the clients’ and contractors’ perspective will be identified from the human perspective and the contract perspective. This lens is used given the context that most of the projects in the ZCI are under performing due to risks and risk misallocation (Auditor Generals' Office, 2006-2015; Kaliba, et al., 2013). Given that when tender documents are prepared the contractor has the opportunity to renegotiate or qualify certain issues in the contract (Laryea & Hughes, 2009), their abilities in risk allocation and management are equally important. This study provided a holistic approach to ensure that the framework to be formulated is robust in terms of risk allocation. Gilbert’s model (management theorem) was adapted to fit the risk allocation.

Gilbert listed six areas (see Table 5.1) where causes of the performance deficiencies might be found: data, instruments, incentives, knowledge, capacity, and motives (Chyund, 2005). The first three categories are environmental supports, and the last three categories are the performer’s personal factors. The theory expresses the following principles.

1.The workers/organization need to have the right information (data, information, and feedback), the right resources (environment support, resources, and tools) and the right motivation (consequences, incentives, and rewards).
2. It is important that incentives don't reward bad behaviour (as an example, an incentive that makes a contractor take short cuts on the task).
3. If all the conditions are in place for the organization to perform well and it doesn't do so, it becomes a matter of considering the client's (consultant's) or contractors' motivation. By observing the organization's behaviour, new conditions can be put in place to get the organization to perform well.

Table 5.1 Gilbert's Management Theorems

	Information	**Instrumentation**	**Motivation**
Environmental Support	Data Information Feedback	Work Environment Support Resources Tools	Consequences Incentives Rewards
Person's Repertory of Behaviours	Skills Knowledge	Individual Capacity	Motivation Expectations

Source: Tiem, Mosley and Dessinger, (2012)

5.3.1. Environmental support

The environmental supports_are important in improving human performance. Risk allocation and the success of risk management need the necessary data, information and feedback to be provided. Information includes communicating clear expectations, providing the necessary guides to do work, and providing timely, behaviourally specific feedback (Chevalier, 2003) in order to make decisions about risk. In a project environment, the nature of the project, the site data and information are important, as are the type of client, the preferred procurement route, etc. Various members of the project team such as the quantity surveyor, architects, project managers, contractors and engineers need timely information to carry out their work. When it comes to risk allocation, internal and external risks should be understood so that relevant decisions are made. Feedback is also needed, as it leads to improved performance (Stolovitch, 2000)**.** In a project environment, then, timely information and feedback are important. It could however be acknowledged that this view is not universal: Stolovitch (2000) argues that immediate feedback is more beneficial for simple tasks while complex tasks require delayed feedback. In addition, having the relevant data, information and feedback is not enough; project team members have to have the relevant skills and knowledge to act on the aforementioned. Once the required data, information and feedback are in place, the project organization needs the relevant resources, tools, supports and work environment to foster risk management.

Instrumentation (or resources) refers to the right tools, time, materials and processes (Chevalier, 2003) that should be available to the project organisation to enable them to do their work. Various tools and resources have been identified for use in carrying out risk allocation. Risk identification determines which risks might affect the project and documents their characteristics, as an iterative process because new risks may become known as the project progresses (Bakr, et al., 2012). Methods for risk identification include checklists, brainstorming, the Delphi technique, interview/expert judgment, influence diagrams, flowcharts, and cause-and-effect diagrams. Of these the most common are checklists, interviews and brainstorming (Bajaj et al., 2010; Ebrahimnejad et al., 2010; Kansal & Sharma, 2012; Osipova & Eriksson, 2011). These techniques could be considered subjective, as they are dependent on the experience of the participants.

Risk analysis is the second stage needed to allocate. Risks analysis is a process that examines each identified risk, refines the risk and assesses the associated impact qualitatively or quantitatively. Risk analysis techniques have been mainly developed to address the project deliverables of schedule (time), budget (cost) and quality (Imbeah & Guikema, 2009) as shown in section 3.4.2.

Risk response, in which risk allocation is implemented, is a process that allows for developing options and determining actions to be taken to enhance opportunities and reduce threats to the project objectives (Hilson, 2002). It involves choosing alternative response strategies; implementing a contingency plan, taking corrective actions and re-planning the project (Bakr, et al., 2012). Response measures could be an alternative procurement method, construction method/material, the use of insurance or bonds, contingency (time or money), sub-contracting or even collaboration (See Bakr et al., 2012; Kardes et al., 2013; Loosemore & McCarthy, 2008; Odeyinka, 2000; Serpella et al, 2014; Uff, 2010; Uher 1991). While the identified tools and resources can be used to equip organisations, it is of paramount importance that these are updated to suit the current environment, in order to ensure that performance is improved. The work environment needs to be enabling in terms of use of the resources and also the exchange of data and information to enhance performance. Once all these are in place, incentives need to be in place.

For risk allocation, it is fundamental that there has to be an incentive to carrying a risk in a project organization (Hackett, et al., 2007). Incentives ensure that the appropriate financial and non-financial incentives are present to encourage performance (Tiem, et al., 2012). Methods used for allocation include transfer, share, retain or eliminate (Smith, et al., 2014). This motivates the project organisation to perform. The motivation could be consequences, rewards or incentives in monetary or non-monetary terms (Gilbert, 1978). Consequences could be in the form of lost revenue e.g. liquidated or ascertained damages. Rewards in the construction industry mainly depend on the type of contract used and the efficiency in the implementation phase. The contract could also be considered as an environmental factor where consequences, rewards and incentives are stipulated. For instance, in guaranteed maximum price contract there is an incentive for completing a task below the agreed maximum price; while in a fixed price contract, savings made by being more efficient (obviously without comprising the expected quality) could be viewed as a reward. Motivation and expectations normally go hand in hand or are dependent on each other.

5.3.2. Individual factors

Individual factors that affect performance include knowledge, capacity, skill and motives. Individual motives should be aligned with the work environment so that employees or an organisation can desire to work and excel. Capacity refers to whether the worker is able to learn and do what is necessary to be successful on the job, while knowledge and skill are needed to carry out a specific project or goal (Chevalier, 2003). Risk allocation process begins with the identification of risks. Knowledge is vital in risk identification, analysis, response and allocation. If one is not knowledgeable about a risk, it may be difficult to identify it or allocate it appropriately. Once the knowledge of the risk is present, capacity is also important as it enables one to foresee future risks and gain capacity on more methods of risk identification, analysis and allocation.

The most common mode of fixing knowledge, motives and capacity shortfalls is training; while fostering the right motives could be achieved by understanding the values and needs of individuals/organisations and providing for them (Boulay, n.d.). The role of knowledge cannot be undermined even in using environmental factors such as information, data and feedback. A knowledge based approach has been advocated by Serpella et al. (2014) and Hosseini et al. (2016) in improving risk management. Boulay, (n.d.) makes an analogy that given the various categories of novice, specialist, expert specialist and experts, there is a tendency for performance to begin to decline at the post expert specialist stage, owing to the discovery that over-analysis and complex fixes are prevalent even for simple problems that need simple solutions. The right knowledge base needs to be present for information to be appreciated (Gilbert, 1978). If information pertaining to risks is given and knowledge is lacking, the information may not be acted upon.

When it comes to capacity, relevant skills are needed by people in the construction industry to be able to make instruments relevant. This also makes the use of tools and technology meaningful. These are processes that make work easier and heighten potential. It is also important that new skills can be acquired. For instance a contractor needs to be able to use new technology or be able to understand risks in unfamiliar contracts; and consultants need to be able to foresee risks that have never been encountered on past projects or prepare to handle pertinent issues in unfamiliar contracts.

The way the work is rewarded is an important aspect in terms of the values and needs of the person engaged in the work, whether employer and employee. Their values and needs should be satisfied as a way of ensuring motivation. The reward should be fashioned in a way that is desirable; for example, financial reward or competition could be desirable for the contractor, while quality, functional utility and cost effectiveness could be desirable for the client. The reward system will not provide the performance required if there is a mismatch between what is asked for and what is rewarded. For example if there is an incentive for early completion a contractor will not ask for this when completion is delayed.

5.3.3 Adaptation of GMT to the study at hand

To adapt the model, the mode of inquiry shown in Appendix 4A/B was used to identify various deficiencies in the contractor's and clients (consultants) performance abilities regarding risk allocation. The focus areas are expressed in the following research questions:

1. What factors influence the choices of contract forms on building projects to impact risk allocation?
2. What are the risk allocation practices used by contracting parties in the ZCI?
3. How are risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?

Some of the data collection methods used to identify a performance gap includes interviews, questionnaire surveys, observations, focus groups, root cause analysis, cause and effect diagram etc. (Tiem, et al., 2012). For this study, a questionnaire survey and interviews were utilised.

5.4 Chapter summary

The chapter has outlined the conceptual framework and unpacked the theoretical foundations for the study. The conceptual model shows what is happening in risk allocation. It deals with the various considerations for risk allocation namely contract selection, the nature of risks, clauses used to allocate risk, the nature of reimbursement, risks response criteria and various risk allocation paths that can be taken for risk allocation between the client and the contract which eventually influence the performance of a project. The chosen theories (Structuration theory and Gilbert's management theory) provide various facets for viewing risk allocation in the construction industry. The next chapter discusses the methodology for the study in detail.

CHAPTER 6 - METHODOLOGY

6. Introduction

This chapter discusses the methodology used in the research to answer why risk misallocation is recurrently contributing to project failure in the Zambian construction industry and it documents the process used to develop a mechanism for improvement. The existing literature demonstrates that projects in the Zambian construction industry are characterised by unacceptably high number of claims (Sibanyama, et al., 2012), high incidences of quality shortfalls, cost and time overruns (Auditor General's office, 2006-2015; Kaliba, et al., 2013). There is also evidence of risk misallocation; poor risk sharing (Sibanyama, et al., 2012); incomprehensive contracts (Kaliba et al, 2009; Sibanyama, et al., 2012) and lop-sided contracts in risk sharing (Mukumbwa & Muya, 2013). It is also evident that the industry has no successful mechanisms for mitigating the aforementioned hence the need for one. To recapitulate, the following are the research aim, objectives and research questions of the study:

Aim

The aim of the research was to investigate why risk misallocation is recurrent in the ZCI with a goal of developing a mechanism for aiding risk allocation in the building sector.

Research Objectives

1. To investigate how the selection of contract types used in the ZCI influences risk allocation
2. To assess the risk allocation practices used by contracting parties in the ZCI
3. To establish how perceived pertinent risks are allocated by contracting parties in the contract forms used in the ZCI
4. To devise and validate a mechanism for aiding risk allocation in the ZCI

Research Questions

Why is risk misallocation recurrently contributing to project failure in the Zambian construction industry and how can risk allocation be improved?

Sub-questions

1. What factors influence the choices of contract forms on building projects to influence risk allocation?
2. What are the risk allocation practices used by contracting parties in the ZCI?
3. How are the risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?
4. What mechanism can be devised and validated to aid risk allocation in the ZCI?

The methodology is discussed under the following sections research approach, research method and research strategies. Further to these, issues of validity, ethics and reliability are addressed.

6.1 The Approach

An approach is a line of action. The areas to be covered under this line of action include the ontological basis for the research; it is epistemology, the strategies available and methods used. All these are embedded within the philosophical choice made. The chosen philosophy was used to research the research questions cited above. Research is defined as a systematic process of collecting, analysing, and interpreting information (data) to increase our understanding of a phenomenon about which we are interested or concerned (Leedy & Ormrod, 2010). Creswell (2009) defined research as the process of making claims and then refining or abandoning some of them for other claims more strongly supported. It is notable that both definitions stress the need for information to understand a phenomenon or to make a claim. The research cycle is illustrated in Figure 6.1.

6.1.1 A General View of Research Philosophy

Research is normally guided by research philosophies or paradigms. Research philosophy is basically the world view a researcher adopts for their study (Greener, 2008). The philosophy could also be understood as the summary of a researcher's belief about efforts to create knowledge (Steenhuis & Bruijin, 2003). Understood in another way, it is an all-encompassing way of experiencing and thinking about the world including beliefs about morals, value and aesthetics (Morgan, 2007). Guba and Lincoln (1994) view a paradigm as a basic set of beliefs that deal with ultimates or first principles. They further describe it as a worldview that defines, for the holder, the nature of the world, the individual's place in it and the range of possible relationships to the world or parts. According to Saunders et al., (2009) it is important to have a philosophy as it helps in making an informed decision about a research design; secondly, it helps to think about and decide on research

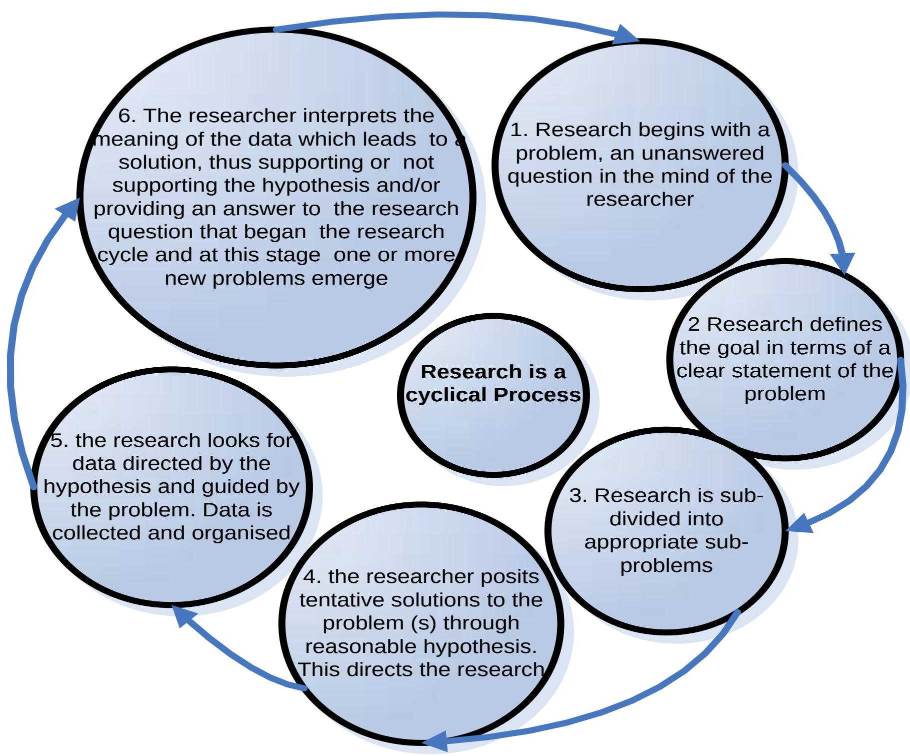


Figure 6.1 Research Cycle Source: (Leedy and Ormrod, 2010)

strategies and choices that will work with a particular strategy and those that will not. Lastly, the research paradigm helps to adapt the research design to cater for constraints. In addition to philosophy, the assumptions one makes about the way the world works in other words the nature of reality or ontology, is important (Saunders et al., 2009). Bhattacherjee (2012) amplified that **ontology** is the philosophical study of the nature of being, becoming, existence, or reality, as well as the basic categories of being and their relations. Risk conveys ontology independent of knowledge and perceptions (Aven & Renn, 2009). Another relevant concept is epistemology, which deals with how we know what we know (Scholten, 2014). According to Stanford encyclopaedia of philosophy, (2005) epistemology is about issues having to do with the creation and dissemination of knowledge, in particular areas of inquiry.

Some authorities consider that there are two main philosophical standpoints; positivism and interpretivist/ social constructionism (Creswell, 2007; Greener, 2008; Leedy & Ormrod, 2010; Easterby–Smith et al., 2010). However, other standpoints include realism and pragmatism (Gray, 2009; Greener, 2008 and Creswell, 2007; Saunders et al., 2009). The diagram below shows the various methodological choices available in research. Notwithstanding this classification, Nirod (2014) gives guidance on the way to choose a philosophy by asking questions that when answered act as a guide. The questions include 1. What is the nature or essence of the social phenomena being investigated? *(Objective or Subjective or both)* 2. Are social phenomena objective in nature or created by the human mind? *(Ontology)* 3. What are the bases of knowledge corresponding to the social reality, and how can knowledge be acquired and disseminated? (*Epistemology*) and 4. What is the relationship of an individual with their environment (conditioned by the environment or environment conditioned by them)? (A*xiology*). The philosophies are discussed below:

6.1.2Positivism

The philosophy begins with a theory, produces a hypothesis from the theory, which relates to the focus and proceeds to test the theory (Saunders et al., 2009). Greener, (2008) described a positivist research as one that uses a quantitative approach; it is objectivist and uses a scientific approach. Easterby-Smith et al., (2015) posited that the key idea in positivism is that the social world exists externally and that the properties should be measured through objective methods rather than being inferred subjectively through sensation, reflection or intuition. Steenhuis and Bruijin, (2003) viewed the ontological viewpoint for positivists and post-positivists as an apprehendable existing reality that is driven by unchangeable natural laws and mechanisms. The ontological assumption in positivism is that reality is external and objective while the epistemological view is that knowledge is only significant if it is based on observations of the external reality (Easterby-Smith et al, 2010). Table 6.1 summarises the characteristics of positivism research philosophy.

Table 6.1 Summary of Positivism:

Query	Resolution
Purpose of the research	Explain and predict, confirm and validate, test theory
Nature of the research process	Focussed, known variables, established guidelines, predetermined methods, independent of the observer
Methods of data collection	Surveys, experiments
Time horizon	Cross-sectional
Research progresses through	Hypothesis and deduction
Nature of the data collected	Numeric data, representative large sample, standardised instruments
Sample requirements	Large numbers selected randomly
Analysis of data	Statistical analysis, stress on objectivity, deductive reasoning
Unit of analysis	Should be reduced to simplest terms
Communication of findings	Numbers, statistics, aggregated data formal voice and scientific style
Effect on population of interest	Results are usually generalised

Adapted from Leedy and Ormrod (2010)

In positivism the research is independent from the researcher as social entities are seen to exist in reality to be independent from social actors concerned with their existence (Greener, 2008; Wright & Losekoot, 2010). It is also objective in the sense that it relies on statistics for the deduction of conclusion (Leedy & Ormrod, 2010). Positivist philosophy works with observable social reality, facts rather than impressions, external to research (Saunders, et al., 2009). The positivist paradigm uses a scientific approach.

A scientific approach is used to explain how the world works. The attitude it takes is scientific, open and transparent (Scholten, 2014). The scientific approach takes a cyclical systematic approach (Steenhuis & Bruijin, 2003). The first stage is an observation which leads to formulation of possible explanation –induction, next stage is identification of the exact explanation-deduction, testing of the exact explanation and making an evaluation (Ibid). This empirical or testing phase should be designed such that it is empirically testable, is replicable, objective, transparent, and falsifiable and consists of logic (Scholten, 2014). This is desired as the goal in positivism is objectivity and generalisation (Steenhuis & Bruijin, 2003). This is made possible by the objectivity of the research instrument. In addition, an appropriate selection (sampling) of respondents and the correct application of statistical methods to determine significance of the findings (Ibid) is required to maintain objectivity. The criteria for objectivity of the research instrument are referred to as validity and reliability (this will be discussed later).

The merits of positivism include it having the ability to cover widely, is potentially fast, economical, and easier to justify for policy formulation (Easterby-Smith et al, 2015). However, it is inflexible and artificial, not good for establishing a process, meaning or theory generation and at times implications for action may not be obvious (Scholten, 2014). The philosophy closest to positivism is realism.

6.1.3Realism

In realism the main question asked is whether objects exist independent of our knowledge of their existence (Saunders, et al., 2009). Two variants of realism are noted. Firstly, direct realism which asks whether what is seen is what is obtainable. Secondly, critical realism asks whether what we experience are sensations, images of things in the real world, not the things directly. Direct realism supposes that the world is unchanging while critical realism supposes the world is constantly changing hence the interpretation is through social conditioning (Ibid). The extreme end of the research continuum is interpretivist or social constructionism.

6.1.4Interpretivist or social constructionism

Greener (2008) described an interpretivist research as one that uses a qualitative approach, is subjective and uses humanistic or interpretative analysis. The approach has heritage from phenomenology which is the descriptive study of how individuals experience a phenomenon (Patton, 2002). Phenomenological researchers generally agree that the central concern is to return to embodied, experimental meanings aiming for a fresh, complex, rich description of a phenomenon as it is concretely lived (Finlay, 2009). This approach refers to how humans make sense of the world around them (Saunders et al., 2009; Barry, 2011) by having direct interaction with phenomena. It is a qualitative approach which mainly utilises in-depth interviews as a means of data collection, after which a rich description of the essential or invariant structures of the experience are given (Patton, 2002). During the interaction with phenomena, human beings interpret them and attach meaning to different actions or ideas and thereby construct new experiences (Finlay, 2009). Phenomenological researchers often search for commonalities rather than only focus on what is unique (Patton, 2002). In summary, a research could be said to be phenomenological if it is rigorously descriptive, uses phenomenological reduction, and explores the intentional relations between persons and experiences through the use of imaginative variation (Finlay, 2009). Reality in interpretivist research is determined by people rather than objects and external factors (Easterby-Smith et al., 2010). The ontological assumption in intepretivism is that reality is internal and analysis is subjective (Leedy & Ormrod, 2014). While the epistemological view is that knowledge is only significant if it is based on interpretation of the internal reality (Easterby-Smith, et al., 2010). The focal theorem of the epistemological view is that individuals develop subjective meanings of their experiences (Ibid). Meanings are constructed by human beings as they engage with the world they are interpreting (Creswell, 2009). Table 6.2 summarises the characteristics of intepretivist research.

The intepretivism philosophy is underpinned by having to understand the area being researched from the viewpoint of research subjects specifically under their worldview and from their point of view (Saunders, et al., 2009). Steenhuis and Bruijin (2003) describe intepretivism as idiographic research. In their elaboration, idiographic research concerns are understood by in-depth research on a few cases.

Hence, the focus is on telling a story with the goal of providing rich information. Therefore, discovery in the context of this paradigm is more important than justifying. Validity and reliability are not a main characteristic of interpretivism rather the level of confidence in the findings (Ibid). The goal is the correct interpretation (Easterby-Smith et al, 2010).

Triangulation is usually used to increase confidence in the findings. This is done by applying various methods. Janesick (1994) cited in Steenhuis and Bruijin (2003) highlighted data triangulation (use of a variety of sources), investigator triangulation (use of different researchers), theory triangulation (use of multiple perspectives to study a single set of data), methodological triangulation (use of multiple methods to study a single problem) and interdisciplinary triangulation (use of different disciplines). Triangulation is important as it fosters trustworthiness, authenticity and credibility of the interpretation made.

Table 6.2 Summary of interpretivism

Query	Resolution
Purpose of the research	Describe and explain, explore and interpret, to build theory
Nature of the research process	Holistic, unknown variables, flexible guidelines, emergent methods, context bound, personal view
Methods of data collection	Case studies, action research, ethnography, participative enquiry, grounded theory
Research progresses through	Gathering rich data from which ideas are induced
Time horizon	Cross-sectional/longitudinal
Nature of the data collected	Textual and/or image-based data, informative-small sample, loosely structured or non-standardized observations and interviews
Sample requirements	Small numbers of cases chosen for specific reasons
Analysis of data	Search for themes and categories, acknowledging that analysis is subjective and potentially biased, inductive reasoning
Unit of analysis	may include the complexity of whole situations
Communication of findings	Words, narratives, individual quotes, personal voice, literary style

Adapted from Leedy and Ormrod (2010)

The interpretivist approach is good for establishing meaning, and processes (Leedy & Ormrod, 2010). It is most useful when flexibility is required and is good for theory generation (Steenhuis & Bruijin, 2003). Consequently, the paradigm enables the collection of less artificial data (Easterby-Smith et al., 2015). However, the philosophy can be time consuming, and analysis and interpretations are often difficult (Creswell, 2009) and may not have credibility with policy makers. Finlay (2009) added that phenomenologists are challenged to recognise that any knowledge produced is contingent, proportional, emergent and subject to alternative interpretation (Creswell & Clark, 2012). Wright and Losekoot (2010) argued that this paradigm is not objective and is biased adding that the researcher is not independent therefore the results are not accurate or reliable. These however, are not the aims of an intepretivist; the goal is rather to provide credible in-depth interpretation (Saunders et al., 2009; Greener, 2008; Easterby-Smith et al., 2010). In the middle of the continuum is the pragmatic view (Saunders et al, 2009, Greener, 2008). The approach is best suited for exploration, description, interpretation, verification and evaluation research (Leedy & Ormrod, 2010; Creswell & Clark, 2011).

6.1.5 Pragmatism

In this philosophy, researchers use all approaches available to understand the problem (Creswell, 2009; Creswell & Clark, 2011). Easterby-Smith et al., (2010) postulated that the central theme of pragmatism is that in the social world there are no pre-determined theories or frameworks that shape knowledge and understanding. Pragmatism uses both qualitative and quantitative methods of data collection (Saunders, et al., 2009). This philosophy therefore allows researcher's freedom of choice of methods, thereby implying that the truth is what works at the time. Pragmatists believe in an external world independent of the mind as well as that lodged in the mind (Creswell, 2009). It could be said that the paradigm uses a mixed-method approach thus utilising both qualitative and quantitative approaches. Wright and Losekoot (2010) argued that the mixed-method approach can lead to less waste of potentially useful information. Hence, the qualitative and quantitative approaches are viewed as complementary to each other (Creswell, 2009). Creswell and Clark (2011) clarified that as a methodology, mixed method involves philosophical assumptions that guide the direction of the collection and analysis and mix qualitative and quantitative approaches in many phases of the research process. By definition mixed method research is research in which the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches and methods in a single study or program of inquiry (Tashakkor & Creswell, 2007). The approach could be applied sequentially (explanatory and exploratory design), concurrently (convergent parallel design) or transformative, multi-phase design and embedded design (Creswell & Clark, 2011).

6.1.6Research Approach for the study

The approach adopted for this study was the pragmatist approach as the envisioned contribution was to the world of practice. Pragmatism is best for establishing meanings and processes and finding how widespread practices are (Gray, 2009; Saunders, Lewis, & Thornhill, 2012). That is what this research aimed at achieving therefore pragmatism was the best suited approach. In addition, an in-depth understanding of the phenomenon of risk and construction contracts as a whole needs to be deeply understood from the perspective of the actors in the real world to determine how best risk allocation can be performed. This cannot be achieved adequately using one pure philosophy but acknowledging that an account of truth is any solution or multiple solutions that satisfy the human need and does not seek validation outside itself (Easterby-Smith et al, 2015). This implies that multiple socially constructed truths can exist simultaneously. In view of this the ontological stance could be viewed as a combination of objectivity and subjectivity more specifically between relativism and determinism.

Determinism is the view that all social events or phenomena are somehow determined by some underlying, intrinsic or even supernatural factor (Gray, 2009); relativism, roughly put, is the view that truth and falsity, right and wrong, standards of reasoning, and procedures of justification are products of differing conventions and frameworks of assessment and that their authority is confined to the context giving rise to them (Baghramian & Carter, 2016). This approach was utilised in finding out how contracts are selected, how documents are prepared with a special emphasis on contract types used, risk allocation practices (methods, techniques, processes, procedure, rules), risk management tools used and how risks are managed once they have occurred. Subjectivism was used to determine the adequacy of contracts used through carrying-out document analysis. However, there was an aspect of objectivism in the use of a questionnaire survey to deduce the pertinent risk factors impacting on the Zambian building sector and assessment of current approaches and tools used to conduct risk management. Therefore, the research was a mixed method to an extent but leant more toward the use of subjective epistemology.

The approach followed is referred to as qualitative mixed method, which is qualitative dominant and is symbolised as QUAL ► Quant ►Qual (Johnson et al., 2007; Creswell, 2012). This is essentially because methods used were dominated by a qualitative approach such as open-ended questions, questions with nominal responses (interview and Questionnaire -for data collection and model validation). Nominal data was collected in the document analysis because the documents were mostly made up of words (Leedy & Ormrod, 2010). Qualitative dominant mixed methods research is the type of mixed research in which one relies on a qualitative, constructivist-post-structuralist-critical view of the research process, while concurrently recognizing that the addition of quantitative data and approaches are likely to benefit most research projects (Johnson, et al., 2007). The implication is that that some analytic decisions are made initially (literature), whereas the remaining analytic decisions are emergent (from the field) (Tashakkoni & Eddie, 2010).

Some of the corner stones of research are assumptions one makes about the way the world works in other words the nature of reality, in an academic sense ontology. As earlier indicated the nature of the study used both subjectivism and objectivism. The research question which addresses the risk factors and risk management practices of contracting parties was approached in an objective manner while the one concerned with contract selection criteria, allocation of pertinent risks, risk management application on risk allocation and contract document was dealt with using both a subjective approach and objective approach. This was done to gain an in-depth understanding from the perspective of the human actors involved and to have an appreciation of how widespread the considerations are.

The second important issue in research epistemology is simply the acceptable knowledge in a particular field of study (Robson, 2011; Saunders, et al., 2009). It is concerned with the nature, sources and limits of knowledge (Klein, 2005). It also deals with how we know what we know (Scholten, 2014). Greener (2008) explains by stating that we know by using a positivist paradigm (objectivism and external) or an interpretivist paradigm (subjectivism and internal). Saunders, et al, (2009) stated that the two main variants of knowledge viewed from the two main philosophies are statistics for positivism and narration of some sort for interpretivism. Statistics were used to understand risk factors and risk management practices affecting the performance of construction acceptable knowledge and for identifying the main risk factors and the risk management practices utilised. This was done using an objective approach while a subjective narration was presented of how various contracts are selected over others, certain contract clauses are used, and how contract documents in relation to risks are documented to ensure the successful performance of a project.

6.2 Nature of the research

The research was explanatory in nature. Bryman and Bell (2015) suggest that an explanatory research is also descriptive and exploratory to an extent. Descriptive, in that current practices were described, exploratory in that various avenues of causes and sources of risk misallocation were explored from contractual perspective and human practice (a risk management) perspective and explanatory in that explanations were offered for current practice and project outcomes. The study was both qualitative and quantitative in nature as both methods of inquiry were used. These aspects of research were based on similar research in the area; interviews (see Sigmund & Radjuukwi, 2013; Hanna et al., 2013 and Gosling et al, 2013), a questionnaire survey (used by Hanna et al., 2013; Gosling et al., 2013; Mu et al, 2013 and Zou & Zhang, 2007), document analysis (used by Hanna, et al., 2013) and Delphi expert panel (Alsalman & Sillars, 2013, Yafai et al, 2014).

The research was inductive and deductive to an extent. Inductive in that the theory of how project participants (clients, consultants and contractors) in the ZCI practice risk allocation was generated by moving from a particular to the general (Saunders, et al., 2009) as consultants, project managers and clients gave a clear picture of their user perspectives, while it was deductive in that the main factors in a quantitative measure of factors affecting contract selection, the risks prevalent and tools used for risk management in the Zambian construction industry were identified. Quantitative research moves from the general factors in literature to particular factors identified in the field of research (Greener, 2008). Literature was used to identify various risks, risk management tools and contract selection considerations. The research enabled the identification of pertinent risks, risk management tools/techniques and contract selection considerations and risk allocation mechanisms utilized.

The study adopted a sequential design thereby drawing on prior data except for the framework verification stage which was done concurrently. In summation, the pragmatic approach was adopted because a mixed methods approach was seen as eminent for the following reasons based on Creswell and Clark (2011) recommendations for designing and conducting mixed methods research. This view is supported by that of Tashakkor and Creswell, (2007) for items 1 to 5 below:-

1. Exploration was needed (qualitative research) and so was the need to understand the entire population (quantitative research). Therefore using one set of data could not have been adequate.
2. There was a need to explain questions/objectives by using different types of data sets and sources (words and numbers/ documents, questionnaire/interviews). Thereafter two types on analysis were needed; thematic and statistical.
3. Research objective 3 needed to be answered using both qualitative and quantitative data.
4. The type of sampling used in the study was both random and purposive with a census in a few cases.

5. The research was problem solving in nature which normally requires using diverse methods normally requires the use of both numbers and words.
6. The theoretical perspectives adopted used different approaches empirically Structuration uses constructivism (interviews and documents) (Phipps, 2001) while Giddens management theory is positivist (structured interviews and questionnaire) (Tiem, et al., 2012).
7. The use of mixed methods provided a way of ascertaining results thereby instilling confidence and a basis for triangulating the results (Creswell and Clark, 2011)

6.3 Research methods

Research methods are particular strategies researchers use to collect the evidence necessary for building and testing theories (Punch, 2005). As earlier highlighted some methods are specific to qualitative and others to quantitative research. Methods used in past studies are summarised in the next section.

6.3.1 Research methods in past studies and proposed approach

Various studies have been done on risk and contracts. Peckiene, Komararovska and Ustinovicious (2013) reviewed literature on risk allocation in contracts for 22 years commencing from 1990. The study reviewed that previous research on risk evaluation in the construction industry had mainly been quantitative (Ibid) using questionnaire survey (55%), followed by game theory (18%) and Delphi Survey (9%), Fuzzy AHP (9%) and Fuzzy TopSIS AHP (9%). The study included 77 journal papers specifically on risk allocation in contracts. While a study done by Ramanathan et al (2012) revealed that most studies since 1995 have used a questionnaire as a data collection tool and in the recent past, case studies have been used mostly using a single case. Most papers on risk management in the recent past have used a single case mainly to develop and test a risk assessment model (Irimia-Dieguez, et al, 2014). Research methodology between 2000 to March 2013 included 28 (35%) theoretical and conceptual, 24 (30.77%) models and simulation, 32 (41.03%) case study, 17 (23%) - majority single case, 5(6.41%) survey and 2(2.56%) Field research/field experiments. It would appear that questionnaire survey is a popular data collection tool in risk allocation studies while models and simulation are commonly used in risk assessment studies (Table 6.3).

Apart from studies conducted in the recent past it would seem that most studies done on risk allocation in the construction industry lacked depth, only offered breadth (See Table 6.4). Past research was able to identify consequences of poor risk allocation such as quality shortfall, cost and time overruns, disputes, claim and adversarial relationships. Further risk factors have been quantified in various researches. However, there is very little detail or information about the solutions rooted in the genesis of the findings. This research hoped to fill this gap by understanding the starting point of the risk allocation. Past studies utilised quantitative methods such as modelling and quantification of results which do not have the ability to give depth or in-depth information and seem not to be utilised by most professionals in practice. This research adds depth by using in-depth interviews and document analysis. In addition, breadth as a component was achieved through the use of a questionnaire survey.

Table 6.3 Methods of Data collection in previous studies

Author	Period of study	questionnaire	Document analysis	Interview	Expert group	Data based/ literature	Case study	observations	experiments	Modelling and simulations
Peckience *et al* *(Risk allocation only)*	1990 - 2012	55%	-	-	9%	-	-	-	-	27 %
Irimia-Dieguez *et al* (*Risk management*)	2000 -Mar 2013	6.41 %	-	-	-	30.77	23%	-	2.56 %	41.0 3%
Author (*Risk management*)	2013 - 2015	29.6 %	7%	14.8 %	7%	37.8 %	40.7 %	3.7%	3.7%	44.4 %

Table 6.4 Methods Employed for studies between 2013 and 2015

Focus	Study and method(s) of data collection	
Risk identification	1.Barlish et al-(2013)AJAS- **questionnaire Survey** 2.Gosling, Naim & Towil--(2013) J. constr. Eng. Manage-**case study approach using interviews, site visits and brainstorming sessions** 3.Surabaya(2015) procedia Engineering**- questionnaire**	3.Sigmund and Radujkovic **(2014)** - Procedia social and behavioural science –**Risk breakdown structure using Interviews**
Risk analysis/assessment	1.Mu et al--(2013) IJPM- **Questionnaire survey** **2.**Soepriyono -(2013) J. basic Sci res- **Case study** **3.**Kuo and Lu--(2013) IJPM- **case study** **4.**Li et al--(2013) Can j. civ Eng- **Literature, Fuzzy AHP –case study** **5.**Zeynalian -(2013) J. constr. Eng. Manage-Advanced programmatic Risk analysis and management model –**Literature**, **APRAM and Delphi Technique** **6.**Chileshe and Kikwasi--(2014a) ECAM-**Questionnaire survey** **7.**Yafai et al (2014), jurnal tecknologi **questionnaire, interviews** 8. Swaminathan & Sachithanandam, (2014) I. J. Applied Engi research- **Questionnaire**	1. Ghaffari- **(2014)** Computer and industrial Engineering-**Fuzzy approach** using PMBOK **literature**. 2.Yildiz et al –**(2014)** Procedia social and behavioural sciences- **case study** 3. Wang, Ding and Love-**(2014)** Expert Systems –**behaviour network- literature** **4.** Marco and Thaheem- **(2014)** AJAS- **Radar Diagram- literature** **5.** Shi et al IJPM- **(2014) case study** (**Fuzzy logic and DEA) Literature** 6. Choudhry et al-**(2014)** J. constr. Eng. Manage- **questionnaire, case study using Monte Carlo simulation**
Risk allocation/response	**1.**Hanna -(2013)-J. constr. Eng. Manage- **questionnaire survey, web based survey, interviews (covered RI)**	**2.**Zhang and Fan **(2014)** IJPM- **literature**, **mathematical model** **3.**Mooney-**(2014)** Management and Procurement law- **document analysis** **4.**Nasirzadeh et al. **(2014)** IJPM-**fuzzy logic, literature** **5.**Hanna et al. **(2014)** -J leg. Aff Dispute Resolution Eng Constr- **document analysis and case law**

Risk management	**1.**Jia et al. -(2013)–Automation in construction- **Literature**, **model development and case study** 2.Jiang and Zhang -(2013)- Journal of networks- **modelling and experiment** **3.**Li and Yan-IJPM -(2013)- **questionnaire** 4.Osipova and Eriksson -(2013) IJPM- **case study approach** 5.Goh and Abdul-Rahman--(2013) Journal of Construction in developing countries- q**uestionnaires, interviews** 6.Dawood, (2015) ECAM- interviews and questionnaire 7.Lim, Chang and Rhie (2015) 10 Pan-pacific conference **-interviews**	**8.**Guo *et al* **(2014)** IJPM- **case study** 9.Lehtiranta and Junnonen- **(2014)** Built Environment Project and Mgt**-case study**

In earlier research, various research strategies were used. The Table 5.5 gives an appreciation of the various strategies available and their suitability for this study after which a detailed account is given for specific methods used in this study.

6.4 Research Strategies

The Table 6.5 shows are the various strategies used in research.

Table 6.5. Various strategies used for research

Research Strategy	Epistemology standpoint	Methods of data collection	Suitability for capturing the contract documentation process with emphasis on risk allocation
Experiments	Positivism	Laboratory experiments, field experiments	This strategy is best suited when using a hypothesis and determining a relationship between variables (Bhattacherjee, 2012). Nevertheless, this is not the aim of the research and as such it cannot be utilized because it depicts an artificial situation and no controls can be successfully implemented on human subjects (Scholten, 2014). Furthermore, Perceptions and the culture of humans towards risk heavily influence how risk can be allocated (Lehtiranta, 2014). These aspects of human nature cannot be controlled for nor manipulated successfully in an experiment hence the method is deficient in this aspect

Survey	Objectivism	Structured interviews and questionnaires	Since surveys are cross-sectional, lack depth and are structured (Greener, 2008). They will be used to give an overview of the process and as a guide into what should be emphasized on e.g. pertinent risks, risk identification methods, criteria for contract selection, etc. This strategy will be used to capture aspects of the decision of what type of issues should be considered in the documentation process and techniques or processes guiding such decisions. Surveys alone do not adequately provide the detail needed to understand the processes but give guidance in understanding the whole. This will help to provide a snapshot of what is happening. Surveys mainly rely on the response from the respondents; however, this may lead to bias based on what can be recalled (Leedy & Ormrod, 2010). Nevertheless, it is an acceptable strategy for the study as it will be able to give an overview of current practice on risk allocation and it will aid in the focusing of the problem areas in the risk allocation from the viewpoint of the contracting parties as it sheds light on their opinions, attitudes, and perceptions.
Case study	Realism, intepretivism, positivism	Questionnaires, interviews, observation	This allows for deep exploring (Creswell, 2009; Scholten, 2014) allowing for understanding the documentation process in reality; however the time periods spent preparing the documents is usually long with an average of 6 months from designing to preparation of tender documents of projects and execution. In exceptional situations such as emergencies the duration is reduced however this is not common practice and an opportunity to study such a case may not materialize. In addition for a framework to be robust use of a case study may limit the perception of risk allocation to the case(s) chosen (Hwang et al., 2014).
Action research	Subjectivism	Observation	This strategy is mainly used to validate a theory (Bhattacherjee, 2012). The theory is mainly brought in to solve a practical problem in a setting that cannot be replicated. This strategy cannot be used because the nature of the research is not that of theory validation but framework formulation and theory building

Grounded theory	Pragmatism	Interviews, observations, focus group discussion	This strategy is mainly used to formulate theory in cases where there is insufficient literature (Bhattacherjee, 2012; Leedy & Ormrod, 2010) and it is therefore suitable to some extent because the research aims to build theory though vast amounts of literature on the subject of contracts and risk allocation exist. It could be a useful strategy to capture the risk allocation process as it captures accurately studies that involve human interactions. It is also useful for exploratory studies. Therefore, aspects of this strategy will be used to some extent.
Ethnography	Constructivism Intepretivism Realism objectivist	Interviews, surveys, participant observations, field notes	Strategy uses various methods and is suited for various paradigms, however; it requires 8 months to 2 years for a researcher to be in a single setting (Bhattacherjee, 2012; Ritchie & Lewis, 2003). Further, it is best suited for culture studies. These tend to differ from project to project and may not give an overview of how risk is allocated. In addition, the strategy may not offer an opportunity to study many types of projects resulting in a less robust framework to be formulated.
Archival		Statistical records, survey archives, and written records.	This makes use of already existing records (Saunders et al., 2009). The records are formulated for different purposes. However, for this study contract documents, which are in fact written records, are a good basis to analyse risk allocation in contract documents for contracts done in the past five years in the Zambian building sector.

6.5 Stages of the Research

The study was divided into stages as depicted by Figure 6.2. The first stage was literature review, the second part research tools development, tools implementation and model/framework development and the last stage was the findings, discussion and conclusions stage.

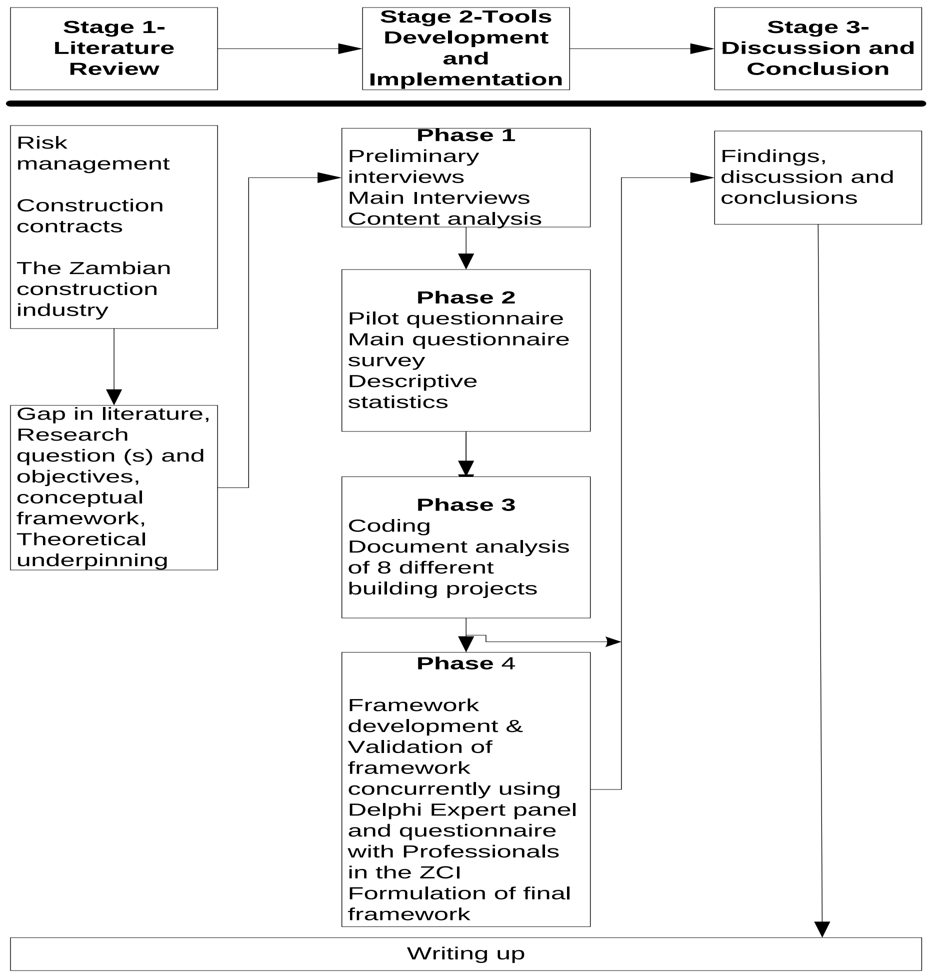


Figure 6.2 Research Flow Chart

6.5.1 Stage 1

During the literature review phase, literature on the Zambian construction industry, contracts types, types of contract clauses and selection process was reviewed. The review included risk management, risk allocation, risk allocation theories and risk factors faced by contracting parties. This was to be done by reviewing relevant literature in secondary literature sources such as unpublished articles, published articles, journals, books, the world- wide-web, reports and construction magazines (Potter, 2006; Easterby-Smith et al., 2015). Some historical data on the development of contracts specifically was done. This gave an understanding on contract development through the ages to present day. The major data bases used included Scopus, Google scholar and Science direct using as key words risk, risk management, risk allocation risk analysis, risk identification, risk assessment, contracts, and types of contracts. Abstracts were then reviewed to assess the relevance of the article to the study.

The literature helped to identify risk variables that are possible risk factors on building projects and those that are considered in contract selection. Thorough identification of variables needs to be done to prevent intrusion of unrecognised variables (Swetnam & Swetnam, 2009). Literature on the relation of current contractual types' relation to risk management was reviewed. This was to broaden the understanding on the two areas to help formulate a research question, research problem and theoretical perspectives used to understand the concepts in the research. Further to this, a conceptual model and theoretical framework for the study was formulated.

6.5.2 Stage 2

Stage two of the research was the development of tools and implementation stage. The research was conducted in a sequential manner starting with interviews as main method of data collection, questionnaire survey and the document analysis (to be used to confirm and explain interview data) leading to framework development and validation/verification. This stage was concluded after the validation of the framework using a Delphi expert panel and professionals in the Zambian construction industry using a questionnaire. The various methods were used to triangulate and validate the study. Triangulation was achieved through various methods of data collection and verification of the same information by using different data sources (Janesick, 1994).

Once the identified tools had been developed; a pilot study for questionnaire and a preliminary interview for interviews were done in readiness for the main data collection In addition, the coding was developed and tested before the content analysis was conducted. The population of interest were consultants, public/private sector clients, project managers and contractors in the construction industry. Consultants because they draft contractual documents, make the selection of contract type and act on behalf of clients (Hackette et al, 2007); and contractors because they are the ones who execute the contract in the construction phase. Clients are also critical as they initiate the projects (Ashworth, 2006) and project managers as they manage the project (Lester, 2006). It was considered that risk management is strongly linked to production phase with contractors being the most active group (Osipova & Apleberger, 2007).

6.5.2.1Methods used

The first step after the literature review was to conduct interviews, then conduct the questionnaire survey. A document analysis was performed once the data from the two methods had been analysed to form a basis for developing the empirical systematic process model which was later validated/verified using an expert panel and professionals in the Zambian building sector (Figure 6.3). Table 6.6 summaries the use of each method against work task and objectives. A summary of each method is given according to guidance given by Creswell (2009).

The rationale of the *interview inquiry* centred on the construction contracts and risk management practices used for building works with the aim of finding out how contracting parties select contracts; processes and techniques used for risk management; and identification of deficiencies in contract practice and risks management from the perspective of the professionals. This was done through gaining an understanding of how professionals apply their risk management knowledge to choose contracts and carry out the documentation of contracts and management of risks during the construction phase. The central phenomenon in the interviews was to find out which considerations and practices were utilised for contract selection, documentation and risk management. The units of observation during interviews were consultants, clients and contractors with the unit of analysis being risk allocation (misallocation and appropriate allocation). Once this exploratory phase was done a questionnaire survey was conducted.

The first purpose in using a *questionnaire survey* was to test the theory of risk allocation to determine the theoretical underpinning most preferred and utilised. In addition, identification of risk factors and risk allocation and management practices prevalent in the industry were identified and evaluated. Further, risk management capabilities of players in the construction industry were established. The risk allocation in the study was considered an independent variable while the risk factors, risk management process and capabilities, risk allocation methods and types of contract clauses were considered dependent variables. The Second purpose of the questionnaire was to find the factors considered in contract selection from the numerous contract types that exist in the construction industry, to gain an understanding of what aspects are considered when selecting a contract type and form for construction projects in the construction industry, their preparation and problem areas and activities leading to agreement. At this stage in the research the selection of various contracts types/forms and risk allocation and management was the sub-central phenomenon being studied through the questionnaire survey. The units of observation in the survey were consultants, clients and contractors with the unit of analysis being risk allocation.

Table 6.6 Methods used in the research

Sub-Questions	**Work tasks**	**Data collection method**
What factors influence the choices of contract forms on building projects to impact risk allocation?	➢What factors are considered in selection? (H_1) ➢Is there a difference in importance rating for the different project Subgroups (H_3,H_5) ➢Is there a relationship within the factors (H_7) ➢What are the natures of building projects? ➢Is the selection criteria appropriate?	Literature, Interview and questionnaire survey
What are the risk allocation practices used by contracting parties in the ZCI?	➢What methods/tools/practices are used to •Identify risk •Assess risk •Respond to risk?	Literature, Interview and questionnaire survey, document analysis
How are the risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?	➢What are the pertinent risks? (H_2) ➢Is there a difference in importance rating for the different project members etc.(H_4,H_6) ➢Is there a relationship within the risk factors (H_8) ➢What are the misallocated risks ➢To who is the risk allocated? ➢What method is used to allocate? ➢What method is used to treat the risk? ➢Which type of clause is used?	Literature, Interviews, questionnaire survey, Content analysis of contract documents and interview
What mechanism can be devised and verified to aid risk allocation in the ZCI?	➢How practical and adequate is the formulated intervention ➢What considerations should be made at each stage	Delphi Expert Panel and Questionnaire with professionals in ZCI

The establishment of how pertinent risks are allocated in the current contracts was done through *documentary analysis* which was both qualitative and quantitative in nature (Robson, 2011). The objective of the documents inquiry centred on the construction contracts used for building works to find out how pertinent risks had been allocated among the various contracting parties in construction contracts. The central phenomenon in the documents inquiry was to find out which risk factors are contractual and which non- contractual; their allocation in the contracts and how allocated. The unit of observation was the contract documents underpinned by various projects with the unit of analysis being risk allocation Analysis of the data from the three methods resulted in the formulation of an empirical model which was validated through Delphi expert panel using professionals in the construction industry in Zambia.

The *Delphi technique* is both qualitative and quantitative in nature (Bourgeois, et al, 2014). It was used to validate the model once developed, with a panel of experts. Additionally, a purposive questionnaire survey was conducted to validate the framework with professionals in the Zambian construction industry. The main aim of carrying out the Delphi expert panel and the questionnaire survey was to evaluate the suitability of the mechanism developed. The units of observation in validation were practitioners in the ZCI and Experts with the unit of analysis being risk allocation model. Figure 6.3 presents a summary of methods adopted and the aims of each stage.

6.5.1.2 Sample Design

For a sample to be representative of the population, it must consist of at least 3% of the population but a larger population is recommended (Manson & Lind, 1974; Lucy, 1989). However, for academic purposes a recommended sample size is 5% of the population of interest (Manson & Lind, 1974). This is which more applicable to quantitative data collection (Barry, 2011). Sample sizes are shown under the respective data collection technique.

6.5.3 Methods of data collection and the design in detail

Various methods of data collection were used these are shown in Figure 6.3. The methods are as follows:

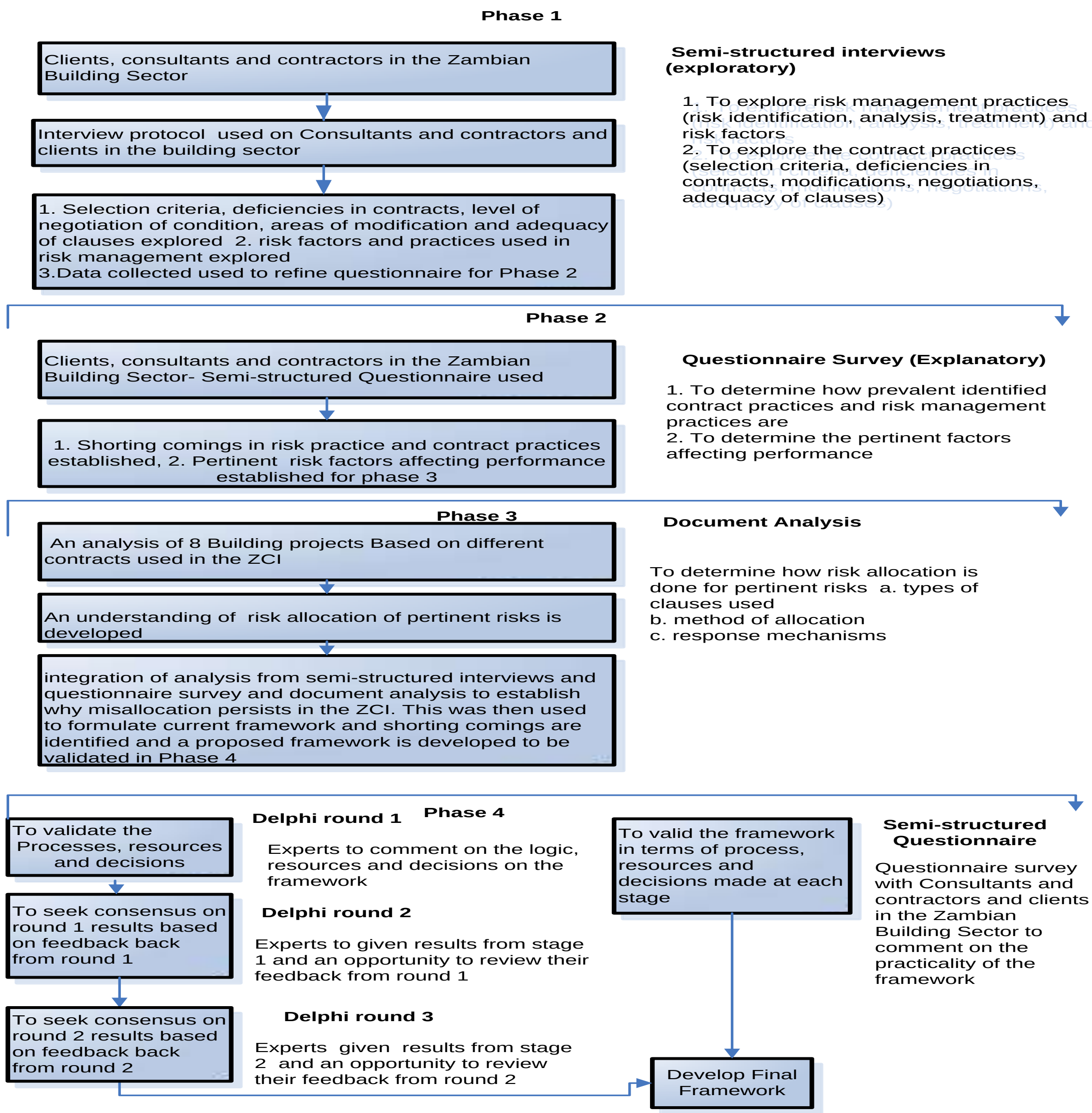


Figure 6.3 Phases of the Data collection

6.5.3.1 Interviews

Interviews are the best tools for collecting in-depth information (Greener, 2008; Patton, 2002). For this research a semi-structured interview was used to collect data. The interview was exploratory in nature to help formulate series of ideas to be investigated. A semi-structured interview is one which has a written set of open-ended or closed questions for use by the interviewer in a person-to-person interaction (Kumar, 2011). Semi-structured interviews normally provide uniform information and require less interviewing skills (Walliman, 2005).

Ritchie and Lewis (2003) suggested interview criteria to ensure that this method of data collection is effective. They proposed that questions should be clear, should not be leading, a variety of broad and narrow questions should be utilized and lastly in depth iterative probing should be utilized. Apart from their ability to collect in-depth information, interviews aid in the generation of historical data (Creswell, 2007). Other advantages of interviews include: information can be supplemented, questions can be explained and they can be used in any type of population (Kumar, 2011). Interviewing is a flexible technique (Walliman, 2005) and has a higher response rate than other methods (Gray, 2009). Conversely, interviews have the demerit of being time consuming and expensive (Kumar, 2011; Gray, 2009; Creswell, 2007; Bhattacherjee, 2012).

Prior permission/consent was obtained for the interviews and heterogeneous purposeful sampling was used for sampling; targeting respondents possessing at least 10 years' experience from diverse registered professions (See Table 6.6). This was to ensure that respondents had enough exposure in working on a number of building projects deploying different contracts, and gathering of diverse views. The method outlined by Creswell, (2007) shown in Figure 6.4 below was followed. Prior to the main interviews, preliminary interviews

Figure 6.4 interview cycle: Source Creswell (2007)

were undertaken to ensure the reliability and validity of the instrument to be used. The interviews were recorded using a digital recorder; for which consent was given and these were later transcribed for analysis. In cases were permission to record was not given field notes were taken, which later formed the basis for analysis. The duration of the interviews ranged from 30 minutes to 70 minutes, which was in line with Leedy and Ormrod, (2010). During interviews brief notes were taken as a backup (Bhattacherjee, 2012). Fifteen participants were interviewed, which was within the 5 to 25 respondents proposed by Leedy and Ormrod (2010). Table 6.7 gives details of the respondents.

Table 6.7 Sample Size for Interviews

Respondents	Quantity surveyor	Architect	Civil engineer	Client	Project Manager	Contractor group 1	Contractor group 2	Contractor group 3	Procurement officer
No.	2	2	2	2	2	1	1	1	2

Preliminary interviews were conducted to ensure that questions are unambiguous and to ascertain a typical duration of the interview. Three preliminary interviews were conducted and these are not presented as part of the findings. The preliminary interviewees included one PhD student, one public sector practitioner and one private sector practitioner. The preliminary interviews lasted between 30 minutes and 52 minutes. This gave confidence that the main interviews could be conducted within 60 minutes. The preliminary interviews also provided a basis for making questions more clear. The interview protocol used to conduct interviews between July and August 2015 is shown in Appendix 7B.

6.5.3.1.1 Design of the Interview Protocol

The interview protocol had three sections. The first section had the demographic information namely the years of experience engaged in building works, the nature of building types engaged in, details of the respondent and their perceptive of risk. The second part of the protocol comprised questions concerned with contracts. The questions asked included the factors considered in contract selection, the contracts in use, the effectiveness of clauses within the contracts and any general observations on the types of contracts used. The last part of the questionnaire was on risk management to determine the methods used for identification, analysis, response and to discover how past projects influences future risk allocation on projects. The risk factors influencing performance and the perception on respondents' abilities and barriers to risk management were also included for investigation. It went further to ascertain how feedback is obtained during the project cycle. The interviews once completed helped in formulation of questions for the survey.

6.5.3.2 Questionnaire Survey

A questionnaire is a written list of questions, the answers to which are recorded by the respondent (Kumar, 2011). The research utilised both closed and opened-ended questions. The data was mainly focused on risk identification, assessment and response methods/tools and practices in the construction industry, and contract types used and negotiation and problem areas for current contracts. The unit of investigation was consultants selected through simple random sampling from various consultancies (using lists obtained from the relevant professional bodies), simple random sampling of both private and public sector clients (public-government departments; and private –registered property developers with Patents and Companies Registration Agency- PACRA); and proportional stratified random sampling of contractors listed on the National Council for Construction (NCC) data base as these are arranged in strata/groups (see Table 6.8 and 6.9 for sample details), samples were selected using the formula below.

For quantifying the stratum the following formula was used for the stratified random method:

$$n_1 = \frac{N_1\, n}{N}$$

Where; n_1 is the sample from the stratum.

N_1 is the percentage sample which has been adopted.

N is the total population.

n is the size stratum.

Randomisation enables an equal chance of selection of participants from the population (Bhatta-cherjee, 2012; Kothari & Garg, 2014; Walliman, 2005). All participants were selected through randomisation and were assigned numbers. To ensure the validity of the data collected through questionnaires, a reliable survey process was followed as shown in Figure 5.6. Four types of questionnaires were disseminated, one type to contractors, one to project managers, one to clients and one to consultants (architects, quantity surveyor and civil engineers) see appendix 11a for questionnaire details.

The merits of a questionnaire survey include; coverage of a wide geographical area and is less expensive, although the response rate may be low, and a survey does not clarify issues by providing in-depth information (Creswell, 2007; Kumar, 2011). The questionnaires were formulated in simple, appropriate and direct language (Swetnam & Swetnam, 2009). In addition variables were clearly established before the formulation of the questionnaire (Walliman, 2005) from literature and semi-structured interviews. The questionnaire was adopted because it enabled uniformity of the questions unlike other modes of data collection, where responses might change according to how the replies develop (Walliman, 2005).

This phase helped to underpin methods, and practices used in contract risk allocation in the ZCI. There were four different types of questionnaire for the contractor, consultants, project manager and client. The questionnaire was arranged in three main sections across the different types. The first section had the demographic information namely the years of experience engaged in building works , the nature of building types engaged in , Type of client (client questionnaire only), nature of consultancy (quantity surveyor, Engineer or Architect, project manager).

The second part of the questionnaire comprised questions concerned with contracts. The questions asked included the factors considered in contract selection (skill and agency), the contracts in use (skill, instrumentation), the effectiveness of clauses within the contracts and any general observations on the types of contracts used (consequences). Respondents were also asked to outline what is modified (skill/work and effort).

The last part of the questionnaire was on risk management to determine the methods used for identification, analysis (work and effort, skill) and to discover how past projects influences future risk allocation on projects (creativity and agency). Additionally, the risk factors influencing performance (materiality) and the rating of respondents' abilities in risk management (skill/materiality). It went further to ascertain how respondents were motived (motivation). The aforementioned were formulated in view of the structuration and Gilbert's management theory facets in Chapter 5.

Questions for contractors were mainly closed with a few open-ended questions (See appendix 7A). The closed questions were mainly based on a 5 point Likert scale of effectiveness, importance, severity, consideration, adequacy and agreement. The later had a mid-point to indicate when respondent was unsure (Appendix 11) other questions were dichotomous in nature requiring a yes or no answer. These were followed by an explanation for the response to give deeper meaning to the answer.

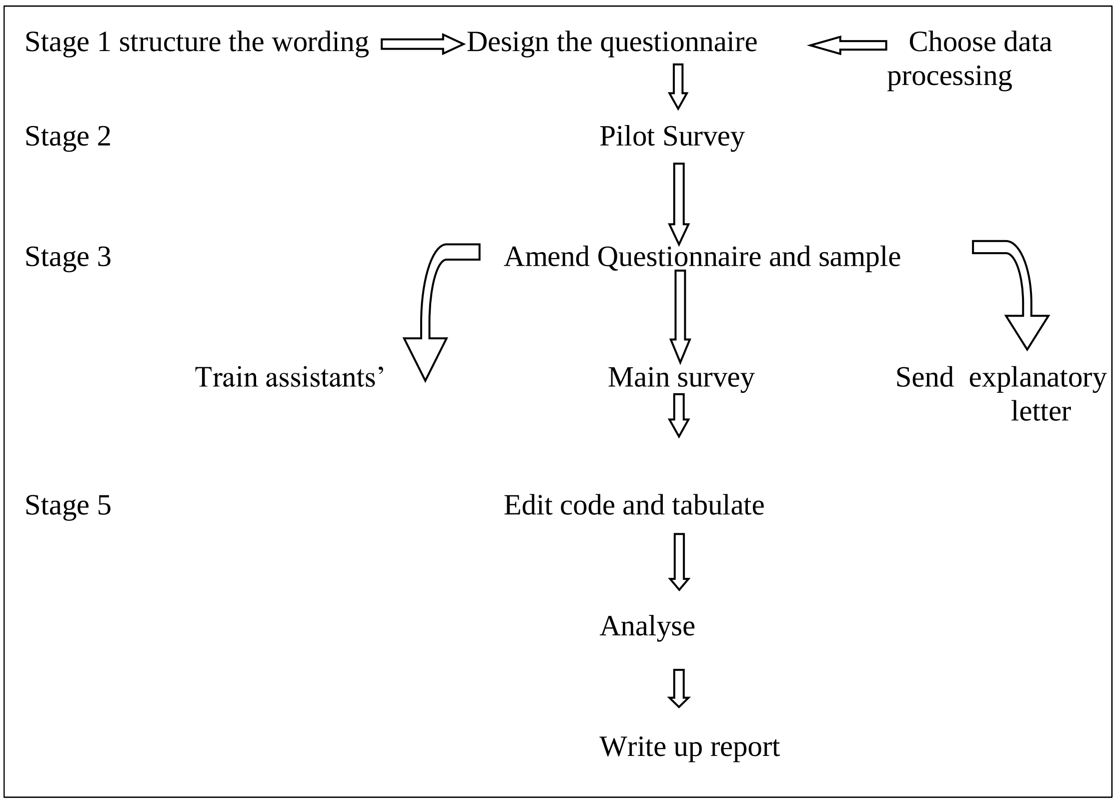


Figure 6.5 Questionnaire Survey Process: Czaja and Bliar (2005)

Table 6.8 NCC list of registered Contractors as of August 2014

Group contractors	Total Population Building	Sampling Frame	Sample size	Confidence level	Confidence interval
1	51	Stratified Random Sampling	26	95%	5
2	30		17	95%	5
3	69		28	95%	5
Total	150		77	95%	5

Table 6.9 Sample Size for Clients and Consultants

Types of Consultancy establishments	Total Population	Sampling criteria	Sample size	Confidence level	Confidence interval
Quantity Surveying	36	simple random sampling	32	95%	5
Civil Engineering	32	Simple random	30	95%	5
Project Management	17	Census	17		
Architecture	54	Simple random	27	95%	5
Clients	11	Census	11		
	150		117		

Once completed, the pertinent factors identified in the survey were used to conduct document analysis on contract documents used on purposively selected building projects.

6.5.3.3 Documents analysis

Document analysis is both a qualitative and quantitative approach (Miles & Huberman, 1994; Konddracki et al., 2002). It was used to determine how pertinent risks were allocated in the different contract types/forms used in the ZCI. It also provided reliability and validation for the semi-structured interviews and questionnaire survey on how risks have been allocated, considering that three separate instruments were used to measure the same thing (Gray, 2009; Creswell, 2007). Mooney and Mooney, (2013); and Hanna, et al, (2013) had used this type of analysis for risk allocation in their studies. This type of data analysis is regularly utilised in the construction industry (Hwang, et al., 2014). Approaches to document analysis could be interpretive analysis or content analysis. Interpretive analysis is targeted at capturing hidden meaning and ambiguity. It investigates how communications are encoded, latent or hidden. Content analysis establishes the occurrence of certain words or concepts within documents (Robson, 2011). For this study content analysis and interpretive analysis were conducted to varying extents. Document analysis has the merits of being inexpensive, unobtrusive, data is permanent hence subject to re-analysis and are easy to replicate. The demerits of document analysis include its being time consuming and information collection has to be tailored to the research as the documents are made for other purposes (Konddracki et al., 2002). This is why closed coding was used to collect the desired information (Bhattacherjee, 2012) with parameters highlighted in Appendix 7C showing the template used for content analysis.

The nature of the samples were purposive so as to compare and contrast, to identify similarities and differences in the various building project categories (Category 1-3) corresponding with the number of standard form building contracts commonly in use. Patton (2002) recommends the use of 4 cases if the sampling is in mixed designs that are sequentially designed using a homogeneous sample or 8 cases to seek convergence through triangulation of results. The sample in Table 6.10 was chosen to fit the purpose of the study, resources, and questions asked. Figure 6.6 shows the contract document collection process.

Table 6.10 Sample for the Document analysis

Contract	ZPPA open national	JLC/ZIA	FIDIC (Internal bidding) /red book	ZPPA Small works
Number	2	2	2	2

Once the coding was done for the content analysis, it was used to collect data (Gray, 2009) for parameters identified in Appendix 11c showing the content analysis template. The unit of investigation was the construction contracts used in the Zambian construction industry. Eight contracts were analysed, two from each form of contract (See Table 6.10) used in the last five years. Limited use was made of descriptive statistics to give meaningful explanations (Bhattacherjee, 2012). The procedure for document analysis was as follows (Robson, 2011):-

1. Formulate research question
2. Decide on sampling strategy
3. Decide the recording unit
4. Construct categories of analysis
5. Test the coding on samples and assess reliability
6. Carry out the analysis

The design of the document analysis instrument was designed to capture how pertinent risks are allocated in the industry in light of the structuration and Gilbert's management theory. The parameters captured were the risk factor, the party to which the risk was allocated, types of clause used to allocate the risk, methods for mitigating the risk, the impact of the risk on the project (time cost and quality). These were included to give indications as to who is responsible for the risk (agency/ skill/perception); allocation method, mechanism needing attention/type of clause (instrumentation/structure/creativity) and the impact of the risk (consequences).

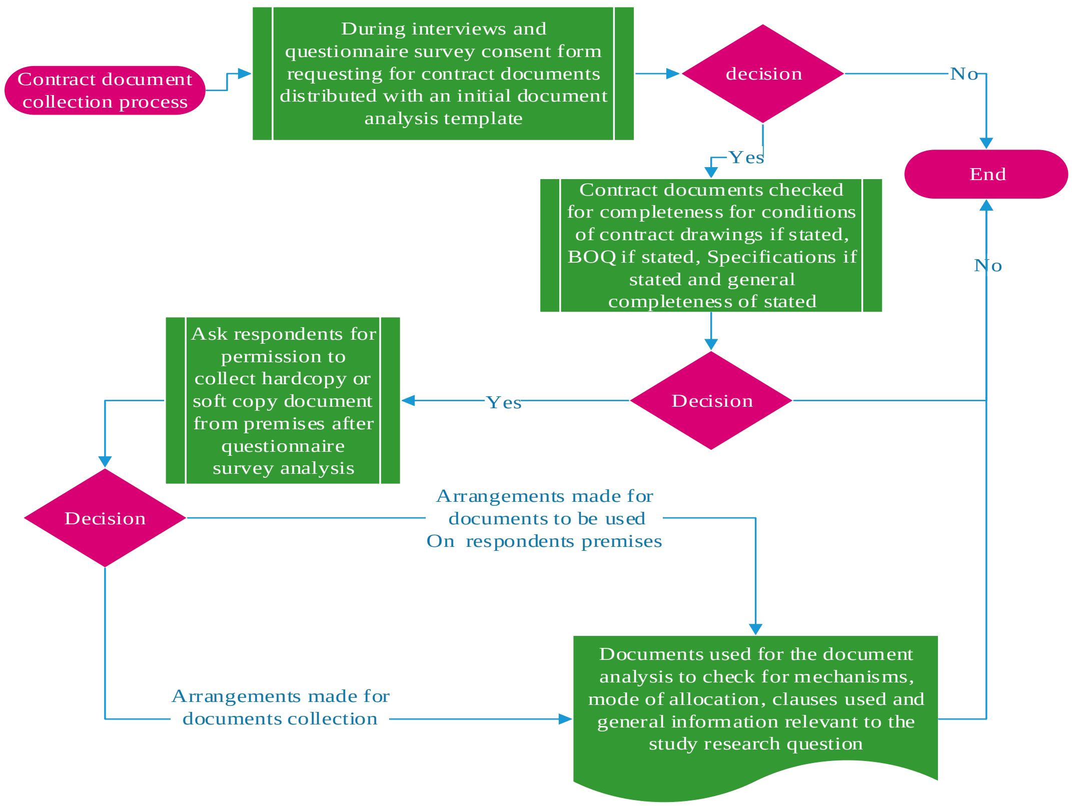


Figure 6.6 Document collection process

6.5.3.4Model/framework works

Once all the data analysis had been finalised from the 3 phases, a model/framework suited for risk allocation/management was formulated. This was done in consideration to prevalent risks, risk management processes and tools of contracting parties, and contracts available for use. The contracts available were further considered based on how adequate the clauses were in addressing pertinent risks. The framework is to be used ideally by the construction client (or consultants) or contractor depending on how the project procurement was to be arranged. The framework can be used from the pre-contract through to the construction stage. The framework is aimed at minimising or preventing the misallocations observed from the empirical data. Figure 6.7 shows process adopted for this study and that can used generically for model development/framework formulation.

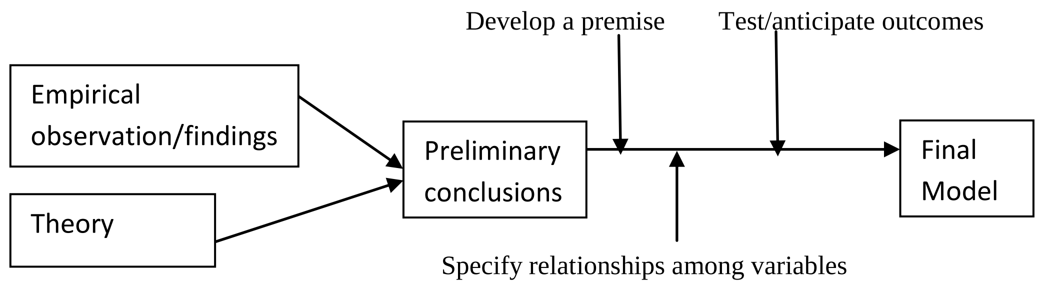


Figure 6.7 Process for Model Development Source: Bhattacherjee (2012)

The model development utilised a rational decision-making process. Rational decision-making models involve a cognitive process where each step follows in a logical order from the one before. A rational decision-making model provides a structured and sequenced approach to decision making (Alsalman & Sillars, 2013). The main aim of the framework was to identify actions that would lead to the desired results. Kendrick (2010) outlined the following methodology for process improvement:

1. *Plan*: Identify poorly performing processes and set the improvement areas
2. *Establish process baseline*: describe the current process using a flow chart or a detailed description of the present standard operating procedure (SOP). Identify root causes or problems as the process is.
3. *Develop changes*: develop option(s) for the new process.
4. *Implement*: Document new standard operating procedure using flow charting.
5. *Measure results or verify*: Compare original process to new one or verify new process

For verifying the results, a questionnaire directed to professionals in the ZCI and a Delphi expert panel were used. The existing literature suggest a panel with a minimum of eight (Hallowell &. Gambatese, 2010; Mongal-Andres et al., 2016; Yousuf, 2007). Once the responses from the phase 4 were analysed a final tool was developed

The Delphi method is a formalized communication technique designed to obtain the maximum amount of unbiased opinions from a panel of experts (Chan et al., 2001). It is a combination of qualitative and quantitative processes that draws mainly upon the opinions of identified experts to develop theories and projections for the future (Bourgeois et al., 2014). The experts contribute knowledge, authority and insight to the problem (in this case process model) (Gupta & Clarke, 1996). Therefore, the Delphi method is about providing quality not quantity (Rowe & Wright, 1999). The method is usually inexpensive to use (Gupta & Clarke, 1996) but normally takes long. It is believed that a three round Delphi is needed (Ibid). The process for the Delphi expert panel is as follows (Yousuf, 2007):-

1. Determining the willingness of individuals to serve on the panel. Members are selected for the Delphi panel due to their expertise. This panel comprised experts with at least four of the following characteristics. (Hallowell &. Gambatese, 2010).

- At least five years' experience construction industry
- Possess a minimum of BSc.
- Has professional registration
- Faculty member at an accredited institution of higher learning
- Primary or secondary writer of at least 3 peer-reviewed journal articles
- Invited to present at a relevant conference
- Writer or editor of book or book chapter on risk management
- Member or chair of a nationally recognized committee

2. Gathering individual input on the specific issue and then compiling it into basic statements. Respondents are kept separated and answer through an open-ended questionnaires in order to solicit specific information about the framework. Keeping them separated avoids the negative effects of face-to-face discussions and avoids problems associated with group dynamics.
3. Analysing data from the panel then members are asked to share their assessment and explanation of a problem or predict a future state of affairs.
4. The researcher controls the interactions among the participants by processing the information and filtering out irrelevant content. This is mainly done by compiling information on a new questionnaire and sending to each panel member for review

5.Replies are gathered, summarized, and then fed back to all the group members.

6.Members then make another decision based upon the new information. This is done by asking each panel member to study the data and evaluate their own position based on the responses from the group. When individual responses vary significantly from that of the group norm, the individual is asked to provide a rationale for their differing viewpoint while limitations are placed on the length of the remarks to keep responses brief

7.The process is repeated until the responses converge satisfactory, that is, it yields consensus. Analysing the input, and sharing the minority supporting statements with the panel. Panel members are again asked to review their position and if not within a specified range, to justify the position with a brief statement.

Alongside the Delphi expert panel, a semi-structured questionnaire survey was conducted with professionals in the Zambian construction to validate the framework from the practitioners' perspective. The interviewees were purposively selected with the sample as shown in Table 6.11. Unlike in a normal questionnaire survey, the framework had to be explained to the respondent for a period not less than 15 minutes and questions asked thereafter.

Table 6.11 Purposive sample for mechanism validation

Members of expert panel	Quantity surveyor	Architect	Civil engineer	Client	Project Manager	Contractor group 1	Contractor group 2	Contractor group 3
No	2	2	2	2	2	2	2	2

The criteria for the selection of the questionnaire respondents was such that they met at least three of the following criteria:

- At least five years' experience construction industry
- Possess a minimum of BSc.
- Has Professional registration
- Senior member or Head of Unit in a private or public organisation.

6.5.2.1 Design of instruments in relation to the main question

The main research question was to determine why risk misallocation is recurrently contributing to project failure in the ZCI. The focus of the study was hinged on two broad concepts of contract practice and risk allocation practice. This was to be done mainly by the use of the two theoretical approaches Structuration theory and Gilbert's management theory, which were used as frameworks. The two could be further divided into structure and agency issues for structuration and environmental and personal repository factors for Gilberts Management Theory as shown in Chapter 5.

The interview protocol questions were designed such that they fall into one of the aforementioned categories. The protocol had three parts. First part had questions on demographics (profession, years of experience, nature of building projects worked on and qualifications) and general understanding of risk. The understanding of risk was important to get understanding of risk practice (RQ2). The second section was on contracts. The section captured contract selection (RQ1 selection factors) and practice (RQ2-modification of contracts, effectiveness of clauses, deficiencies, feedback). The Third section was on risk management. The section captured risk practice (RQ2 Risk identification, analysis, risk allocation considerations, motivation and consequences of risk, barriers to risk management) and how risks are allocated (RQ3-balance of allocated, effectiveness of mechanisms: insurance methods of construction, subcontracting, and pertinent risks). In the protocol, questions on contracts used, adequacy of subcontracting, monitoring, and the existence of an existing risk management framework are environment related while issues on methods used for risk identification, analysis and how lessons learnt from previous projects are used on future projects are agency or personal repository related. In the final analysis observed deficiencies in personal and environmental attributes are used to explain the reason why risk misallocation is recurrent.

The questionnaires though slightly different for clients, project managers, consultants (architects, engineers and quantity surveyors) and contractor had three Sections. First section had questions on demographics such as profession, years of experience, nature of building projects worked on and qualifications. The second section was on contracts. The section captured contract selection (RQ1 selection factors) and practice (RQ2-modification of contracts, effectiveness of clauses, deficiencies, feedback). The Third section was on risk management. The section captured risk practice (RQ2 Risk identification, analysis, risk allocation considerations, risk management abilities, risk source, motivation and consequences of risk, barriers to risk management) and how risks are allocated (RQ3-pertinenet risks, effectiveness of mechanisms: insurance methods of construction , subcontracting, time allocated). The questions on contracts included, types of contracts used, adequacy of subcontracting, monitoring, and the existence of an existing risk management framework are environment related while issues on methods used for risk identification, analysis and how lessons learnt from previous projects are used on future projects are agency or personal repository related. In the final analysis, shortcomings observed in the results of the two theoretical findings are used to explain the reason why risk misallocation is recurrent.

The document analysis answers the question how are risks perceived to be important allocated in the contract documents (RQ3) using closed categories namely: methods of risk allocation, risk response mechanism used type of clause used and to whom the risk is allocated, nature of the risk. These determine who the cause of the risk is; whether it can be controlled internally (project team) or not, the response mechanisms applicable, the clauses associated with pertinent risks and how the allocation is done. These form a basis for determining associated focus areas and also solutions to be considered in the framework. This outlines the environmental aspects and role of agency.

6.5.2.2 Data collection and Analysis timelines

Data collection commenced on 21 July 2015. This was when the preliminary interviews were conducted. The main interview commenced 29 July 2015 to Mid- September 2015From the week commencing 29 July 2015 the main interviews were conducted in Lusaka province, around end of August 2015 in Central and Copperbelt provinces and early September 2015 in Southern province. Some initial analysis of interviews was conducted before pilot questionnaires.

From 7 October to 9 October 2015, pilot questionnaires were distributed based on some constructs gathered from the interviews. The main questionnaire survey was concluded on 14

December 2015 as most construction related firms had closed for their industrial break. Initial analysis on the data collected began in July on the semi-structured interviews and ended mid-December. The questionnaire distribution covered 100% of clients, 85% of contractors and 95% of consultants registered as at 14 August 2015. The main analysis for questionnaire survey was conducted from mid-December to Early February 2016 when the document analysis began and concluded in first week of March 2016. From mid-March to end of June 2016 the initial design for the process model was undertaken and underwent a verification and evaluation process from early July to end of September using a Delphi panel of up-to three rounds and each round taking nearly three weeks and a purposive questionnaire to ZCI professionals and clients.

6.5.2.3 Data preparation

Once the data has been collected it has to be prepared for analysis. This is done in order to get reliable results. The following data preparation measures were taken to ensure that the data used was reliable (Kothari and Garg, 2014).

- Questionnaire checking: questionnaires were checked for completeness. Only those questionnaires with sufficient number of answers were used. Some questionnaires were discarded for incompleteness.
- Editing: this was done to examine the raw data for omissions and errors to correct these when possible. This was done in the field once the respondent had handed the questionnaire to the researcher.
- Coding: this was then done when entering the data into SPSS or tables for qualitative data to reduce the data but at the same time ensuring that the data was exhaustive.
- Data cleaning: was done for consistency and treating of missing values. The missing values were replaced with a neutral value.

6.5.2.4 Data analysis

Quantitative and qualitative data analysis methods were employed as explained below.

A. Quantitative analysis

Once the data had been collected they were entered into SPSS 20 software for analysis. Descriptive statistics methods of data analysis were applied e.g. means, median, frequencies and percentages, then summarised into charts from which conclusions were drawn. For determining the ranking of factors (risk factors and consideration factors for contract selection/ risk allocation consideration factors for consultants and common risk response criteria by contractors) calculation of means and standard deviation were used to rank and mean index scores. The smaller the Standard deviation meant the risk factor was ranked higher if the means were equal (Rovai et al, 2013, Kothari and Garg, 2014. This approach has been used by Chan et al., (2011); Mbachu and Taylor, (2014); Shehu et al., (2014); Tang et al., (2007); Wang et al., (2004); Wibowo and Mohamed, (2010); Wiguna and Scott (2005).

The mean score index was calculated to establish which factors were mostly considered for contract selection, risk management, for risk allocation and response and the pertinent risks in the Zambian building sector. On the Likert scale 1-2 was interpreted as low consideration/importance/severity while 3 was moderate and 4-5 was high. Cross tabulations were done to determine relations between particular risk identification and analysis techniques and participants level of education, profession and years of experience.

Descriptive statistical analysis was used mainly to describe, aggregate and present the constructs of interest or associations between the constructs (Bhattacherjee, 2012). Univariate analysis using frequency distributions, central tendencies and dispersion were utilised. When percentages or frequencies were used the following interpretation was applied:

- ≥80%≤100%- Most;
- ≥60%≤80% Majority
- ≥40%≤60% Less than half to more than half
- ≥20%≤40% Less than half
- ≥1%≤20% Minority

For determining important factors (risk factors and consideration factors for contract selection/ risk allocation consideration factors for consultants and common risk response criteria by contractors) calculation of Relative importance index (RII) was used. The formula used for conduction the RII is as follows

$$RII. = \sum (Pi*Ui)/ (N-n)$$

Where Pi = Respondent's rating

Ui = Number of respondents placing identical rating

N = Sample size

n = Highest value on Likert scale

This was used to determine what factors were mostly perceived to be of high importance and used for the document analysis. This approach has been used by (Othman et al, 2005; El-sayegy & Mansour, 2015; Aziz, 2013; Jarkas and Haupt, 2015) to rank the importance of factors. The rationale for the importance index is that the importance of contract selection factor or risk factor is the result of the frequency of the factor (Alinaitwe et al, 2013). Thus, two factors with the same frequency of occurrence would have the same importance if they have the same scores for the consideration or importance (Ibid).

Some inferential statistic were conducted on the survey data to determine the significance of factors (risk factors and contract selection factors) and also to ascertain the differences in perception of the various sub-groupings thus contractor and consultants. To do this several hypotheses as shown below were formulated. In addition to the hypothesis testing effect sizes (Appendix 10A-10N) were computed and reported to complement interpretation of a significant hypothesis test. Apart from the correlation coefficient for spearman rank correlation, Eta squared was used for the Kruskal Wallis interpretation of estimates of 0.01 for small effect, 0.06 medium effect and 0.14 large effect (Rovai et al, 2013; Hatcher, 2013). For Mann Whitney U and Wilcoxon tests the effect size denoted by r was interpreted by 0.1 small effect, 0.3 medium effect and 0.5 large effect (Ibid).

In view of the sampling techniques used the clients and project manager are excluded for tests were inferential statistics were applied as they were not randomly selected as a condition for both parametric and non-parametric tests (Kothari and Garg, 2014; Rovai et, 2013). The one sample Shapiro_Wilk test was done on the sample data to determine if data comes from a normal distribution for both small (<50) and large samples (>50). To ascertain the nature of statistical tests to use.

One sample Wilcoxon rank test was conducted at a cut of point of 4 which approximates to Strong or high consideration/importance on the Likert scale used. This was done using SPSS 23. The test is appropriate even for small samples. The test is used when the sample is randomly selected; when variables are measured using scale, ratio or interval and when the normality of the distribution of the population can be over looked (Rovai et al, 2013). Various hypothesis tests were conducted in this study. The one sample Wilcoxon rank test was used to test the following hypothesis so as to determine which factors were perceived significantly different from the hypothesised median.

•*H1*: The Median of contract selection factors (CSF):1-15 equals 4

•*H2*: The Median of risk factors (RF):1-55 equals 4

To ascertain the difference in perceptions One way Kruskal Wallis for non-parametric statistic was used. Conditions for carrying out the test include (Rovai et al, 2013) 1. Random sample selection, 2. The dependent variances are measured on ordinal, interval or ratio scale, 3 samples are selected independent of each other and 4. Adequate cell size of at least 5 is met. This test was used to test the hypothesis:

H_3: The perceptions of consultants with regard to contract selection factors are similar across the different roles (Research question 1)

H_4*:* The perceptions of consultants with regard to contract selection factors are similar across the different years in experience (Research question 1)

H_5*:* The perceptions of consultants and contractors with regard to risk factors are similar for risks influencing performance (Research question 3)

H_6 The perceptions of consultants and contractors with regard to risk factors are similar across the different years in experience for risks influencing performance

While the Mann Whitney was used to test the hypothesis *H5*: There is equality of means in responses of different groups of respondents in ranking the degree of influence of risk factors influencing performance as this was a group of two- contractors and consultants. The test determines if ranked scores defer between two independent groups. Key assumptions include random selection of samples; independence of observations and variable measured on the ordinal, interval or ratio scale (Rovai et al, 2013).

Further to comparisons between groups relationships were investigated for contract selection factors and risk factors. To achieve this correlation in the form of spearman's rho was used as data were not normally distributed. Correlation is a statistical technique that measures and describes the relationship between variables. Spearman's' rho is used when the continuous-level variables, linearity, heteroscedasticity, and multivariate normal distribution of the variables to test for significance are not met (Kothari and Garg, 2014). Spearman's correlation determines the strength and direction of the relationship were a monotonic relation between variables exists. Yilz et al (2012) and Lee et al, (2009) argue that risk factor normally have interdependencies. The correlation coefficient r_s ranges from -1(strong negative) to +1 strong positive. Zero signifies no relationship. For the study only strong and moderate relationships are reported as these are the ones that have a notable influence (Rovai et al, 2013) in the relationship of factor. The null hypothesis tested was:

H7: There is no (moderate to high) relationship between Contract selection factors (CSF1-15)

H8: There is no (moderate to high) relationship between risk factors (RF1-55).

In hypothesis testing Type 1 (reject null when it is true) and type II errors (Accept the null when it is false) are common. The probability of these errors is determined in advance by indicating the critical value P = 0.05 or 0.001 representing a 5% or 1% chance of making the error respectively. However, in multiple hypotheses, testing types II error is increased. The Holm- Bonferroni multiple testing correction adjusts the individual p- value for each variable in order to keep the overall type I error probability rate less than or equal to specified significance level (Hatcher, 2013). The specified significance level is then compared to the calculated P-Values. If p-value is smaller, reject the null hypothesis. The test stops when you reach the first non-rejected hypothesis. For this reason the p-values associated with each hypothesis are arranged in descending order. The specified significant value is calculated as specified significance value = target critical value/ (n-rank+1) where n= number of tests, rank is determined after arranging the p-values in descending order. This was done in this study as shown in Appendix 10A-10O) for various Tests. For correlations the Bonferroni correction was used as follows: target critical value divided by number of Tests. So for contract selection factors specified critical value was 0.0003 and for risk factors the specified critical value was 0.0009. The correction is important to 1) control the probability of incorrectly rejecting one or more true null hypotheses, and 2) simultaneously maintain substantial power in detecting one or more component false alternative hypothesis (Rice, 1989). While the correction is important Rothman (1990) and McDonald (2014) argue that this approach results is the non-reporting of results that might be significant if further testing is utilised. Therefore, the possibility of some results being significant will be reported despite their being insignificant after the correction for multiple hypothesis testing.

The last quantitative analysis in the study is for the risk allocation model validation conducted using two questionnaires. Analysis of the Delphi expert panel questionnaire and the questionnaire for professionals in the Zambian Construction Industry was done firstly by calculating means, modes, standard deviation and the co-efficient of variation. These measures were used to determine the extent to which the experts agreed on various issues.

B. Qualitative data analysis

The qualitative data was from the semi-structured interviews, open-ended questionnaire responses and document analysis. Themes were extracted after the qualitative data had been transcribed and coded for analysis. Creswell (2009) proposed the identification of statements that relate to the topic (categories), arranging grouped statements into joint meaning, seeking divergent perspectives and constructing a composite (commonly known as thematic analysis). A theme captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set (Braun & Clarke, 2006). This enables the description of risk management and contract practices through the eyes of users in the construction industry. Burnard (1991) summarised the qualitative analysis process in fourteen stages as follows:-

1. Notes are made after the interview regarding topics discussed during the interview. It is also advisable for the researcher to write memos.

2. Transcripts are read and notes are made throughout the reading on themes within transcripts. This enabled the generation of various themes and formulation of various categories.
3. Transcripts are read and many headings are made describing all aspects of the content. This is to ensure that all possible themes are captured. Headings and categories should help to capture interview data.
4. List of categories is surveyed by researcher and grouped together under higher order headings. This is done with the aim of collapsing similar headings into categories.
5. New list of categories and headings is worked through and repetitions or very similar headings are removed to produce a final list. This enables the formulation of a concise list of categories.
6. Two independent parties are approached to generate systems, independently without seeing the researchers list. This method is used to validate that the categories formulated by the researcher are acceptable.
7. Transcripts are re-read alongside the finally agreed list of categories and sub-headings to ensure that all aspects of the interview are covered.
8. Each transcript is worked through with the list of categories and sub-headings and coded according to list of categories and headings. Codes can be colour coded to differentiate the theme being captured.
9. Each coded section of the interview is cut out of the transcript and all items with the same colour code are collected together.
10. The cut sections are pasted into sheets, headed up with appropriate headings and sub-headings. The pasting endeavours to capture cuttings with the same colour code.
11. Selected respondents are asked to check the appropriateness or otherwise the category system of the quotations pasted on the sheet to ensure that the categories a correctly formulated.
12. All sections are filed together for direct reference when writing up the findings. For items that are unclear reference is made to the original interview transcripts and recording.
13. Once all sections are together and meaning has been made out of the sections, the writing process begins.
14. The researcher may write up the findings with verbatim examples of interviews to illustrate various sections and then link findings to the literature or researcher may write up findings alongside references to literature.

This process was adapted to the research with the omissions of step 6 and 11 as no willing participants were found. But additional effort was made to return to respondent for clarifications. This process necessitated the identifying of recurrent material or subject and differences within responses (Saunders et al, 2012). These were later presented as verbatim, or in Tables or Figure as the researcher deemed fit.

6.5.3 Stage 3

This was the final stage of the research. It included mostly writing up of findings and conclusions of this research. The final literature search was done and literature review write-up was concluded. Various tools are utilised in this research. As with all the methods employed in a research, it is important that they are employed in an ethical manner, are valid and reliable.

6.6Validity

Validity may be defined as the ability of an instrument to measure what it was intended to measure (Gary, 2009). While Robson (2011) defined it as the accuracy of a result. Various types of validity exist, namely content or face validity, concurrent validity, predictive validity, criterion related validity and construct validity (Punch, 2006). Content validity looks at how well the measuring instrument samples from all areas of content in the conceptual description; concurrent validity asks how the measuring instrument compares with another measure of the same construct; predictive validity asks how well it predicts later behaviour; and construct validity asks how an instrument conforms to the theoretical expectations.

Content validity in this study was achieved by having items or questions that reflect the aspects of consideration in the study domain of contract practice and risk management. Perceptive of various stakeholders (clients, consultants and contractors) in these two domains were sought. Pilot and preliminary studies helped to explore the relevant constructs and determining the importance of the constructs specifically for the survey. This to a large extent determined what questions should be included in the different questionnaires used for clients, consultants, project managers and contractors. In validating the framework a panel of experts was used to assess that items in the intended domain were addressed (Rovai et al, 2013). The problem under investigation was investigated in depth with various data collection methods combining words with numbers to ensure coverage of important issues.

Construct validity in this study was based on operationalizing the two theoretical perspectives of structuration and Gilbert management theory. By design the two theories were chosen because they have similar main focuses structure and environmental factors; and agency and personal repository factors. The theoretical lenses facilitated appropriate and adequate interpretations. To improve the internal validity triangulations of methods and data was employed (Rovai et al, 2013)

Predictive validity to a large extent is associated with external validity in other words generalizability of findings. This is more associated with quantitative research. Nevertheless qualitative findings can be generalised to a similar context or setting (Gray, 2009). This therefore calls for accurate reporting of methods, settings and participants. This to a large extent has been achieved in this Chapter 6 (participants), Chapter 2 (context description) and Chapter 7 (projects and participants) were the context and the participants are described for qualitative data and representative samples have been used for the quantitative data.

Validation has three main components for quantitative data (Eurostat, 2014):

1. Data editing – The application of checks that identify missing, invalid or inconsistent entries or that point to data records that are potentially in error;
2. Missing data and imputation – Analysis of imputation and re-weighting methods used to correct for missing data caused by non-response. Non-response can be total, when there is no information on a given respondent (unit non-response), or partial, when only part of the information on the respondent is missing (item non-response). Imputation is a procedure used to estimate and replace missing or inconsistent (unusable) data items to provide a complete data set. The few partial incidences of incomplete data were completed by going back to respondents were necessary;
3. Advanced validation – Advanced statistical methods can be used to improve data quality. Many of them are related to outlier detection since the conclusions and inferences obtained from contaminated (by outliers) data set may be seriously biased.

A pilot questionnaire and preliminary interviews were conducted as a validation measure (Gray, 2009). These were part of the validation process to ensure that that what was intended to be measured was measured. Additionally in the main survey for the questionnaire there was random assignment of participants to the various groups of clients, consultants and contractors as a measure of internal validity. An additional measure for internal validity was to use interviews and questionnaire. For the document analysis consistency in coding was tested on a sample. Once the data had been collected, it was checked for missing data, invalid and inconsistent entries as a measure of achieving validity. Imputation was done to replace missing or inconsistent data items to provide complete data. When the missing data and imputation had been done the data set was then ready for analysis.

Leedy and ormrod (2010) indicate that use of unobtrusive measures adds to internal validity of a research. This measure was utilised in the document analysis as the information used from the contract documents is permanent. Further, to this the concept of thick description was used for each project so that readers can draw their own conclusions from the data presented (Bryman & Bell, 2015).

The use of various data collection methods is in itself a method for validating the data by triangulation (Creswell, 2009; Leddy and Ormrod, 2010). The framework developed was validated using an expert panel (9 experts) and professionals in the ZCI. The method collected opinions of experts through a questionnaire survey (Chen, 2014). These were knowledgeable people whose expert opinions were valued. Having identified various theories as a lens for risk allocation in the construction industry, this avenue was used to validate theory through theory triangulation.

6.7 Reliability

A measure has to be reliable for it to be valid (Robson, 2011). Reliability is defined as an indication of consistency between two measures of something (Gray, 2009). Punch (2006) defined it in two ways; in quantitative research it is the consistency of measurement over time and in qualitative research the dependability of data. There are two types of reliability (Gray, 2009). Internal reliability measures the stability of results across items within a test while external reliability refers to the extent to which a measure varies from one use to another.

The measure of reliability gained from the design of the research was from using different instruments: interviews, the questionnaire survey and the document analysis. Basically this was triangulation; the use of multiple sources collaborating evidence from different sources (Creswell, 2009). The consistency of measurement was achieved by using the same questionnaire and same questions in the interview and the same template for collecting data on contract documents. The dependability of the data in the qualitative data was achieved by interrogating actors in the industry who initiate, design and constructs the projects. Using these sources enhanced the credibility of the findings and at the same time makes them trustworthy.

To test the reliability of the questionnaire instruments the Cronbach's alpha was used. For a reliable instrument the Cronbach's alpha is expected to be above 0.700 (Kothari and Garg, 2014; Reynold and Santos, 1999). Further to this the conducting of the preliminary interviews, document analysis template and questionnaire survey provided reliability of the instruments and they were tested before wide application.

6.8Ethics

Research involves various ethical considerations and procedures to achieve academic integrity (Punch, 2006). The starting point for ethical requirements for the research was to obtain ethical clearance from the University of the Witwatersrand (See Appendix 9) for the clearance issued by the University). The nature of the research usually dictates the considerations to be made, and these are shown in Table 5.12. Harm to participants should be avoided in any type of research especially when dealing with human subjects. Human error can sometimes result in sampling error more so in survey research (Rovai et al, 2013). The following were some considerations taken into account to reduce response bias, Survey bias, Selection bias and other ethical issues as shown in Table 6.12.

Table 6.12 Ethics considerations

Technique	Ethical issues	Solution employed
Content analysis	Selection bias	Use of documents for projects within six-year period for building projects only based on the needed contract forms
	Observation bias	Use of closed coding
	Privacy and confidentiality	Projects on which documents will be collected will be identified anonymously to protect those who were involved on a particular project.

Table 6.12 Ethics considerations continued

Technique	**Ethical issues**	**Solution employed**
Interview	Confidentiality	Anonymity of interview and storage of interview data
	Privacy	Interviewee to be contacted at time of convenience. Seeking of permission to record interview in any format
	Informed consent	Information about the research will be given and seeking of written consent
	Discomfort/ harm	Interview will be discontinued or line of questioning is changed
	Location of interview	Interview to choose the time and place either private or public of the interview
	Respect	Voluntary participation
	Recruitment of participants	Use of professional bodies
	Interviewer bias (leading questions)	Use of clear and unambiguous questions
	Interview bias (lying)	Use of different questions to triangulate responses
Questionnaire survey/ Delphi expert panel	Consent	Information about the research given and seeking of written consent
	Confidentiality	Anonymity of survey and storage of questionnaire data
	Recruitment of participants	Use of professional bodies
	Respect	Voluntary participation
	Question design bias	Clearly worded questions and use of appropriate scales
	Bias in questionnaire design	Use of vertically designed responses as required Avoiding the use of neutral responses at the middle of the scale
	Questionnaire administration	Extent the time for retrieval of questionnaire and send reminders to respondents
	Response bias	Use of neutral questions
	Survey bias Selection bias	Use of randomised sampling except for Delphi -purposive

6.9 Chapter Summary

The chapter has outlined methodology used in the study. These included the research approach, methods and design. An appreciation of current research methods in the area of risk allocation and contract was given and the choices made were justified. The following chapter presents the results obtained using this research methodology.

CHAPTER 7 - RESULTS

7. Introduction

This chapter presents and discusses the findings from the interviews, questionnaire survey and the document analysis. Qualitative and quantitative analyses are presented separately. The characteristics of the respondents or documents used are given first, and then findings are presented and briefly discussed, in line with research questions. The discussion chapter (7) gives a detailed discussion on how the objectives were achieved. As a recapitulation, the research questions for the study were as follows:

Main research questions

Why is risk misallocation recurrently contributing to project failure in the Zambian construction industry and what mechanism can aid risk allocation?

Sub-questions

- What factors influence the choices of contract forms on building projects to influence risk allocation?
- What are the risk allocation practices used by contracting parties in the ZCI?
- How are risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?
- What mechanism can be devised to aid risk allocation in the ZCI?

Only the first three sub-questions are dealt with in this chapter. The last research sub-question on the mechanism development and verification is discussed in Chapter 9. The results are presented in a sequential manner namely semi-structured interview, questionnaire survey and document analysis. This is the manner in which the results were collected. This guidance is supported by Creswell and Clark (2011) and Bell and Bryman (2015). The results are integrated, triangulated and related to the literature and theory at discussion stage as guided by Creswell and Clark, 2011 in chapter 8. Signposts are included to give an indication of the research question being addresses at each presentation of findings and results.

7.1 Semi-structured Interviews-Qualitative Results

The interviews were semi-structured and administered to practitioners from both the private and public sector to give a holistic picture of risk allocation and contract practices in the Zambian construction industry. Each interview lasted between 30 min and 70 minutes. Table 7.1 gives some characteristics of the respondents. The respondents had at least 10 years' experience and had worked on different types of building projects ranging from small to large projects. Table 7.1 shows the characteristics of respondents' sector of work, years of experience, role in the construction industry and nature of building projects engaged in. On average interviewees had 17 years' experience (Calculated from Table 7.1) with mode 10 years and median experience 15 years.

Table 7.1 Respondent's characteristics

No	Pseudo code	Sector	Years' of experience	Role in construction	Nature of building projects engaged in
1	PUQS1	Public	15	QS	Offices, houses, schools
2	PUCE	Public	12	Civil Eng.	Offices , hospitals, schools
3	PUPO1	Public	10	Procurement officers	Offices, houses
4	PUQS2	Public	20	QS	Housing units, offices, health facilities, hospitals
5	PUA1	Public	19	Architect	Schools, offices, border infrastructure, houses
6	PRC1	Private	10	Contractor	Houses, student hostels, high rise buildings
7	PRPM1	Private	32	QS/PM	Offices, hospitals, residential, banks, filling stations, stadia, factories
8	PUCL	Public	21	Client org	Primary schools, secondary schools, colleges, houses
9	PUPM2	Public	23	PM	Prisons, military installations, houses, rural health centres, flight terminal, border facilities, offices
10	PRCE	Private	30	Eng. Consultant	Showrooms, schools, filling station, hospitals hotels, office buildings
11	PRC2	Private	29	Contractor	Housing, offices, banks, schools, hostels
12	PRC3	Private	10	Contractor	High schools, maternity wards, student hostels, offices
13	PRCL	Private	10	Client Org	markets, fire stations, bus shelters, houses,
14	PUPO2	Public	15	Procurement Officer	Office blocks, houses, farm layouts and different buildings, lodges, banks
15	PRAR1	Private	10	Architect	Houses, offices, shops, farm buildings, banks

The nature of building engaged in was diverse therefore providing a good mix for the study. To maintain anonymity the following pseudo codes Shown in Table 7.1 were adopted for reporting results from the semi-structured interviews. The government being the biggest client with standard operations, processes and procedures, resulted in saturation after interviewing 6 respondents from the public and private sectors (respondents: 1,3.5,7,10, and 15 from Table 7.1). The next section shows findings for the research question and sub-questions shown below

Research question	Sub questions
What drives the choices of contracts types used on building projects and how should the selection be made to mitigate risk misallocation?	➢Which contracts are used? ➢Are contracts used in their standard form? ➢What deficiencies exit in current contracts? ➢What factors are considered in selection? ➢What are the common types of building projects in ZCI? ➢Is the selection criteria appropriate?

7.1.1 Contract forms used in the ZCI

Construction contracts are the documents where risk liability is outlined (See Figure 7.1). It was important to find out what contracts are used in the ZCI. It was found that government being the largest employer, its preferred contract form ZIPPA is the most commonly used form of contract This has three suites :-

1.ZPPA open national bidding contract
2.ZPPA Open international bidding contract (FIDIC-red book)
3.ZPPA small works bidding contract

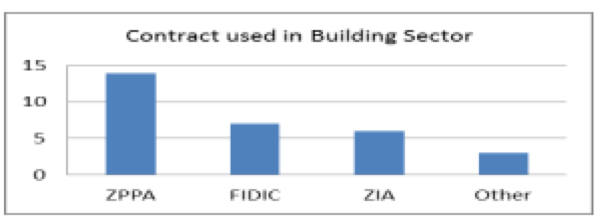


Figure 7.1 Contracts used in ZCI (Interviews)

It was also found to be not uncommon for private clients to use other forms of contracts for their building projects. These included African Development Bank (ADB) contract form and American contracting system contracts, and the JBCC (South African). This shows that the client has a pivotal role in choosing contract types for use on construction projects. The above findings were also congruent with the survey as will be later become clear. However, the contract forms used were originally designed for separated procurement but integrated procurement was seen to be practiced as highlighted by at least more than half (52%) of the respondents. Additionally, though section 2.3 highlights various contract types for use only lump sum/fixed-price forms are used.

7.1.2 Factors considered in preference of particular contract forms

The interview results underscored that various contract types are in use. It was also important to find the reasons for selecting a particular contract type and various factors were identified by interviewed clients, contractors, and consultants. It was worth noting that some factors identified were sector specific as shown in Table 7.2.

Table 7.2 Considerations for contract selection

Factors (Private sector)	Design of the structure, nature of feasibility studies done, <u>nature of the structure</u>, materials prescribed, client choice (after advice on available forms), *type of client*, type of development, contract characteristic
Factors (Public sector)	*Type of client*, financiers preference, <u>nature of work</u>, size of project, urgency of project, public benefit, procurement unit, specialisation, value of work, time available, quality of works, procurement method

Both the private and public sector respondents were of the view that nature of the client was key in the selection of the type of contract for use. This is so because there is a suite of contracts for use in the public sector developed by the Zambia public procurement Agency and contracts preferred for use by the private sector. In addition to this, where the government of the republic of Zambia is not funding the project the financiers of projects determine the contract for use. It was also highlighted that especially in peri-urban and rural communities the contract types used would also have public benefit clauses that are aimed at empowering local contractors and communities. Additionally, after the designs are complete, Bills of quantities are prepared, the procurement units are left to choose the contract type which are normally based on the value of projects in the public sector as shown below. Traditionally projects procured in the public sector use ZPPA contract form while PPP projects mainly use contracts developed by the Procurement unit in conjunction with the Private partner:

1. ZPPA open national bidding contract -K500,000-20,000,000
2. ZPPA Open international bidding contract over K20,000,000
3. ZPPA small works bidding contract –below K500,000

In the private sector the contracts in use are FIDIC red book and Joint liaison committee contract (commonly known as ZIA contract). The JBCC and NEC3 (2005) contracts are hardly utilised. Projects that are seen as complex and materials that are not available locally make use of the FIDIC while relatively medium- small projects use the ZIA form.

Several factors influence the choice of contracts for building works in the public sector. The decision is based on value of works, nature of procurement and the financier's preference based on the nature of work and public benefit to be offered, while in the private sector the client decides what is used based on the advice from consultants with regard to nature of project, type of development, design, materials, characteristic of contract (in terms of how favourable it is to the client) and size of the project.

7.1.3 Modification of standard form of contract(s)

Drafters of most standard forms of contracts envision their use without modifications. However, most clients do make modifications to standard form of contracts. This is sometimes beneficial as it adapts the contract to the nature of the project while on other occasions the risk allocation may be changed. Standard forms are also used on the understanding that parties to the contract are familiar with the contract terms and conditions. This does not hold if the contracts are modified. When asked on contract modification, all the respondents indicated that contracts are usually modified and sometimes the modifications are very extensive (see comment below).

> *"…Sometimes but mostly lawyer do not like the wording of certain clauses and hence modify. This is very annoying because they make us feel as if we do not*

know what we are doing….sometimes the modification is extensive they modify up to 3 whole pages. This is annoying". –PUPR1

The modifications have basically two sources as captured from the interview data 1. Client and their representatives and 2. The financiers of projects. The modifications take the form of changing the wording of clauses or the removal or waiving of clauses altogether. It could be argued that the modifications change the risk allocations as pointed out by one of the respondents.

"…because they know if those clauses are there, their risks will be high and they would be found wanting and because they are the ones who have the sole privilege of coming up with the form of contract that they want to have. Us as contractors have no input in that if anything those contracts that we use are just shoved down our throats…."- PRC2

Areas of modification are normally pointed out in the special conditions of contract or particular conditions of contract such as project information, insurance limits, retention values to be withheld, securities such as insurance, performance bonds, bid security, advance payment bonds, other bond requirements, defects liability period, liquidated and ascertained damages, quality, safety, payment, and compensation.

Modifications of standard contract forms that change risk allocation are mostly done via fluctuation and escalation clauses which are normally omitted or waived and this shifts the risk from client to contractor. Modifications are not always beneficial to all parties involved and should be made therefore with consideration of both parties interests. It has been demonstrated that clients use their power and interest to make unfavourable modifications which result is risk misallocation to create an unbalanced contract.

7.1.4 Deficiencies in contracts used

The contracts highlighted for use were the ZPPA type, FIDIC and the JLC (ZIA) contract. Most of the deficiencies identified result from contract preparation. In the public sector contracts are currently prepared by the procurement units. These are people trained in procurement of goods as opposed to infrastructural facilities as highlighted by PUP02. The following were some of the comments from the respondents:-

"Currently the procurement office is given the duty to prepare contract documents. They do not have a clue what happens in construction. We only

prepare bills of quantities and they prepare the contract document. They prepare documents with deficiencies".-PUQS

"The procurement entities in the various departments or units structure the contracts. As departments we prepare BOQs. These are sent to the procurement units to make the contract. This was initially done by ourselves".-PUPM

"...Procurement units are the ones responsible to include whatever ZPPA has approved to be included in the contracts". -PUA

When asked the kind of deficiencies in these documents one response was:

"Sometimes they do not indicate the retention period or omit the retention clause entirely, other times the insurance minimum cover is not indicated. Liquidated and ascertained damages are not indicated at times. There are many deficiencies". -PUQS

Apart from deficiencies arising from the preparation, 12/15 respondents reported that documents are generally not read by contractors and 11/15 respondents reported that clients are usually in breach of the contractual provisions:

"We do not read the provisions that are there, the client does not follow for instance when there are delays caused by the client claims for extension of time are difficult to make successfully though under the contract conditions this is valid" -PRC3

Respondents from both the private and public sector pointed out the following deficiencies or shortcomings in the contracts they use. This was an avenue to explore in general the deficiencies in contracts and the reported ones are summarised in Table 7.3.

ZPPA open national and small works contract

- Payment clause (payment within 28 days is not feasible)
- GCC 20.1 Site possession 7 days after signing contract (not practical due to other logistics such as building permits)
- GCC 33.1 Defects liability period fixed as 12 months (may not include a rainy season for testing the roof)
- GCC 48.1 Advance payment fixed at 20% within 60 days(not possible in practice due to clients bureaucracy or lack of funds)

- GCC 1.1 commencement date 14 days after signing (pre-requisites-site handover, performance guarantee, mobilisation which are not normally attainable within stated period)
- GCC 49.1 (a) no time limit for performance security provision given to the contractor hence the performance security can be obtained at any time by the contractor
- GCC 7 sub-contracting is not limited to a percentage but 20% of the contract sum may not be exceeded
- GCC 18 safety- contractor not compelled to ensure basic safety as there are no penalties for non-compliance
- Lack of provisions and guidance of how monitoring and supervision should be done
- Interest on late payment (not honoured as client is not compelled to comply and enforcement is difficult)
- Appointment of arbitrator by client without contractor involvement of occasion
- Decision of the place for arbitration by client without consulting the contractor
- Provision of risk assessor on safety issues (needed to improve safety)

FIDIC-Red book/ ZPPA open international

- Payment clause (payment within 28 days is not feasible due to bureaucratic process and lack of funds on occasion)
- Subcontracting is a maximum 20 % of the contract sum; which for specialised work electrical , plumbing, roofing (most times inadequate) is inadequate as these are areas where it is most needed
- Fluctuation clauses and escalation clauses (these are removed from original red book to the detriment the contractor) omitted on government works. No compensation apart from delayed payment.
- Lack of provisions and guidance of how monitoring and supervision should be done by consultants
- Appointment of arbitrator by client without consulting contractor
- Decision of the place for arbitration by client is made without consulting the contractor
- Use of nominated contractors only resulting in contractor not having a say in the matter
- Removal of payment guarantee clause (disadvantages the contractor)
- Need for the provision of a risk assessor on safety issues

Joint Liaison Committee (JLC/ZIA)

- Payment clause (period not realistic due to bureaucratic process and lack of funds on occasion)
- Lack of interest on late payment (no provision on the contract)
- Critical standard provisions such as variations limits, retention, statutory approval are sometimes omitted
- The non-existence of the option to insure the works during defects liability period so as to release retention fund
- Insurance of works after sectional completion by client is non-existent
- The contract does not clearly outline compensation events and the criteria for enforcement is not outlined
- Termination events are not clearly outlined hence client may decide to terminate at will to the detriment of the contractor

Various deficiencies were highlighted mostly relating to clauses that deal with time bars and payment (Table 7.3). There is a need to curtail these risks by putting realistic periods for activities. In other instances, clauses should be provided to cater for certain events such as defects liability period that will cover a rainy season or shifting liability for work that has been handed over to client from the contractor. In some cases decisions have to be made jointly by client and contractor e.g. on dispute resolution, use of domestic/nominated subcontractors and removal of vital clauses from the standard form of contract without according the contractor alternative methods of recourse. From the interview findings, some of the aforementioned deficiencies occur due to lack of approvals from the various professionals e.g. provision of securities; and lack of negotiations with contractor at contract signing stage to arrive at a mutually agreeable contract e.g. place of arbitration.

Further to this, the interviews provided evidence that especially in the public sector; compliance was scare to contractual provisions such as provision of bonuses for early completion and awarding of costs with extension of time.

Table 7.3 Identified deficiencies in Contracts used

Issue needing attention	JLC	FIDIC/ZPPA international	ZPPA-Open national and Small works
Payment period	X	X	X
Interest on late payment	X		X
Variation limits	X		
Retention	X		
Statutory approval	X		
Insurance options (defects liability period)	X		X
Insurance Sectional Completion	X		
Compensation events	X		
Termination	X		
Sub-contracting threshold		X	X
Escalation/Fluctuation clauses		X	
Payment guarantee clause (removal)		X	
Provision of risk assessor		X	X
Monitoring/supervision guide lines		X	X
Use of nominated contractors		X	
Appointment of arbitrator		X	X
Place of arbitration		X	X
Safety			X
Provision of security by contractor (time limit			X
Period for release of advance payment			X
Site possession/commencement period requirements			X

7.1.5 Types of clauses used in contracts

a) Penalty clauses

These are clauses used to punish a party for non-performance. These are generally effective in risk allocation when both parties adhere to their contractual obligations. Nevertheless they are rarely utilised because the client is normally late in making payment as indicated by 9/15 respondents. While they are effective, they are difficult to implement due to default by the client. Both private and public clients tend to pay the contractor late, consequently it difficult to implement penalty clauses. However, contractors who have not been operational for more than three years do not know when to claim while those who know when to claim indicated that they do not do so in order to preserve the relationship with the client. Those who are successful in claiming only get extension of time and not cost. This clearly is not in line with the contractual provisions. This lack of enforcement of penalty clauses on public works normally results in audit queries. Such clauses are only effective when parties carryout their roles especially the client.

b) Escalation clauses

Contracts beyond a 12 months period should ideally have an escalation clause in anticipation of changes in prices for materials, plant/equipment and labour. The contract type mostly used in both private and public sectors in the Zambian construction industry is the fixed price contract. According to the majority of the respondents (11/15) the escalation clause is generally removed or waived, especially when dealing with fluctuations of material prices and exchange rates. Interest on delayed payment is normally maintained though it is difficult to implement as the client is not always compliant. Contractors are of the view that the escalation clause should be maintained moreover consultants interviewed were aware of the fact that contractors tend to over-price due to the absence of this clause. Therefore by removing this clause from the contract, the client could be unnecessarily paying for risk(s) that do not eventuate. This is what one of the contractors had to say about the escalation clause.

> "*…contractors are given the risk for escalations, they are required to pay for all those materials or labour fluctuations. In the end it impact negatively on the delivery of the project so why maintain it when it's not benefiting the client in the final analysis. So client should just accept and pay*"- PRC2

In cases were escalation clauses are provided especially by some private clients, contractors tend not to claim, in order to maintain a good relationship or avoid the client's attitude towards the claim (see comments below). Nevertheless, the client should ask themselves whether they are helping the contractor by denying them what they are entitled to, resulting in opportunist behaviour in form of high bids.

> *"These are not claimed to maintain a good relationship" PRC1*

".. Even if claimed for, they are rarely honoured. It does not work so instead we try to use provisions for extension of time to minimize our losses." PRC2, PrC3

c) Exemption clauses or exculpatory clauses

Most of the respondents (13/15) did not seem to know what this type of clause is and often asked for examples. Once this was done they indicated that generally warning must be given by the party intending to use the clause in writing and should be bolstered by a substantiation. It was generally implied that these clause types are not applied though are present in the contract documents currently in use. Therefore, it is possible that claims have been made outside a time bar and may have even been successful based on comments below. However, from the contractor's perspective; it is more likely that claims resulting from exemption clauses may have been ignored to maintain a relationship with the client. Nevertheless, contractors are cautious about the amounts involved. The view on the seriousness of this type of clause is depicted from some comments of respondents below.

"We do not really keep to those minute details"-PRPM

"This is rarely done but if amounts are big then we try to go directly to the client despite the applicable clauses applied' –PRC2

"Exculpatory clauses are rarely followed because opportunities for then to be used are few. We normally do not claim for fear of missing out jobs' - PUCL

"We rarely apply this even when we should to maintain a good relationship but it also depends on how much is involved….." –PRC1

Clearly, this type of clause is rarely applied. Its application depends on how much is involved versus the preservation of relationship between the client and the contractor. Its application is not consistent with contract provisions.

7.2 Risk allocation practices in the Zambian construction industry

Before exploring the risk allocation practices in the industry it was also important to first have an appreciation of risk impacting on projects in the industry. This in part helped to answer the following research question:

Research Question	Sub-questions
How are risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?	➢What are the pertinent risks? ➢What risk misallocations occur?

7.2.1 Risks impacting on performance in ZCI

The most prevalent risks as indicated in the Table 7.4 below were late payment (12/15); poor inspection, monitoring and supervision by both client and contractor (11/15); contractor's financial difficulty (11/15), lack of adherence to contractual provision by client (indicated by 10/15 especially were compensation was due to the contractor), followed by other risks as shown.

Table 7.4 Risk importance

Risk affecting performance	Risk Factors
High importance (indicated by 10-15)	Late payment, contractors financial difficulty, lack of inspection, monitoring and supervision, lack of adherence to contractual provisions
Moderate Importance (indicated by 5-9)	Change in material prices and exchange rates, slow and bureaucratic decision making process, poorly skilled artisans and poor workmanship, incomplete and insufficient designs, extension of time without costs, unavailability of funds/budget, changes in scope
Low importance (indicated by 0-4)	Lack of interest on delayed payment, poor quality works, non-compliance to tender requirements on site, difficulty in implementing clauses, poorly prepared contract documents, poor quality of materials, unavailable material, contractor's lack of skill and experience, difficult access to site, late site hand over by client, corruption, poor interpretation of contract,, poor safety on site, disputes, high taxes, political interference, inclement weather, low level of sub-contracting, inadequate site investigation

The risks are diverse in nature due to the diverse nature of building projects. Late payment is mainly attributed to poor financial standing of the client, poor budget planning or bureaucratic processes. While many acts by the client e.g. omission of escalation/fluctuation clauses and non-compliance to contract conditions, are aimed at reducing costs however, the eventuating consequences such as interest on late payment, project abandonment and slowing down of work by the contractor does not equate to reduction in costs.

7.2.2 Nature of Risk Misallocation in the Building Sector

One of the fundamental questions to be addressed though established in other studies was the existence of risk misallocation in the Zambian building sector. As shown in Table 7.5 all respondents responded that the allocation of risk is not balanced because contractors are compelled to carry more risks than the client. Additionally, in certain instances, risks which are better shared between the client and the contractor, such as escalation in the cost of materials and unstable exchange rates, are shifted to the contractor even for contracts beyond a 12 month period. The underlying reason for this practice, as explained by the consultants, was to minimize the cost to the client. It was also clear that certain methods of allocation preferred by the client contributed to misallocation, such as the practice of obtaining bonds from banks only and the allowable level of subcontracting. This was indicated by 9/15 of the respondents. Some risks were not allocated despite being specified in the original standard forms of contract which were modified using waiver clauses, leading to some clauses becoming non-applicable

Table 7.5 Nature of risk misallocation in the construction industry

Nature of misallocation	***Frequency***	*%*
Unbalanced risk allocation	*15*	*100%*
Wrong/imperfect method of allocation	*9*	*60%*
Risk allocation to wrong party	*9*	*60%*
Lack of allocation in signed documents	*3*	*20%*
Inadequate or wrong resources used in allocation (personnel)	*12*	*80%*
Inadequate or wrong resources used in allocation (plant or equipment)	*6*	*40%*
Inadequate resources used in allocation (finance)	*15*	*100%*

The respondents (9/15) suggested that sometimes either the client or the contractor is wrongly allocated a risk resulting from modification of a standard contractual clause, such as the omission of fluctuation and escalation clauses. Lastly, it was also common to allocate resources wrongly due to underestimating the scope or nature of the work. This form of misallocation would be mainly in terms of inappropriate finance allocation, as reported by all 15 the respondents; insufficient personnel to supervise and monitor the works, as pointed out by 12 respondents and insufficient or wrong plant and equipment revealed by 9/15 respondents. This is occasioned by incomplete design and a lack of investigation of the site conditions.

This section covers the interview results from the question and sub-questions shown below.

Research question	Sub questions
What are the risk allocation practices used by contracting parties in the ZCI?	➢Have contracting parties in ZCI had formal training in managing risk/risk allocation? ➢What are the perceptions of risk among players in ZCI? ➢What is the rationale behind risk allocation in the ZCI? ➢What are the barriers to risk allocation? ➢What methods/tools/practices are used to identify, assess and respond to risk? ➢What do professionals learn from past projects about risk allocation?

7.2.3 Formal training in risk management (interview)

The more than half of the respondents 9/15 (60%) had some formal risk management training in risk identification, analysis and risk response. This was mainly through university curricula, workshops/seminars/short courses and professional certification (RICS). This coupled with experience helped them to identify, analyse and respond to risk. The remaining 40% mainly depended on experience to carry out risk management.

Figure 7.2 Risk Management Training (Interviews)

7.2.4 Perception of risk

The way risk is perceived heavily impacts how the allocated. What is perceived to be of high impact is given more attention than low impact risk which should be considered as less serious. The current body of knowledge is of the view that a risk is an occurrence that can have either a negative or positive impact on project performance once it has occurred. The 15 respondents were asked what their perception of risk was and below are some of the responses.

<u>Perception</u>

"Risk on a construction site is negative –PUAR1

"Risk is when a contractor doesn't perform sometimes due to economic situation…..our main risk is late implementation. When we advertise and bidders are non-responsive because they have not met the requirements for technical, do not have qualified personnel, basically the requirements are not met". –PUPR1

"Risk is in the contracts" PRC3

"Risk is mainly negative aspects that affect quality and cost of construction -PUCE

"Risks are real. Risks exist in every project. Risks have negative impact on project" -PUQS

"Risks mainly depend on how they are managed, if poorly managed it will have a negative impact while if managed properly there may be no negative impact" -PUQS

"Risks are always present in project but as a developer one has to learn to mitigate risks in order to ensure that profits are realised out of a venture"-PRCL

"everyone looks at a risk as a negative something that stops you from engaging into a business but from a professional point of view there is nothing that you can do without a risk so you always want to look at a risk as an opportunity to improve your service"-PRA

"Risk is a possibility of failure that can affect either the client or contractor"PRC2

"Risk is the possibility of not completing a project e.g. due to lack of funds"-PRCE

"Risks are usually too much especially on safety of projects" PRC1

"In procurement there are no-known risks, these usually manifest during the implementation phase"PUPR2

From these responses, risk was mainly seen as an event or occurrence negatively impacting on the project event however the effect depends on the primary role of the professional e.g. design, cost. Some respondents mentioned lack of assurance that payments will be effected; another cited the risk that the award of project may not materialise after incurring tendering expenses, on the other hand one respondent saw it as an opportunity to improve their service. In addition, the negative aspect of risk seemed to have some risk factors such as economic situation, and poor management. It was also further implied that there is a specific place where risk is to be covered (in contract) or is manifested (mostly in the implementation or construction phase). Nonetheless, other respondents did emphasise that late implementation and non-responsive bids are what they perceive as risk. The perceptions are diverse and risk is mainly viewed as an event with a negative impact on a project, congruent with the findings of Hartono, et al, (2014). It was also widely understood that all projects have risk(s). Notwithstanding that the current body of knowledge presents risks as positive (opportunities) and negative (threats) (Project Management Institute, 2008); current perception of risk in the ZCI is mostly negative, implying that opportunities resulting from risk are hardly exploited.

7.2.5 Rationale for risk allocation

Bunni (2009) and other researchers have pointed out various methods for allocating risk however what has come out from most of these studies is that risk should be allocated to the party most competent to manage it. When asked the rationale for risk allocation in the industry various respondent believe that the allocation is based on responsibility 9/15, transferring to the contractor 2/15 (views from consultants) while others believe it is based on ability to manage the associated impact. One of the respondents' summarized the rationale for risk allocation as follows "*Responsibility is the main driver of risk allocation who can best be associated with the risk, the client or contractor"-PUPM*. At this point the question would be, is the person responsible best suited to be liable for the risk and secondly what about risks for which no one is responsible (external risks)? Is the responsibility adequate as a means for risk allocation? The extant literature underpinning that the best person able to manage the risk should be allocated the risk, implies that responsibility alone may not be the best allocation factor.

7.2.6 Description of risk allocation in the ZCI

Giddens (1984) structuration theory posits that an agent only begins to make changes to what they perceive as a situation needing transformation. It was important to find out what players in the construction industry thought about risk allocation practice. The implications for practice would be that a balanced risk between the client and contractor would result in maintaining current practice while if the opposite was true then some transformations would need to take place. It was unanimous that risk allocation in the industry was not balanced and heavy on the contractor. Below are some relevant extracts from the interviews.

> *"Risk is not balanced contractor carries most of the risk. Clauses meant to protect the contractor are not implemented" PRC3*
>
> *"The rationale is to ensure that a contractor bears as much of the risk as possible…" PUC1*
>
> *"I would say the contractor has more risk than the client"PRC1, PUPR*
>
> *"I would say it is balanced in the documents but in practice it is a challenge"-PUQS1*
>
> *"I would say the contractor carries most of the risk. It is assumed that the contractor usually prices the risk"- PUQS2*
>
> *"It is not balanced, not at all, not even a bit. It's not balanced. The contractors are made to take a huge share of that risk" –PRC2*
>
> *"At the moment my perception is that it's heavy on the contractor than on the client" -PUA, "Contractor carries most of the risk" PRA,*

It appears from the responses that the contractors have more risk to contend with than the client. Most of this has resulted from the omission of certain clauses that protect the contractor in the contract documents. The clients feel this practice reduced their transaction cost, for instance the omission of escalation clauses and a lack of granting extension of time with costs means the contract sum remains constant. However, does the client benefit from resultant actions such as slowing down of work on site or project abandonment or having to deal with claims of various natures from the contractor? The answer is not at all. Therefore, there has to be a change in the way risks are allocated.

7.2.7 Methods of Risk identification and Risk analysis

The most common method of risk identification (See Table 7.6) is experience and its application could be said to be un-formalised and unsystematic. These characteristics arise due to differences in levels of experience and in the nature of experiences seeing that similar projects may face different risks even when implemented in similar locations and time. Most practitioners depend on what they have experienced in past projects to identify risks on future projects. Naturally not all risks eventuate on a particular project so experience may not be the best method to base risk identification on, under today's diverse dynamic physical, social and economic conditions.

Risk analysis is not done very often in the Zambian building sector. The respondents who reported that they conduct risk analysis do so mostly by the use of qualitative methods. It was further indicated that risk analysis is rarely conducted due to limited know-how.

In summary when risks are identified, analysis is rarely done. The methods used could be subjective as they are based mostly on experience. New entrants in the industry who do not have much experience may be disadvantaged as there is no objective way of risk identification or analysis in the Zambian building sector.

b) Methods of construction

Methods of construction are used to allocate risk especially to the contractor who sometimes has various options on how to produce a structure, with various outcomes. These outcomes can sometimes be controlled by the client and consultants through prescribing the methods to be used. However, in the Zambian construction industry this method of risk mitigation is left for the contractor to decide. One respondent indicated that consultants normally ask for method statements to be able to evaluate a method to be used. However, in exceptional circumstances methods of construction are indicated and agreed between client and contractor.

Table 7.6 Risk practices in ZCI

	Primary profession	Risk identification method	Risk analysis method
1	QS	Past projects, regional characteristics, level of education of area, how friendly the community is, economic and social factors, also consider risks prevalent in an area by talking to locals	Intuition, experience
2	Civil engineer	Past projects, experience, local knowledge about an area	Project analysis (SWOT)
3	Procurement officer	contractor	none
4	QS	Experience, particular area information	None
5	Architect	experience	Experience, Project analysis (SWOT), judgment, contractor performance in relation to project deliverables
6	Civil engineer	Experience, documentation of project, site investigation	Intuition, experience, work task analysis, safety requirements
7	QS/PM	Document review, experience, intuition, site location	none
8	QS	Meetings, experience	none
9	Architect	Meeting, experience	none
10	Engineer	Method statement, experience	none
11	QS	Contract documentation, construction process,	Experience , judgment
12	Project manager	Experience, cash flow, document review, compare projects	experience
13	Architect	Experience, local knowledge, meeting	Experience, meetings
14	Procurement officer	none	none
15	Architect	Experience, intuition, site investigation, past projects, meetings	Cash flow, meetings

"*It's up to the contractor to decide. You are just given the drawings of that what is required. So as a contractor you have to figure out how to produce that structure*". *PUPM*

"*Mostly we devise our own methods of construction. But we have a challenge in finding ways that can make the work move faster. For this we need the right equipment and personnel to move the work fast- PRC3*

"..Contractors will normally do work the way they see fit and since the supervision is not regular the works are sometimes affected in terms of quality".-PUCE

"Methods of construction are not dictated but we devise what we deem right and use it".PRCL2

It was acknowledged that methods of construction used are basic and not highly mechanised. However, the construction industry in Zambia lacks skilled tradesmen. This concern was highlighted by 7/13 respondents (2 respondent declined to comment) when asked about risks encountered on building projects. It was stressed that methods of construction are attainable with supervision.

c) Insurance/Bonds

Insurance and bonds are one of the major methods of covering risk in the construction industry. This is a means of transferring risk to a third party. Obtaining of bonds and insurance has become easier than in the past however, the availability of bonds and insurance does not mean these are easy to obtain. All the contractors and some consultants interviewed expressed a variety of concerns. See comments below

Contractors

"It's a financial instrument. It has financial connotation……you have to provide collateral for it… so you find most of us do not have those fixed assets…..Obtaining insurance or bonds is not difficult as a process per se *but the challenge comes in when you have several projects and need to get bonds for all of them this reduces our cash flow" PRC2*

"When we have many projects money is tight; so in that instant it is difficult PRC1'

Consultants

"Those (meaning insurance and bonds) they are easy to obtain we sometimes disqualify tenders on this basis of failing to provide bonds/insurance"- PUPR1

"It's easy to get cover for coverable risks…things like negligence are not coverable"-PRA

"Banks want collateral. You know so if a contractor has one house and is tender or involved in several projects there is that aspect which is very restricting on the capacity of the contractor." -PRQS

"The insurance houses might not want that kind of firm collateral if you like. …they are a bit more flexible but the problem actually begins with the client who might say they want a bond and or a guarantee approved from the banks other than insurances or building society"-PRPM

Is obtaining bonds easy?" For those contractors who are in good standing with the banks and have a good relationship…yes"-PUA

"We have had challenges with contractors for them to secure bonds….. Sometimes they fail to raise these bonds"-PUCL

"*Obtaining bonds could be said to be easy but it's a challenge. Contractors have been said to be non-responsive due to not providing these due to the requirement of collateral'-PUPR1*

"It could be said to be easy but it's a challenge. Contractors have been said to be non-responsive due to failure to provide insurance and bonds due to the requirement of collateral… Sometimes it has been difficult to start a project because advance payment has not been guaranteed due to strict rules of the bank"-PUPR2

Evidently, obtaining bonds and insurance are not difficult as processes; but is surely a challenge in practice. The main hindrance being that clients mostly require bank issued guarantees/bonds and these need collateral in form of fixed assets. These in turn limit the cash-flow for the contractor. The clients should allow contractors to obtain securities from insurance houses as these often charge premiums as opposed to asking for collateral in form of fixed assets. By so doing the client would help improve the contractors' financial challenge which was indicated as the fourth most pertinent risk impacting on performance in the Zambian building sector .

d) Contingency (sums) and float

Contingency sums are a common measure for responding to financial risk and time-related risks. While it is generally accepted that time-related risks are covered in the duration of the project, contingency sums are normally dictated as a percentage of between 2.5% to 10% of the contract price depending on the nature of the works. However, these are only deemed adequate if limited to the initial scope of works, implying that whenever there is an increase in scope the sum becomes inadequate. Changing of scope by the client is one of the risks highlighted by contractors and consultants. Subsequently, provisional and prime cost sums affect the accuracy of predicting the contingency sums. Respondents suggested that the fewer the items provided through provisional and prime cost sums the higher the accuracy of predicting the contingency sum therefore making it more adequate. It was pointed out by 13/15 respondents that contingency sums are never adequate to cover for uncertainties. These respondents pointed out that contingency sum and float are only adequate when firstly, the initial scope is unchanged and secondly, when the items included in the bills of quantities are accurately measured.

e) Subcontracting

Sub-contracting is mostly used to cover risks of capacity and also to have specialised works done by experts. All the respondents who were contractors indicated that in some cases the level of subcontracting is inadequate as it needs to be dependent on the actual work that needs to be subcontracted as opposed to relying on the regulatory 20% of contract sum for public works. One responded commented "*there are times when the specialised work is more in value compared to the rest of the works e.g. combining plumbing, electrical works and mechanicals such as lifts, escalators, air-conditioning"-PUCL*. Sometimes the work value that needs to be subcontracted is more that the allowed 20% however, depending on contractors work load this is unavoidable. The general views on subcontracting were that firstly, sub-contractors should not be imposed on main contractors and secondly the level of subcontracting should be dealt with on a project-to-project basis based on the need. This was the view of all contractors who were interviewed.

7.2.9 Risk allocation barriers

Barriers to risk allocation are those issues that hinder the appropriate/equitable allocation of risk (See Table 7.7). During the interviews several issues were highlighted as shown in Table 7.7. From the comments in Table 7.7 it could be deduced that the biggest barriers to risk allocation were risk perception; appreciation, awareness, knowledge and training. Risk allocation is highly affected by perception (Lehtiranta, 2014). It therefore follows that a risk that is not perceived cannot be allocated. Most practitioners have some knowledge and training about risk however, more training is needed to foster a systematic approach to risk management.

Table 7.7 Risk allocation barriers

Comment (partial)	Concept	Categories of themes arising
1. Limited knowledge and skill (PUPM, PRPM, PUCL) 2. Lack of training (PUPM) 3. Lack of education (PRPM, PUCL) 4. Lack of understanding of current risk allocation practices (PRPM,PUCL,PRCL)	Limited knowledge lack of training Poor risk practice	Knowledge and training
5. Limited Budget allocation, (PUPM 6. Poor financing of projects (PRC3,PRC1,PUCL) 7. Unaffordable sources of bonds and insurance (PUCL,PUPR1)	Poor allocation of funds	Finance
8. Poor monitoring (PUPM,PUPR1,PUPR2,PRCE) 9. Lack of early warning of risk (PRCL)	Un-formalised monitoring	monitoring
10. Indifference towards consequences of risk misallocation (PRCE, PUA) 11. Poor consciousness /awareness (PRCE, PRPM) 12. Poor appreciation of risk impact on project delivery, (PUCL, PRA) 13. Aversion towards the criticality of risk, (PUCL, PRA) 14. Work processes not understood in terms of risks presented by the work task (PRC1)	Non prioritization of risk Consequences of risk	Risk Perception
15. Lack of implementation of contract clauses protecting the contractor (non-compliance to contract provisions) (PRCE, PRPM) 16. Fear of bad public relations when claims on risk events are made (PRCE)	Poor implementation of contract clauses	Implementation

7.2.10 How past experiences influence risk allocation/response

Structuration theory emphasises how agents can be creative by overcoming problems based on past experience. It was important to find out how past risks influenced future risk practice. This was done by understanding the creativity of the agents as a step to transforming their future through their past experiences. Most of the responses on this question were based on

Table 7.8 Past experiences influence on risk allocation/response

Comment	concept arising	Categories of themes arising
Helps to modify contracts to safeguard interests of contracting party (PUQS) To better contract documentation and contract administration (removal of unfair clauses) (PRQS)	Modification of contract	Contract documentation
Studying the drawings for any mistakes for early rectification. (PRC1/PRC2) Insisting on feasibility studies (PRA) Eye opener on what to look out for (PRC3)	Studying drawings Feasibility study	Risk identification
Slow down work on site (PRC2) Providing resources for monitoring (PUPR) Payment only after proof of performance (PUQS) Use of proper safety precaution (PRC1) Petition of down-grading of some contractors (PUCL) Being careful in contractor selection (PUPR)	Progress of work Monitoring Payment Safety Contractor selection	Risk response
Having allowance for late payment (2.5%) (PRCE.) Employing consultants early (PUCL) Start project only when the budget is available (PUPM) Consultant to advise consultants on what is expected of them (PRCE.) Doing work correctly from inception to avoid rework (PRC1) Sourcing of finance and studying the drawings for any mistakes for early rectification. (PRC1, PRC2, PRC3)	Payment Finance Avoid rework	Risk mitigation
Insisting on feasibility studies (PUA) allow for subcontracting (PUPM)	Feasibility study Subcontracting	Risk planning

risks that had been faced before. There was no real sense of agents being able to predict other risks but the risks faced were used as learning tools to guide against future occurrences. The following themes arose from the qualitative data from the interview transcripts and the open-ended question in the questionnaire survey. Table 7.8 shows the themes and categories arising out of how past risks influence future projects risks response/allocation. The terms concerned with analysing the influence of risks in past projects on future practice as expressed in interviews are outlined below:

Interview responses

a.Contract documentation

Modification of standard contract forms is an accepted part of practice. The question asked was how past risks influence risk allocation and response. Quantity surveyors interviewed indicated that they use past experience to safeguard the interest of contracting parties and also to remove unfair clauses. However, when contractors asked to comment generally on clauses used they indicated that most of their negotiations with clients are on the use of unfair clauses. This is an indication that contract documentation needs to be worked on to reduce unfair clauses.

b.Identification

Risk identification is the first stage in risk allocation. One of the themes arising from the influence of risk on past projects is that it helps one to identify risks on drawings by identifying what is missing and in general these risks serve as "*eye openers on what to look out for*". Clearly this suggests an element of wanting to be proactive so as to ensure risks are reduced before they occur. This is also the idea behind having feasibility studies to ensure that risks are appreciated beforehand.

c.Response

Risk response is the aspect of risk allocation where the persons liable for treatment of the risk are identified and the mechanisms for response decided on. Various responses are resorted to depending on the nature of anticipated risk/ Contractors seem to think that when the client is defaulting, slowing down work on site will make them respond. Contractors also take safety precautions to prevent accidents, while procurement personnel believe that if monitoring is done risks will not eventuate, quantity surveyors are mindful that contractors do not always make valuations equivalent to what has been done and so before payment, proof of performance has to be confirmed. Procurement officers and clients feel that care must be taken in selecting a contractor to execute work. Consequently, contractors should be in a grade that is reflective of their capacity

d.Risk mitigation

Mitigation is understood as lessening or alleviating a risk. Some of the measures for risk mitigation are given below.

- Having allowance for late payment (2.5%) (PRCE)
- Early consultant's involvement (PUCL)
- Commencement of project on confirmation of budget/funds (PUPM)
- Well-articulated consultant brief (PUCE,PRCE)
- Proper design quality from inception to avoid rework (PRC1,PRC2)
- Declaration of source of finance and studying the drawings for any mistakes for early rectification. (PRC1/PRC2)

From this list it is clear that various measures are taken by project team members to avert risks which they are sure will eventuate at some point during the project.

e. Planning

Planning is an important aspect of any endeavour. Conducting a feasibility study on a project helps to identify risks and also to put measures in place to mitigate the risks. Subcontracting is another measure to ensure quality for specialised work and so to increase the capacity for performance.

Questionnaire responses

The questionnaire responses on how past risks affect risk allocation or response to future risks is discussed below. Each comment is given partially or in full Pseudo codes used in the reporting are shown in Table 7.9.

Table 7.9 Pseudo codes for Questionnaire survey

Category	Category description	Code
1	Quantity Surveyor	QS 1-32
2	Contractor group 1	Ka 1-20
3	Contractor group 2	Kb 1-15
4	Contractor group 3	Kc 1-42
5	Client	CL 1-6
6	Engineer	ENG 1-28
7	Project Manager	PM 1-14
8	Architecture	AR 1-38

Table 7.10 Summary of responses from questionnaire on use of past knowledge on new Projects

Respondent and No. of comments	**Risk avoidance and mitigation**	**Lessons leant**	**Risk planning**	**Contract documentation**	**Risk identification**	**Risk response**	**Risk analysis**	**Risk allocation**
Architects (26)	6	0	6	3	5	5	3	2
Project managers (7)	2	2	3	1	1	1	0	0
Client (5)	2	2	3	0	0	1	0	0
Quantity Surveyor (21)	8	2	1	2	1	3	0	5
Engineers (16)	4	3	1	1	0	5	0	2
Contractor Group 1(13)	2	1	5	0	1	4	0	0
Contractor Group 2 (10)	8	1	6	0	3	3	0	1
Contractor Group 3 (31)	6	2	2	0	7	31	0	0
Total (129)	38	13	27	7	18	53	3	10

*Note in some cases more than one issue was raised

Issues arising from Past projects on New Projects

An open-ended survey question was asked to elicit from the professional respondents how risks allocation influences future allocation and responses on new projects. In total 129 comments were obtained and by using thematic content analysis these were categorised as shown in the Table 7.9. The majority of themes were about risk response followed by risk avoidance and mitigation. The specific themes are discussed theme by theme in the next section.

f.Risk Avoid/mitigation

Experience of past risks equips the practitioner in the building sector to lessen and avoid risks. This is shown in Appendix 9A. The experience helps the contractor to manage risk better in the future. Engineers claimed that it helps them transfer risks more cost effectively. While quantity surveyors, architects, project managers and contractor reported that past risks faced help them to foresee, plan and manage projects and so handle risks better in future. From the contractors' perspective, it clear that some of the risk mitigation learnt is about what type of clients and projects to engage with. Generally, realistic cost and construction periods are arrived at based on past projects

g.Lessons learnt

Generally, past risks present a learning experience to those involved as shown in Appendix 9B. This is true among contractors, architects, project managers, quantity surveyors, and engineers. Learning involves risk identification, risk avoidance/reduction, performance and delivery improvement. In terms of theory this provides evidence of a learning curve in risk allocation practice in the ZCI as it demonstrates that repeated experiences have enabled practitioners to gain skill.

h.Risk Planning

Risk planning is an important part of dealing with risk. It is clear that past risks forms a basis for risk planning. The planning informs resources to use, possible risks to be faced, safety precautions and achieving realistic estimates for works (see Appendix 9C).

i. Documentation

In their quest to better allocate risk consultants seem to have acknowledged that there is a need for documentation and specifications that is clear and detailed; to have clauses that are in accordance with market conditions, to update standard forms, to add clauses to clarify risk allocation as shown in Appendix 9D. This is an indication that current standard forms are inadequate in some areas hence the need to be modified. This is in line with the question on deficiencies of contracts in use.

j. Identification

Past projects are a good resource of identifying risks as demonstrated in Appendix 9E. Consultants and contractors alike identify risks from past projects. In essence past projects make risks foreseeable, recognizable and certain scenarios avoidable. This is more relevant when projects are similar.

k.Risk response

From the responses shown in Appendix 9F much of the experience of past risk influences risk response. It has enabled various players to respond to risk accordingly. Some of the response measures included use of skilled labour, assigning realistic duration to projects and appropriate resources, allowing for price escalation and demanding more information to be able to have full appreciation of risks. The responses were dependent on the project role of respondents. Consultants, contractor's client and procurement officers will respond to risk as best suits their role.

l.Risk Analysis

The analysis of risks helps to determine the severity of identified risks. From the results shown in Appendix 9G there seems to be an indication that risk analysis is done by very few players in the construction-building sector. Only architects seem to use risk analysis learnt from past projects.

m.Risk allocation

Based on past projects consultants reported (see Appendix 9H) that they use past risks to better allocate risk in future projects. Analysis of risk allocation effectiveness leads to noted improvement in areas such as remedies for use to counter particular risks, risk allocation improvement and evaluation of the adequacy of remedies.

Summary

Giddens structuration theory supposes that agents transform current practice to bring about changes in their environment (Giddens, 1984). The data from interviews and questionnaire survey was analysed thematically and the following categories emerged about what improved from experience of past projects: risk mitigation, risk allocation, risk planning, risk identification, contract documentation and lessons learnt (risk identification, risk avoidance/reduction, performance and delivery improvement). Most responses were about risk mitigation and risk response. These were presented in relation to the role of professional in the project. From this, one can conclude that the transformation in the building sector mainly hinges on practices of those involved and is role based e.g. design, documentation and so on. However it seems that changes to practice have not led to significant performance improvement given the current performance outcomes.

7.3 Questionnaire Survey -Qualitative Results

Research question	Sub questions
What factors influence the choices of contract forms on building projects to impact risk allocation?	➢ Are contracts used in their standard form? ➢ What are the common types of clauses used? ➢ What deficiencies exist in current contracts? ➢ Is the selection criteria appropriate?

7.3.1 Clause modifications

Table 7.11 Modification of contract clauses

Category	**Yes**	**No**	**Areas modified**
Client	5	1	Key personnel required, communications channels, insurance (3), inspection, quality, safety programme, extension of time, payment (2), securities, termination criteria, compensation events, variations, statutory approvals, retention (2), finance and payment related (3), defects liability (2)
Project managers	6	8	Appendices, payment and finance related, and change management, specific conditions of contract (3)
Total	11	9	

Standard contract forms are designed to achieve balanced and equitable risk allocation (Picakavance, 2005) so when modifications are made this may not be the case. The question was exploratory and from the findings summarised in Table 7.11 it can be concluded that most of the modifications made relate to project information and mostly concern financial matters.

7.3.2 Responses on types of clauses used

Table 7.12 shows the responses from respondents when asked on any general comment they had on clauses used in contracts.

Table 7.12 Responses on types of clauses used

Source	**Comments (some comments were not on clauses hence not reflected)**
Architects	Act as safe guard between client and contractor (3); clauses fairly adequate (4), at times client may not understand them as they too technical.
Quantity Surveyors	They are effective though they favour the client more in terms of risk and penalties. They make aware all parties about risks and available remedies, clauses need amendment according to project, clauses favour client, some clauses need to be revised.
Engineers	More instruments are needed to deal with poor performance; contractors rarely apply escalation clauses for fear of breaking relation, LAD rarely applied.
Project manager	Adherence and implementation of clauses is driven by level of professionals and prudence of parties involved, effectiveness depends on type of client, penalty clause is motivation for client/ contractor, there are more risks allocated to the contractor.
Client	Clauses on finance are difficult to effect, some clauses are difficult to enforce in an unstable environment, there is a need to revise clauses to cater for delayed payment, contractors rarely enforce interest on late payment clause in order to garner good will to as a way of securing future projects, the financial control system has made clause ineffective.

Quantity Surveyors: Quantity surveyors reported that the clauses give clear indication on what is expected from both parties and that the clauses favour the client more.
Architects: Responses from architects showed they perceive that contracts used are fairly adequate and act as a safeguard between client and contractor.
Engineers: Engineers reported that contractors rarely claim for escalation. Additionally, they suggested that the penalties/measures for non-performance are inadequate. However, it is unclear where the inadequacy is or it could be that the current provisions are difficult to implement.
Project managers: The clauses in the contract documents are a motivation for both the client and contractor to perform their roles. Nevertheless, contractors seem to bear more risks than the client does.

Clients: Generally, clients reported that financial clauses in their current state are un-enforceable. Consequently, contractors forego their financial entitlement to ensure they are employed again in the future.

Contractors

The contractors pointed out in Table 7.13 that escalation clauses are rarely implemented by the client and contractors seem not to ensure that this is done to enable them have projects in the future.

Table 7.13 Responses on types of clauses used (contractors)

Source	No of comments	Comments summary
Contractor Grade 1	5	interest on late payment clause not effective,, escalation clauses are sometimes followed, escalation clauses not followed (2), penalty clauses on delay implemented
Contractor grade 2	13	Escalation clauses are usually ineffective, escalation clauses not adhered to, some clauses are unattainable like prices going up, punitive measures are not taken to deal with contractors at fault, clauses protect the client and contractor loses, clauses not very effective because contractor normally not granted EOT with costs (2), not very effective because contractor normally not paid on time, clients apply clauses that favour them more e.g. no escalation clause., escalation clauses not included in public tenders, escalation clauses are not applicable on most projects
Contractor grade 3	26	Escalations are rarely honoured (2), fixed contracts are affected when kwacha depreciates, LAD clause is very effective, certain clauses used do not consider unstable economic situation, clauses are not implemented for fear of losing future contracts, not all penalty clauses are practicable, for compensation events contractor is left in uneasy situations, employers are reluctant to rectify losses., contractors on escalation never want to jeopardise relationship with client, application of clauses is on selective circumstances, when client is in the wrong there is a reluctance to apply clauses, escalation clauses are rarely enforced, clauses are applied selectively to local contractors, late payment of interest on late payment results in cost for the project (2)

7.3.3 Adequacy of contract documentation for making decisions on risk

As shown in Table 7.14 the majority of Grade 1 contractors (11/14) indicated that the contract documents are inadequate in the areas identified while only 3/11 thought that the documents were adequate to make decisions on risk. Amongst grade 2 contractors 8/20 felt that documents

Table 7.14 Inadequacies identified in contract documents

Contractor Grade	Sample size	Inadequacies identified
Grade 1	15	Lack of site information (2); lack of drawings at tender stage/late drawings (4); missing/omissions in drawings (5); inadequate detail (1), specification and design (5), getting details of other projects (1)
Grade 2	22	Inadequate detail in drawings and specifications (3); errors in the documentation (2), lack of drawings at tender stage (3); variances in contract documents (1); getting details of other projects (1), Lack of site information (1),
Grade 3	42	Missing/Lack of detailed drawings and specifications (11); incomplete drawings and specifications (2); inadequate information in BOQ (2), lack of site information (2), variance in Drawings and BOQs (2), getting details of other projects (1)
Total	79	Lack of site information – 5, Drawing & specification issues (detail, late, missing) -36, Getting details of other projects - 3 Variances/errors in contract documents -5

were adequate while 12/20 felt they were inadequate. Of the grade 3 contractors 17/42 indicated that documents were generally adequate against 25/42 who indicated that the documents are not adequate to make decisions on risk. In all, 53/76 or approximately 70% of the respondents indicated that contract documents do not give adequate information for risk purposes. The areas of concern pointed out are indicated in Table 7.14. Commonly cited areas were: lack of detailed drawings or drawings, lack of site information and getting details of other projects. This demonstrates a need for clients together with their consultants to adequately prepare contract documents especially where these are fixed price contracts. Moreover, Mousavi et al (2011) highlighted poor design specifications as sources of project failure. Aditionally, if ddesign is not complete then the popular fixed prices contract should not be used as highlighted in section 3.5.1.1). Design issues could be a reason why claims are rampant in the ZCI drawing on Minato's (2003) research.

7.3.4 Negotiation of conditions

Standard form construction contracts are widely used in the building industry. However, the forms could be modified or some information needed to make decisions on risk liability may be incomplete hence the need to have a discussion on some conditions set forth by the client. The questionnaire survey asked contractors whether they have an opportunity to negotiate the contract conditions before signing and Table 6.18 shows the response.

It is clear that more than 50% of the contractors negotiate for conditions change and terms that are commonly negotiated across all categories of contractors included Bill of Quantity items (materials specified) payment intervals and schedule, contract duration, advance payment amount and repayment procedure (Table 7.15). It is clear that contractors look for risks that could hamper their cash flow and ease of performance such as materials specified. This could also imply that when formulating conditions to deal with payment intervals and schedules, advance payment amount and repayment plan, clients do not consider the difficulties of cash flow faced by the contractor. Contractors pointed out that most negotiations are dependent on market conditions such as exchange rates because most materials used are imported.

The majority of contractors indicated that public sector clients only entertain negotiations on project conditions before the tender submission so that such negotiations are rarely entertained at signing. In the literature this form of contract is referred to as a contract of adhesion "take it or leave it" (Kanamugire, 2013) as shown in Section 4.2.3 in Chapter 4. This has resulted in contractors entering into contracts which they know are risky. Private clients are more open to negotiation.

Table 7.15 Contractual issues negotiated for (contractors)

Contractor Grade	No.	Negotiation for change	No negotiation for change	Changes negotiated for
Grade 1	13	9 (69%)	4(31%)	Liquidated damages (1), advance repayment plan (1), amount for advanced payment(1), materials in the BOQ (2), price adjustment (2), discounts asked for by client (1), unfair conditions/clauses (3), payment plan (1)
Grade 2	20	11(55%)	9 (45%)	BOQ items (1), payment plan (1), difference in specific conditions and bidding data (1), advance payment (1), contract duration (1), market trends-currency fluctuation (1), unfair conditions/clauses (4)
Grade 3	44	24(57%)	19 (43%)	Contract duration (2), payment terms (4), notification periods (1), materials in BOQ (2), discounts (2), advance payment (2), difference in specific conditions and bidding data (1), unfair conditions/clauses (6), market trends exchange rates/fluctuation (2), discount (1)
Total	75	44	32	Liquidated damages-(1) Payment issues …Payment plan/terms (6) Advance payment issues (5) Contract duration (3) Unfair conditions (13) Discount (2) Material issues (5) Escalation/fluctuation issues (5) Notification period (1) Variance between specific conditions and bidding data (2)

7.3.5 **Feedback -** Contractors

To investigate issues on feedback an open-ended question was asked as to the nature of feedback obtained by contracting parties as shown in Table 7.15A.

Table 7.16A Feedback

Contractor grade	No.	Feedback (Yes)	Feedback (No)	Issues on feedback
1	15	15	0	Quality of work (5), project behind schedule (3)
2	21	20	1	Quality of work (11), progress not as scheduled (5), safety issues (1)
3	42	39	3	Project behind schedule (12), increase labour force (1), quality of work (11) , where to source materials (2)
Total	78	74	4	Quality of works (27) Project behind schedule (20) Safety issues (1) Material source (1) Increase labour force (1)

The results indicate that the majority of contractors (74/78) do get feedback on their performance. Some contractors indicated that the feedback is monthly either during meetings or site inspections. The feedback is mostly on quality followed by project being behind schedule. The contractors seemed to have been of the notion that they only get feedback when there is something negative to report and seldom receive positive feedback.

Consultants

Feedback for the consultant seemed to have depended on role; either about quantity surveying issues or design issues. Most of the feedback for consultants was on design issues (Table 7.16B). The nature of design queries included lack of specification, design inadequacies, under design of project, more detail or clarifications on design. This was followed by estimates and variation issues. When it is came to risk allocation it appears that if designs do not have all details it is not easy for contractors to fully understand their risk liability. Furthermore, the use of firm-fixed price contracts is not suited when such vital information is lacking.

Consultants/Client

Table 7.16B Issues needing feedback

Source	Number of respondents	Feedback (Yes)	Feedback (No)	Issues needing feedback
Quantity Surveyors	23	19	4	Cost of project (3), additional works and variations (3), design inadequacies (2), estimates (5)
Engineers	23	20	3	Increase in scope (1), change in specification (1), alternative cost effective solutions (1), variations (3), unforeseen ground conditions (2), more design detail /clarification on design drawing (3), low estimates (1), delay in payment (1)
Architects	30	30	0	Inadequate design details (16), under-design of project (4), lack of specification (2), low estimates (4)
Total	76	69	7	Cost of project (4) Design issues (27) Estimate issues (10) Variations/additional works (7) Unforeseen conditions (2) Payment (1)

7.3.6 Motivation

Table 7.17 Motivational factors in Building Sector

Source	Financial	Non-financial	Other motivational factors
Architects	24	22	Professional experience (6), Responsibility (2), professional satisfaction of completing a project (3), Reputation (1)
Quantity Surveyors	21	18	satisfaction of completing a project (3), Professional experience (1), contribute to development (1), knowledge transfer (1), delivering quality(1), obligation (1), good working relationship (1), gaining knowledge (1)
Engineers	17	15	Professional development (2), gaining professional experience (3), gaining knowledge (2), pride in work done (1) , contribute to national development (2) , excellence and quality of product (3), recognition (1)
Project manager	9	9	Professional development (2), professional satisfaction of completing a project (2), professional experience (2), parties/gifts (1), company growth (1), client satisfaction (2), recognition (1)
Client	5	3	Professional experience (1), parties and gifts (1), professional development (1), up lifting end users (2), professional satisfaction of completing a project (4), professional obligation (1), appreciation (1)
Contractor Grade 1	21	4	Experience (2), satisfaction of achievement (1)
Contractor grade 2	13	4	Career/Professional development (1), Professional experience (1), contribute to national development (2)
Contractor grade 3	35	18	Professional development (4), bonuses (1), professional satisfaction of completing a project (3), Reputation (1), employer-employee relationship (1)
Total	145	93	Career/professional development (11), Experience and gaining knowledge (17), Professional obligation (2), Satisfaction of achievement/excellence (13), National development (3), Reputation/recognition (3), Appreciation/gifts/bonuses (4), Working relationship (2), Client satisfaction-(1), Uplifting end users (2), Knowledge transfer (1),

Many of the risks in most standard contract forms are based on responsibility in terms of allocation; client's finance projects, architects and engineers design while quantity surveyors offer cost related information (Table7.17). While these agents work as a team, how an individual is motivated in carrying out their role is key in their carrying out of any management function, risk allocation included, (Giddens, 1978). The majority (145/198) of respondents indicated they are motivated financially. Other forms of motivation included experience and gaining knowledge; this was mostly indicated by respondents who had experience of 1-5 years while those who had more experience (6 years to over 15 years) indicated that their motivation was the satisfaction of achievement/excellence in delivering a project. Most of those who indicated that they are motivated by Career/professional development had experience less than 11 years.

Research question	Sub questions
What are the risk allocation practices used by contracting parties in the ZCI?	➢ What methods/tools/practices are used to Identify risk? Assess risk? Respond to risk?

7.3.7 Risk Management training

Using the Gilbert management model, training as an area of practice or application is important because it builds capacity and confidence. Risk management training is vital for effective risk allocation. Most responding consultants, contractors and clients in the building sector had had some training (See Table 7.18). This was indicated by 94/198 the respondents. Nevertheless 50/61 who indicated how they had gained this knowledge responded that it was from their tertiary education. Further to this 12 indicated that they needed more training.

Table 7.18 Training in risk management

Source	Yes	No	Nature of training
Architects	10	28	During tertiary education (university/college) (7), workshop (1)
Quantity Surveyors	15	17	training by expert at work(2), During tertiary education (university/college) (8),
Engineers	11	17	Workshop (1), During tertiary education (5), training by expert at work (1)
Project manager	7	7	During tertiary education (6)
Client	4	3	Short course (1), During tertiary education (2), work shop(1)
Contractor Grade 1	8	7	During tertiary education(5)
Contractor grade 2	12	10	During tertiary education(4), training by expert at work(2)
Contractor grade 3	27	15	During tertiary education(13), training by expert at work (2)
Total	94	104	Training by expert at work (7) During tertiary education (50), Workshop (3) Short course (1)

7.3.8 Established risk management process

Risk allocation is normally achieved during the risk management process. This is supposed to be a systematic and reiterative process for it to provide meaningful results (Project Management Institute, 2004). However, majority Zambian building sector firms/organisations that participated in this study (123/198) did not have established risk management processes. Nevertheless, practices such as risk identification are fairly conducted (See Table 7.19). For those who have established systems (17/75) indicated that they only used the process when things go wrong. Clearly, risk management and impliedly risk allocation are not done systematically and are not well established practice in the Zambian building sector.

Table 7.19 Risk management practices

Source	No. of Respondents	Yes	No	Nature of practices highlighted by respondents
Architects	38	6	32	Company policy (1), expert judgment (1), braining storming (1), indemnity cover (1), Depend on provisions in the contracts (1)
Quantity Surveyors	32	7	25	SWOT analysis (1), guarantees and bonds (2), periodic monitoring (1), Depends on provisions in the contracts (3), adherence to safety precautions (1), risk identification (1), risk transfer (1)
Engineers	28	10	18	Risk assessment (1), risk planning (1), risk control (1), risk identification (1), policy(1), risk categorisation (2), project monitoring (1), project screening (1), review of designs (1)
Project manager	14	8	6	Checklists, risk identification (4), risk assessment (2), financial history (1), work experience (1), previous working relationships (1), bonds and insurance (1), risk allocation (1), response (1)
Client	6	5	1	Risk policy (1), risk identification (2), risk monitoring (1) , risk control (1), bonds (1), Depend on provisions in the contracts (1)
Contractor Grade 1	22	14	8	Company policy (2), risk identification (1), experience(1), brainstorming (2), risk assessment (1), meetings (1)
Contractor grade 2	15	11	4	Company policy (2), meetings (1)
Contractor grade 3	43	14	29	Risk analysis (1), risk identification (1), qualitative and quantitative risk analysis (1), site visit (1), study drawings (1), risk assessment (1), material assessment, study clauses before signing (2), meetings (2), brainstorming, risk schedules (1), risk planning (1)
Total	198	75	123	Summary: Policy (company/risk) (1),Brainstorming (3),Risk identification (10), Risk Analysis-and assessment (6), Material assessment (1), Safety (1), Experience-(1), Meetings (4), Checklists (1), Contract Provisions/guarantee and bonds/transfer (9), SWOT (1), Site visit (1), Study drawings (2), Expert judgement (1), Monitoring/screening (4), Risk planning-previous relationship (2).

7.3.9 Processes from decision to build to construction stage

The interviews were able to elicit the following processes used in the building sector. There is evidence of integrated procurement as depicted in Figure 7.5 and 7.6 though contract in use are based on traditional procurement.

Public sector

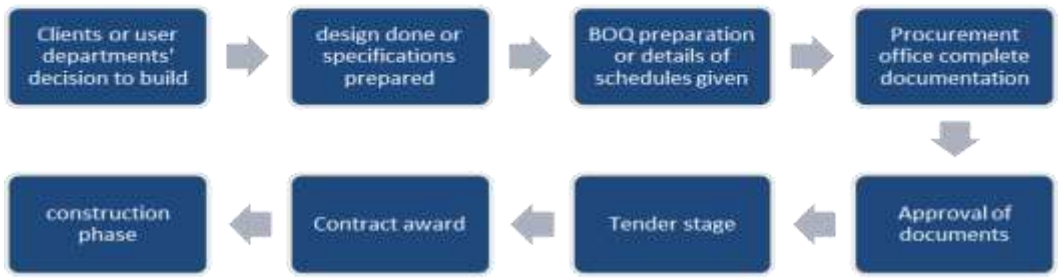


Figure 7.3 Public sector procurement processes

Private sector- Option 1

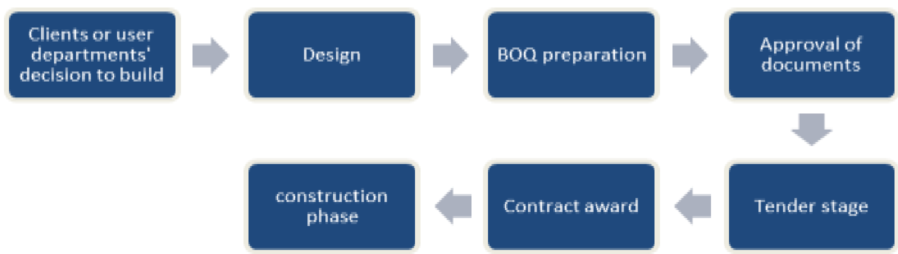


Figure 7.4 Private sector processes

Option 2

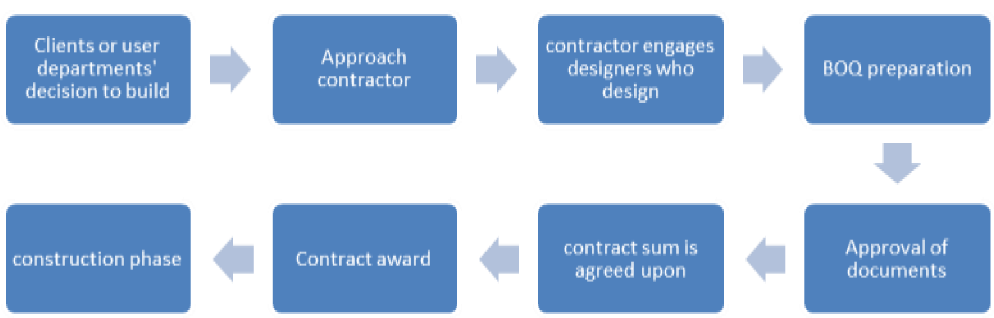


Figure 7.5 Private sector processes

Option 3

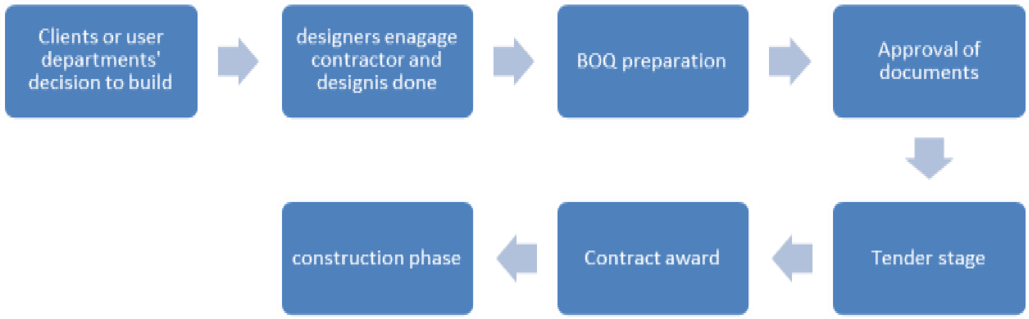


Figure 7.6 Private /Public sector processes

As shown, various processes or procurement options are used in the industry. These include traditional options of procurement and integrated systems of procurement

7.4 Questionnaire Survey (Quantitative Results)

The questionnaire survey comprised of contractors grade 1-3, consultants (architects, engineers and quantity surveyor, project managers) and clients engaged in the construction of buildings. The majority of the responses came from consultants although nationally there were more contractors than consultants. Various challenges were faced in the data collection especially from contractors:

1. Contractors were not found at the physical address at which they were registered for practice.
2. Group 1 contractors were mainly foreign where there was a language barrier problem.
3. Some of the contractor listed by the National Council for Construction as engaged in building constructions were actually building materials suppliers.
4. Others had not had any work in over five years and had diversified into manufacturing of construction materials and as a result could also not participate in the study. Yet others had not had any work from date of registration. And therefore, could not participate in the research.

Various efforts were made such as reminders in form of telephone calls and emails to increase the response rates. Both private and public clients were targeted. Of the 32 private clients listed as property developers only 5 actually developed property using an in-house team thus reducing the population from 32 to 5. The others engaged consultants and contractors to do this, as a consequence responses from consultants and contracts were deemed to cover client views, as suggestions were made to get the information from the contractors who were also in most cases made responsible for engaging consultants by the private clients. Figure 7.7 below shows the response rate.

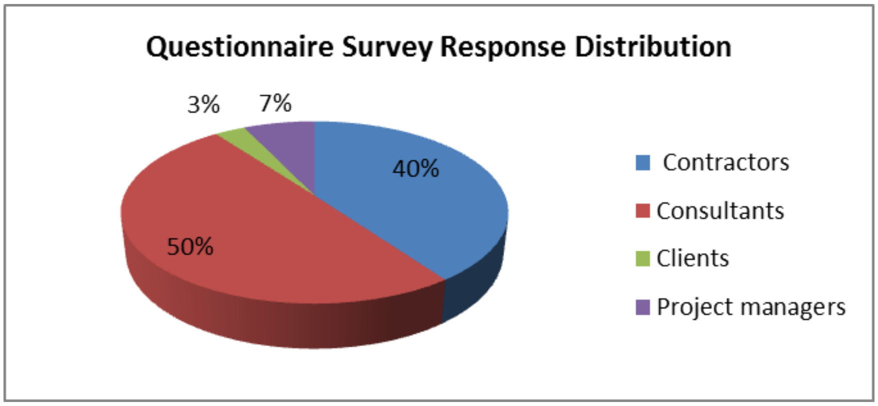


Figure 7.7 Survey response distributions

The Figure7.7 response rates from the various targeted groups. The Table 6.24 shows a breakdown of respondents according to contractor grade and consultancy type. A reliability test using Cronbach's Alpha was computed. Using SPSS 20 and the coefficients were 0.916 for 142 items for consultants (who normally act on behalf of the client), and 0.935 for 138 items for contractors. These were considered acceptable rates of reliability according to Reynold and Santos (1999). The population and sample size for clients (166 items) and project managers (159 items) were too small >30 to produce a reliability result (Tavakol & Dennick, 2011) nevertheless, the response rate of over 60% and 80% respectively demonstrates the reliability of the results provided (Moyo and Crafford, 2010). Such response rates are considered to be in a normal range and acceptable as they are within the bound of similar studies done in the context using similar samples. For instance Muya et al (2013) had a 76% response, while Sibanyama et al. (2013) had a 63% response rate and Mukumbwa and Muya

(2013) had a 28.5% response rate. The population sizes and response rates for different target groups are shown in Table 7.20

Table 7.20 Showing survey response rate

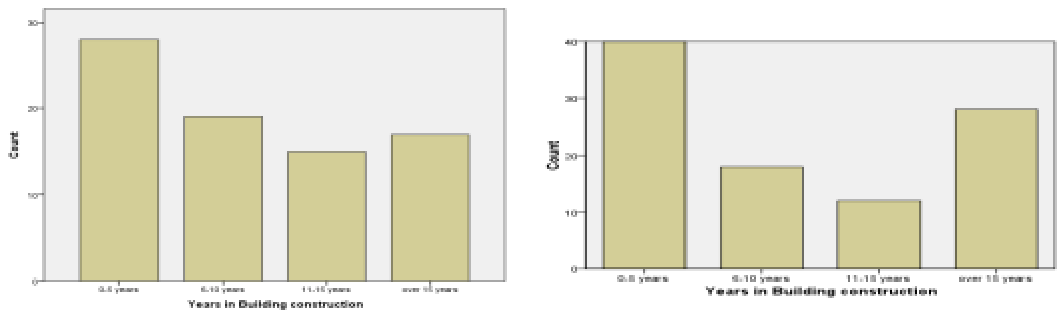
Category	Sub- Group	Population	Responses	Response rate %
Contractors As at 14 August 2014	Group 1	51	22	43.1
	Group 2	30	15	50.0
	Group 3	69	43	62.3
Consultants	Quantity surveyor	36	32	88.9
(firms) engaged in	Engineers	32	28	87.5
buildings	Architects	54	38	70.4
Project managers (PM) (firms)		17	14	82.0
Clients	Public (ministries)	6	4	66.7
	Private	5	2	40.0
Total		300	198	66.0

The response rate was lowest among private clients and grade 1 contractors and highest among engineers and quantity surveyors. Thirteen questionnaires in total were inadequately filled therefore rendered unusable and did not form part of the analysis. The response rates were over the recommended limit for built environment research of between 7% and 40% (Moyo and Crafford, 2010) thus the results were considered reliable.

7.4.1 Experience of respondents in the construction Building sector

The respondents comprised of people with different levels of experience in the building industry as shown in the bar charts below. While the majority of respondents had experience of less than five years, company owners ensured that they approved the information given in the questionnaire before the questionnaire was handed over. It was important to collect this information to determine whether there was a relationship between methods of risk identification/analysis and years of experience as will be seen later.

Consultant Contractor



Client Project Manager

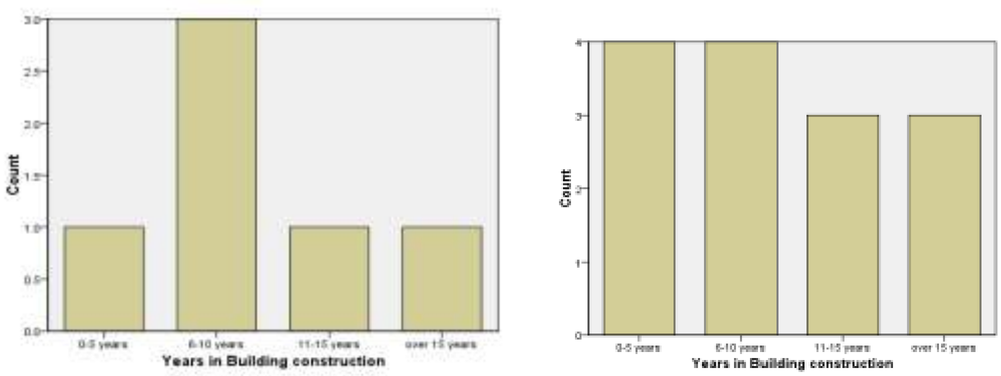


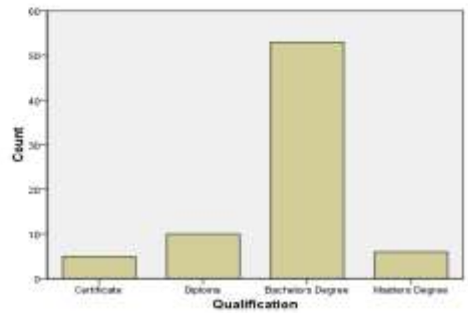
Figure 7.8 years of experience in building construction of various project members

Average years in experience were 10 years for project managers, and 9 years for clients, contractors and consultants (quantity surveyor, architects and engineers). These respondents were of acceptable experience levels.

7.4.2 Level of Education possessed by respondents

The majority of respondents had a Bachelor's degree as did all 6 responding clients. The consultants have the highest level of education.

Project managers Contractors



Consultants

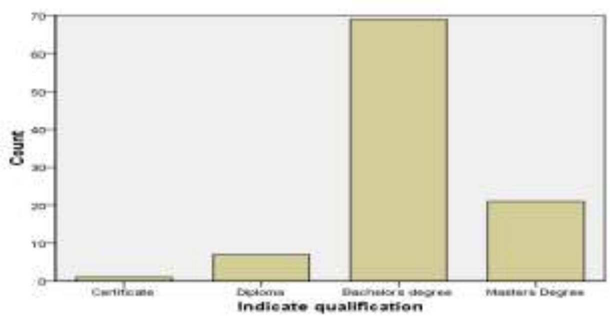


Figure 7.9 Levels of Education by respondent

It could therefore, be deduced from this that the majority of professionals and contracting practitioners had an acceptable level of education.

7.4.3 Risk Management Training

Training is an important aspect of professional practice. Gilberts management model holds that if desired performance is not being received then either workers are not properly skilled or if they are properly trained or skilled they need to be motivated better to attain the desired performance. Therefore, it was important to find out whether training in risks management had been done, as this is where risk allocation is addressed. Table 7.21 shows training levels for risk management of the various target groups.

Table 7.21 Formal training in risk Management

Respondent type	Have had training	No training	Total
Client	3	3	6
PM	7	7	14
Consultants	36	62	98
Contractors	44	35	79
Total	90 (45.7%)	107(54.3%)	197 (100%)

The results overall showed that slight less than half of the respondents had received some training in risk management, suggesting a need for more such in the industry. A higher proportion of consultants had received training and fewer contractors had training in risk management.

7.4.4 Nature of Building construction

Less than half of works that consultants, project managers and contractors Figure 7.10 were engaged in were new works (34% by volume). Renovations and refurbishments (23% by volume) of existing buildings were also common followed by extension (16% by volume) of existing buildings (Figure 7.11). The second least type of work was rebuilding works (14%). These are necessitated by demolition works (13%). The closeness in volume of rebuilding and demolition demonstrates that the measure of building works was reliable as these works are usually carried out together.

Figure 7.10 Nature of building construction in the industry

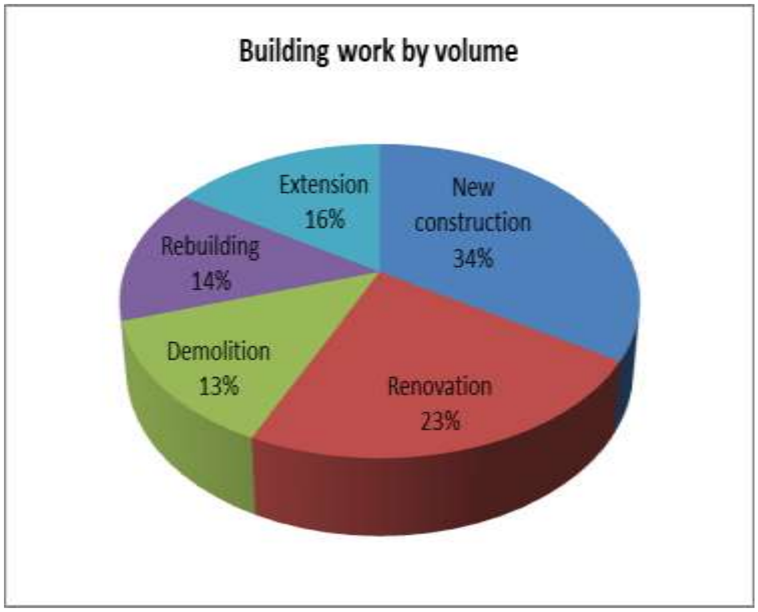


Figure 7.11 Building works engaged in by proportion

Having established the nature of construction, it was also important to appreciate the building types in the industry.

7.4.5 Types of building works

The nature of building works carried out in the building sector is diverse (see Figure 7.11). However, the most common types reported by participants were residential, schools, shops and markets. Less commonly cited buildings included airports, prisons, police stations, banks and farm buildings.

7.4.6 Building types in the ZCI

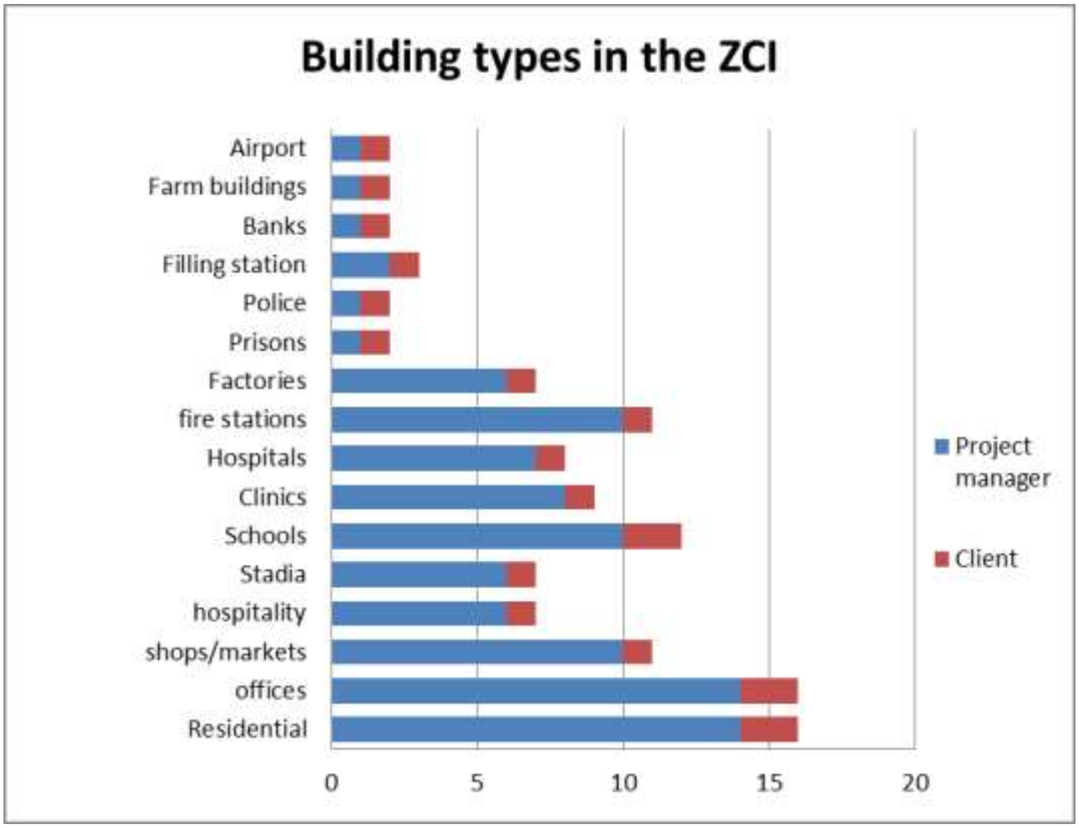


Figure 7.12 Type of Building works in ZCI

Research question	Sub questions
What factors influence the choices of contract forms on building projects to impact risk allocation?	➢What contracts are used? ➢How effective are clauses used? ➢What factors are considered in contract selection? ➢What is the relationship between factors?

7.4.7 Contracts used in ZCI

Various contract forms are used in the ZCI as shown in Figure 7.13. The respondents comprised of 79 contractors, 6 clients and 14 project managers (PM). The findings on contract usage were congruent with interview findings that the most used contracts form is the Zambia Public procurement contract with the 3 suits as highlighted earlier. The other contracts in use as highlighted by the survey were New engineering contract NEC and Joint Building Contracts Committee (JBCC). It is not surprising that the most commonly used contract is the ZPPA open national bidding because in Zambia like many other developing countries the government is the biggest client for construction works and it mainlly uses ZPPA. This is followed by the FIDIC Redbook also common for donor funded works under the government and also the ZPPA Open International which is based on the FIDIC 2005 harmonised version.

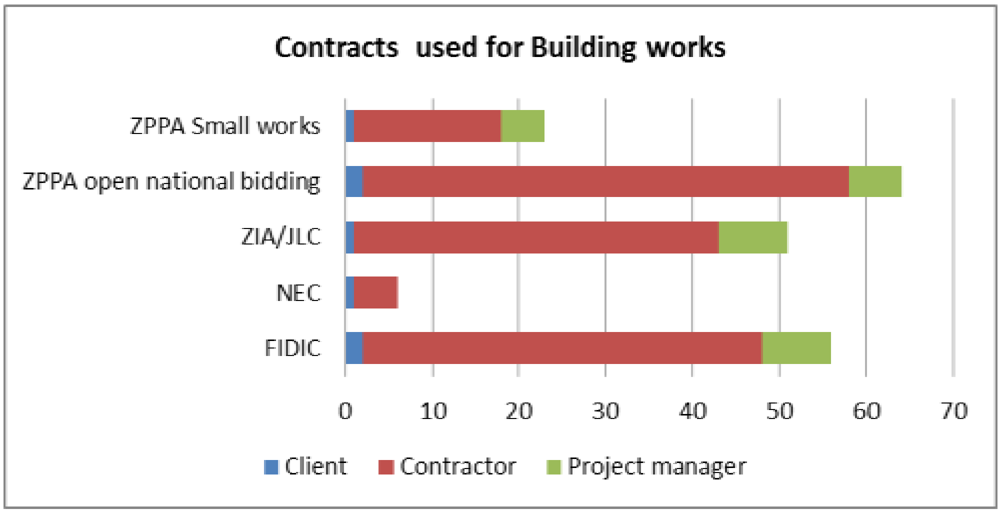


Figure 7.13 Contracts used in ZCI

The rating was based on a 5 point Likert scale with 1 indicated no importance, 2 slightly important, 3 moderately important, 4 strongly important and 5 exceptionally important in influencing contract selection performance in the building sector. From the means shown in Table 7.22 it can be deduced that the majority base their contract selection on type of work undertaken, clients objectives of time, cost, quality and size of the project as these above the mean of four interpreted as strongly important on the utilised Likert scale. A high standard deviation shows that the data is widely spread (less reliable) and a low standard deviation shows that the data are clustered closely around the mean (more reliable) (Ravoi et al 2013). Table 7.22 does not show the factors that are considered low, moderate or highly important. For this a relative importance index (RII) was calculated. Values for Skewness and Kurtosis are not zero implying that the distribution my deviate from normal (Hatcher, 2013). A normality test was applied to verify.

7.4.8 Factors considered for contract selection

Contract selection is the beginning of risk allocation once risks have been identified. Different contract types allocate risks differently. Fifteen factors were identified in the literature and interviews as being relevant for contract selection. The consultants were asked to rate their perceptions of the importance of the 15 factors and the ranking were the outcome based on the computation of the means and standard deviations (Table 7.22).

Table 7.22 Descriptive Statistics of contract section factors for the entire sample

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Type of work undertaken	115	1.00	5.00	4.2870	.75817	0.575	-1.150	0.226	2.244	0.447
client objectives of time cost quality	115	1.00	5.00	4.2000	.89050	0.793	-1.165	0.226	1.196	0.447
size of project	115	1.00	5.00	4.1217	.96562	0.932	-1.497	0.226	2.706	0.447
complexity of the requirements	114	1.00	5.00	3.9211	.92310	0.852	-0.666	0.226	0.042	0.449
Type of development	115	1.00	5.00	3.8783	.96562	0.932	-0.763	0.226	0.504	0.447
risk preference	115	1.00	5.00	3.8435	1.00517	1.010	-0.628	0.226	-0.180	0.447
type of contract documentation	115	1.00	5.00	3.8348	1.02538	1.051	-0.704	0.226	0.023	0.447
financiers preference	114	1.00	5.00	3.7807	1.09511	1.199	-0.663	0.226	-0.247	0.449
procurement method	114	1.00	5.00	3.7719	1.06460	1.133	-0.426	0.226	-0.860	0.449
status of design	111	1.00	5.00	3.6396	1.15831	1.342	-0.544	0.229	-0.472	0.455
method of price determination	113	1.00	5.00	3.3628	1.18820	1.412	-0.447	0.227	-0.540	0.451
degree of price competition	109	1.00	5.00	3.3578	1.27310	1.621	-0.237	0.231	-0.868	0.459
flexibility in design	114	1.00	5.00	3.2719	1.12325	1.262	-0.442	0.226	-0.509	0.449
public benefit (empowering community/ contractor)	112	1.00	5.00	3.1161	1.16050	1.347	0.016	0.228	-0.914	0.453
incentive	113	1.00	5.00	2.8761	1.10302	1.217	0.128	0.227	-0.468	0.451
Valid N (listwise)	88									

Table 7.23 Relative importance of Factors considered in contract selection by individual consultants/client

Contract Selection Factor	PM		QS		Architect		Engineer		Client		Overall	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Type of work undertaken	0.857	2	0.85	1	0.839	3	0.815	3	1.000	1	0.857	1
Types of development	0.814	3	0.713	8	0.816	4	0.729	7	0.080	4	0.840	2
Status of design	0.714	7	0.669	11	0.727	9	0.793	4	0.800	4	0.824	3
Size of project	0.786	4	0.781	3	0.878	1	0.821	2	0.833	3	0.784	4
Method of price determination	0.657	9	0.619	12	0.717	10	0.696	10	0.600	8	0.776	5
Degree of price competition	0.657	10	0.7	10	0.68	12	0.648	12	0.600	8	0.769	6
Financiers preference	0.743	6	0.735	6	0.794	7	0.748	6	0.760	5	0.767	7
Clients objective of cost, time & quality	0.871	1	0.819	2	0.863	2	0.83	1	0.833	3	0.756	8
Public benefit (communities/contractors	0.759	5	0.56	13	0.646	13	0.724	8	0.667	7	0.754	9
Procurement method	0.714	7	0.744	5	0.794	7	0.721	9	0.833	3	0.728	10
Complexity of requirements	0.700	8	0.775	4	0.8	6	0.668	11	0.867	2	0.673	11
Risk preference	0.700	8	0.781	3	0.761	8	0.793	4	0.800	4	0.672	12
Type of contract documentation available	0.743	6	0.71	9	0.803	5	0.785	5	0.800	4	0.654	13
Flexibility of design	0.646	11	0.729	7	0.697	11	0.621	13	0.720	6	0.623	14
Incentive available	0.629	12	0.523	14	0.589	14	0.615	14	0.467	9	0.575	15

7.4.8.1 Relative importance index for risk factors

The Relative importance index RII value has a range of 0 to 1 (0 not inclusive); the higher the RII, the more important was the contract selection factor. The RIIs was then ranked, and the results are shown in Table 7.23. The same procedure was conducted to show the differences in rank of contract selection factors of the sub-groups of the consultants and client. As shown in Table 7.23

. $$RII = \sum (Pi * Ui) / (N - n)$$

Where Pi = Respondent's rating

Ui = Number of respondents placing identical rating

N = Sample size

n = Highest value on Likert scale

The importance for the factors is ranked as; above 0.800- highly important contract selection factors; between 0.800 and 0.600 average to important contract selection factors and below 0.600 are low importance selection factors when using a 5 point Likert scale (Othman and Pasquire, 2005). Therefore the overall important contract selection factors are type of work undertaken, client's objectives of cost, time and quality and the size of the project. The literature posits that risk allocation in contracts is determined by procurement method, price determination and characteristic of the project (Murdock & Hughes, 2008). Though procurement method and method of price determination are considered by respondents they are of average to high importance. The important factors considered associated with the characteristic of the project are types of work undertaken and the size of the project. The indicated important selection factors would aid a consultant/client in selecting a suitable contract if using standard forms however if a bespoke contract would be relied upon important dimensions such as complexity, procurement method, and status of the design would have to be included to ascertain the actual risks to be expected.

The selection factors are however differently ranked when considered by individual sub-group. In view of this difference it was important to check if the differences in rating were significant between the sub-groups and also to determine which factors were not ranked important by chance. A hypothesis was formulated to test normality of data in order to determine the statistical test to employ. The following steps are followed in the rest of this thesis for hypothesis testing; 1 stating of null and alternative hypothesis, 2. Setting critical value-α normally 0.05 giving a 95% confidence interval. 3. Calculating the test statistics and correct the P value for type I error then accept or reject hypothesis based on results and 4. Draw conclusions based on results and highlight possibility of significance for some factors that are not significant after the correction for multiple hypotheses testing (McDonald, 2014). The Lilliefors Significance Correction was used for the tests for normality.

The test statistic used a hypothesis of H_a The sample comes from a normal distribution and the alternative H_b the sample does not come from a normal distribution with the significance $\alpha = 0.05$ using a single tail test. Therefore to reject the null hypothesis using Shapiro Wilk test at 0.05 the p-value should be less than the threshold. Appendix 10 shows Shapiro-Wilk test ranging from 749 to 908 (df = 72, p = 0.000 < 0.05). There is therefore strong evidence that the population from which the sample is drawn may not be normally distributed. Having made this conclusion it was also important to establish the significance of the factor rating to do this a one sample Wilcoxon rank test was conducted for the all the consultants with the except of project manager as these were not randomly selected as shown in Section 6.5.2 of Chapter 6. The client sample was also omitted for non-random selection. The hypothesis was H_1: The Median of Contract selection Factors:1-15 equals 4 (Research question 1). The critical value was 0.05 with a 95% confidence interval. The critical value was corrected for each factor using Holm-Bonferroni method as shown in Appendix 10A.

A preliminary test was done at hypothesized median of 3. Most risk factors were found to be statistically significantly higher than the hypothesized median after correction for multiple hypothesis testing except for incentive available (t = 700.50, z = -1.040, p = 0.294) and public benefit (t = 1525, z = 1.734, p = 0.083).

There are significant differences in perception in the ZCI on some contract selection factor such as method of price determination, degree of price competition, public benefit, flexibility of design, incentive available and status of design for hypothesized median of 4 (See Appendix 10A). Of these, factors that directly explain risk such as method of price determination (t = 396, z = - 4.376, p = 0.000 , r = -0.405) with a nearly large effect size, degree of price competition (t = 675, z = -4.027, p = 0.000, r = -0.218) with an effect size short of being medium, Flexibility in design (t = 203.5, z = -5.394, p = 0.000, r = -0.551) with large effect size, status of design (t= 675, z = -4.027, p= 0.003, r = -0.218) with an effect size short of being medium and incentives (t = 600, z = -2.949, p = 0.000, r = -0.307) with a medium effect size. The mentioned are perceived significantly lower than the hypothesized median meaning they are not considered highly. Public benefit (t = 292.5, z = -5.55, p = 0.000) is also significantly viewed differently perhaps because it is a criterion common in the public sector. Additionally, there is a possibility that there is difference in perception for type of work (t = 1060, z = 3.09, p = 0.02, r = 0.317) with a medium effect, client objectives of time cost and quality ($t = 1045$, $z = 2.221$, $p = 0.026$, $r = 0.228$) with a small effect, procurement method ($t = 797.5$, $z = -2.115$, $p = 0.034$, $r = -0.218$) with medium effect and size of projects ($t = 931$, $z = 2.103$, $p = 0.035$, $r = 0.216$) with a small effect. Of these, procurement method could be perceived significantly below the hypothesized median (Appendix 10A). In view of the findings, it was important to carry out one sample Wilcoxon for engineers, architects and quantity surveyors to determine which contract selection factors are perceived statistically significantly different for each profession. The P values are corrected for Type 1 error see Appendix10B-D.

For engineers, there is statistical evidence to show that there is significant difference between population median and hypothesized median for type of development ($t = 30$, $z = -2.134$, $p = 0.03$, $r = -0.403$) with medium effect, method of price determination ($t = 16.5$, $z = -2.359$, $p = 0.018$, $r =-0.453$) with medium effect, flexibility in design ($t = 8$, $z = -3.148$, $p = 0.002$, $r = -0.112$) with a small effect, degree of price competition ($t = 37.5$, $z = -2.628$, $p = 009$, $r = -0.526$) with a large effect and incentive ($t = 30$, $z = -3.648$, $p = 0.000$, $r = -0.702$) with large effect. Therefore the perception of factors is the same except for the differences in perception of the aforementioned (Appendix 10B).

For quantity surveyors, there is statistical evidence to show that there is significant difference between population median and hypothesized median for status of design($t = 228$, $z = -2.976$, $p = 0.003$, $r = -0.529$) showing a large effect, method of price determination ($t = 37.5$, $z = -3.300$, $p = 0.001$, $r = -0.592$) showing a large effect, flexibility in design ($t = 24$, $z = -3.463$, $p = 0.001$, $r = -0.612$) showing a large effect, public benefit (contractor/community)($t = 19.5$, $z = -4.057$, $p = 0.000$, $r = 0.741$) showing a large effect and incentive ($t = 21$, $z = 4.216$, p 0.000, $r= -0.757$) showing a large effect as shown in Appendix 10C. There is also possible significant difference in how type of development ($t = 66.5$, $z = -2.086$, $p = 0.037$, $r=-0.369$) and degree of price determination ($t = 100$, $z = -2.014$, $p = 0.044$, $r = -0.368$) is perceived by quantity surveyors. Therefore the other factors are considered to be perceived the same except for the differences in perception of the aforementioned.

Appendix 10D shows that Architects significantly statistically perceive type of work undertaken ($t = 161.50$, $z = 2.985$, $p = 0.003$, $r = 0.49$) showing a slightly below large effect, size of project ($t = 241.50$, $z = 2.888$, $p = 0.004$, $r = 0.480$) showing slightly below a large effect, public benefit (contractor/community) ($t = 48$, $z = -3.331$, $p = 0.000$, $r = -0.563$) showing a large effect and incentive ($t= 21$, $z = -4005$, $p = 0.000$, $r = -0.677$) showing a large effect. These are perceived significantly lower from the hypothesized mean. There is a possible difference in the perception of client's objective of cost, time & quality ($t = 178.50$, $z = 2.449$, $p = 0.014$, $r = -0.480$) with medium effect and degree of price competition ($t = 105$, $z = -2.336$, $p = 0.019$, $r = -0.395$) with medium effect among architects.

From the differences, different consultants accord different levels of importance when selecting contracts. Perhaps, this to a large extent is dependent on the characteristics of the project and type of client. For instance the private clients would hardly consider public benefit. What is apparent is that all groups of consultants perceived incentives significantly differently from the hypothesized median within their sub-group.

7.4.8.3 Difference in Rank of contract selection factor based on years of Role

In view of the findings, the Kruskal Wallis one way was used to determine if there is a difference in the perception of consultants in the consideration factors for contract selection having established that there is a difference within different consultant groups in perception of contract selection factors. Kruskal Wallis one way test is appropriate for use when (Rovai et al, 2013):

(a) Three or more groups are to be compared;

(b) When the groups of respondents are independent and randomly selected

(c) The data are not normally distributed;

(d) The sample size for each group should at least be five

Since the above requirements have been met Kruskal Wallis Test can be used. The null hypothesis H_3 = the perceptions of consultants with regard to contract selection factors are similar across the different roles , and the alternative H_{3b} the perceptions of construction practitioners with regard to contract selection factors are not similar across the three different roles. The test showed that the perception for selection factors were similar for all selection factors after apply the Holm-Bonferroni method (Appendix 10E). However, there is a possibility of status of design and Public benefit being perceived significantly differently by various consultants. The pairwise comparisons show that quantity surveyors may perceive status of design significantly different from Engineers ($t = -21.121$, $z = -2.929$, $p = 0.009$, mean ranks: engineer = 60.64, QS = 39.52) while Public benefit may be viewed significantly different by quantity surveyors and engineers (t = -19.617, z = -2.665, p = 0.023, mean rank QS = 37.63, Engineer = 57.25). Therefore, it can be concluded that there may be some significant statistical difference in the consideration of contract section factors by quantity surveyors and engineers. Additionally no statistically significant difference in perception were observed for the various consultants across various qualifications (Diploma, Bachelors' degree, Masters) (d.f. = 2, p = 0.117 to 0.992, chi-square ranging from 0.016 to 4.294)

7.4.8.4 Difference in Rank of contract selection factor based on years of experience

Given that there may be some differences in consideration of selection factors of the sub-groups it was also important to find out if there was a difference in contract selection consideration depending on the number of years a professional had spent in the industry. The null hypothesis H_4 was the perceptions of consultants with regard to contract selection factors are similar across the different years of experience, and the alternative hypothesis: the perceptions of consultants with regard to contract selection factors are not similar across the different years of experience in the construction industry.

The findings show (Appendix 10F) there is no statistical evidence to suggest that the consideration of contract selection factors differ in consultants of varying years of experience after the correction for multiple hypothesis testing. However, method of price determination, types of development and incentive available may be perceived differently within the sub-groups with various years of experience. Type of development may be perceived significantly differently by those with over 15 years in relation to 6-10 years' experience (t = 19.8, z = 2.425, p = 0.015, mean rank over 15 yrs. = 41.52, 6-10 yrs. = 61.32). Method of price determination may be perceived significantly different by those with 1-5 years in relation to over 15 years' experience (t = -18.319, z = -2.771, p = 0.033, mean rank over 1-5yrs = 38.73, over 15 yrs. = 57.25). A significantly different perception may also exist for incentives available for 11-15 years of experience and 6-10 years of experience (t = 3.44, z = 2.99, p = 0.016, mean rank over 11-15yrs = 32.68, 6-10 yrs. = 63.13). Therefore, as professionals gain experience they are not likely to have many differences in perception when selecting a contract for use on a building project (Appendix 10B - 10D. It is clear that different consultants have different selection factors that they use when selecting building contracts.

7.4.8.4 Relationships among the contract selection factors

Another inferential statistic of interest was to determine relationships or associations that describe the contract selection factors therefore a non-parametric correlation analysis was conducted using spearman's' rank correlation denoted as r_s. The hypothesis being tested was *H_7: There* is no (moderate to high) relationship between Contract selection factors (CSF1-15) (Research question 1). In view of the findings shown in Table 7.24. This hypothesis is rejected as there are several moderate to high correlations. For this test, a test was considered significant when $p \leq 0.0009$ approximated to 0.001 using the Bonferroni correction (α/k, $\alpha = 0.05$, $k = 55$) so as to reduce type 1 error. As a matter of interpretation Rovai et al (2013) suggest the following guide to describe strength of statistically significant relationships follows:

Between 0 and ±0.20 very weak
Between ±0.20 and ±0.40 weak
Between ±0.40 and ±0.60 moderate
Between ±0.60 and ±0.80 strong
Between ±0.80 and ±1.00 very strong

Correlations were computed among 15 contract selection factors for a sample of 98 respondents. The results suggest that 117 out of 225 correlations were statistically significant. However, 69 were greater or equal to, r_s (98) +4.00, $p < 0.05$ two tailed showing a moderate correlation (Table 7.24). After applying the Bonferroni correction the following moderate correlations were found to be significant. The correlation of type of work rating with all other selection factors were not significant with the exception of type of development r_s (94) = 0.42, p = 0.000. There was a moderate correlation for degree of price completion and clients objective of time, cost and quality r_s (89) = +0.401, p = 0.000; procurement method and complexity of requirements rs (92) = 0.489, p = 0.000; flexibility in design and incentive rs (92) = + 0.466, p = 0.000. A moderate correlation was also observed for risk preference and contract documentation r_s (94) = + 0.463, p = 0.000.The factor with the most number of correlations was method of price determination; it was moderately correlated with status of design r_s (90) = + 0.485, p = 0.000, financiers preference r_s (93) = 0.404, p = 0.000 and flexibility in design r_s (113) = 0.402, p = 0.000. For other correlations see Table 7.24. One

7.24 Table showing the correlations of contract selection factors

Spearman's rho		CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7	CSF8	CSF9	CSF10	CSF11	CSF12	CSF13	CSF14	CSF15
Type of work undertaken (CSF1)	C.C	1.000	.420**	.303**	.147	.158	.132	.042	.178	.042	.337**	.087	.235*	.246*	.112	.114
	Sig.		.0000248	.0035095	.1599538	.1310106	.2066997	.6951121	.0874549	.6918451	.0009450	.4118283	.0225627	.0174186	.2845477	.2812072
	N	95	94	91	93	93	93	88	93	91	93	92	94	93	94	91
Type of development (CSF2)	C.C	.420**	1.000	.367**	.215*	.157	.318**	.008	.185	.177	.147	.166	.264**	.315**	.126	.212*
	Sig.	.00002		.00032	.03848	.13353	.00180	.94123	.07471	.09157	.15862	.11168	.00959	.00210	.22523	.04206
	N	94	95	92	93	93	94	89	94	92	94	93	95	93	94	92
Status of design (CSF3)	C.C	.303**	.367**	1.000	.344**	.485**	.302**	.308**	.260*	.429**	.370**	.258*	.248*	.269*	.358**	.292**
	Sig.	.004	.000324		.000916	.000001	.003641	.003949	.012797	.000028	.000305	.013981	.017236	.010328	.000492	.005491
	N	91	92	92	90	90	91	86	91	89	91	90	92	90	91	89
Size of project (CFS4)	C.C	.147	.215*	.344**	1.000	.244*	.217*	.073	.326**	.171	.188	.223*	.023	.242*	.244*	.056
	Sig.	.160	.038	.001		.019	.037	.495	.001	.104	.073	.033	.829	.019	.018	.598
	N	93	93	90	95	92	93	89	93	91	92	92	94	94	94	91
Method of price determination (CSF5)	C.C	.158	.157	.485**	.244*	1.000	.404**	.221*	.048	.268*	.377**	.187	.225*	.275**	.402**	.146
	Sig.	.131	.1335281	.0000013	.0190870		.0000604	.0387659	.6501232	.0101072	.0002120	.0742036	.0294402	.0080873	.0000650	.1678640
	N	93	93	90	92	94	93	88	93	91	92	92	94	92	93	91
financiers preference (CSF6)	C.C	.132	.318**	.302**	.217*	.404**	1.000	.209*	.240*	.178	.052	.369**	.188	.471**	.233*	.154
	Sig.	.207	.002	.004	.037	.000		.049	.020	.090	.621	.000	.068	.000	.024	.142
	N	93	94	91	93	93	95	89	94	92	93	94	95	93	94	92
Degree of price competition (CSF7)	C.C	.042	.008	.308**	.073	.221*	.209*	1.000	.401**	.331**	.236*	.159	.084	.125	.397**	.354**
	Sig.	.695	.941225142	.003948916	.494772175	.038765863	.049123219		.000099623	.001722312	.026921978	.139608411	.432585975	.241449276	.000106929	.000761059
	N	88	89	86	89	88	89	90	89	87	88	88	90	89	90	87
Client objectives of time cost quality (CSF8)	C.C	.178	.185	.260*	.326**	.048	.240*	.401**	1.000	.149	.158	.308**	.096	.197	.247*	.137
	Sig.	.087	.0747051	.0127967	.0014515	.6501232	.0198682	.0000996		.1572842	.1304452	.0026539	.3536799	.0585636	.0163210	.1934543
	N	93	94	91	93	93	94	89	95	92	93	93	95	93	94	92
Public benefit (empowering community/ contractor) (CSFS9)	C.C	.042	.177	.429**	.171	.268*	.178	.331**	.149	1.000	.329**	.306**	.121	.288**	.246*	.165
	Sig.	.692	.091575	.000028	.104439	.010107	.089991	.001722	.157284		.001438	.003179	.247532	.005649	.018053	.119062
	N	91	92	89	91	91	92	87	92	93	91	91	93	91	92	90
Procurement method (CSF10)	C.C	.337**	.147	.370**	.188	.377**	.052	.236*	.158	.329**	1.000	.489**	.182	.276**	.189	.055
	Sig.	.001	.158618	.000305	.073468	.000212	.621207	.026922	.130445	.001438		.000001	.078908	.007834	.069515	.604110
	N	93	94	91	92	92	93	88	93	91	94	92	94	92	93	91
Complexity of the requirements (CSF11)	C.C	.087	.166	.258*	.223*	.187	.369**	.159	.308**	.306**	.489**	1.000	.193	.367**	.067	-.035
	Sig.	.412	.111684	.013981	.032709	.074204	.000249	.139608	.002654	.003179	.000001		.061868	.000321	.525354	.739946
	N	92	93	90	92	92	94	88	93	91	92	94	94	92	93	91
Risk preference (CSF12)	C.C	.235*	.264**	.248*	.023	.225*	.188	.084	.096	.121	.182	.193	1.000	.463**	.182	.216*
	Sig.	.023	.009593	.017236	.828858	.029440	.068159	.432586	.353680	.247532	.078908	.061868		.000003	.077025	.037918
	N	94	95	92	94	94	95	90	95	93	94	94	96	94	95	93
Type of contract documentation (CSF13)	C.C	.246*	.315**	.269*	.242*	.275**	.471**	.125	.197	.288**	.276**	.367**	.463**	1.000	.323**	.229*
	Sig.	.017	.0021020	.0103281	.0187894	.0080873	.0000019	.2414493	.0585636	.0056490	.0078341	.0003214	.0000026		.0014925	.0291365
	N	93	93	90	94	92	93	89	93	91	92	92	94	95	94	91
Flexibility in design (CSF14)	C.C	.112	.126	.358**	.244*	.402**	.233*	.397**	.247*	.246*	.189	.067	.182	.323**	1.000	.466**
	Sig.	.285	.225229446	.000491632	.017964065	.000064979	.023717525	.000106929	.016321013	.018053312	.069515060	.525353792	.077025275	.001492500		.000002852
	N	94	94	91	94	93	94	90	94	92	93	93	95	94	96	92
Incentive (CSF15)	C.C	.114	.212*	.292**	.056	.146	.154	.354**	.137	.165	.055	-.035	.216*	.229*	.466**	1.000
	Sig.	.281	.042061797	.005490509	.598025002	.167864022	.141548323	.000761059	.193454326	.119062250	.604110238	.739945982	.037917793	.029136454	.000002852	
	N	91	92	89	91	91	92	87	92	90	91	91	93	91	92	93

C.C: Correlation coefficient, Sig: 2 tailed   Significant Moderate correlations statistically insignificant negative correlation was observed for complexity of requirement and incentive r_s (93) = -0.035, p =0.740.

The results suggest that the contract selection factors that are moderately correlated with others once omitted in the selection criteria decrease the likelihood of considering the other e.g. inclusion of method of price determination as a contract selection criteria may increases the likely consideration of status of design, financiers preference and flexibility in design. Similarly inclusion of type of work as selection criteria may increase the consideration of type of development as a contract selection factor.

7.4.9 Effectiveness of clauses used

Different types of clauses are used in contracts to show the nature of liability for various types of risks. When effective they help to mitigate that risk well and vice versa. A question was asked as to the effectiveness of clause types in covering for risks. The results are shown below:

Escalation clauses

From the survey escalation clauses were rated as effective by 83% of the clients, 78.6% of project managers, 50.6% of the contractors and 79.6% of the consultants. A notable percentage of contractors (49.4%) reported that this clause is not effective. This was affirmed by the modal response being 2 (slightly effective). Contractors tended to represent escalation clauses as not effective while all others considered escalation clauses to be effective. From the interviews and the other comments in the questionnaire it was suggested that escalation clauses are rarely included in contracts therefore it could be concluded that when they are used they are effective. The implication is that when an escalation clause is used both clients and contractors may be protected from changes resulting from events like escalation of material prices, labour prices and other resources such as plant and equipment.

Penalty Clauses

Penalty clauses were generally considered effective, that being affirmed by 100% of the clients, 78.6% of the project managers, by 87.8% of the consultants 77.2 % of the contractors. The modal values for the responses 3 (effective) and 4 (very effective) confirmed that penalty clauses were seen to be effective in covering for risk. This means that both contracting parties can be penalised for default under the contracts used.

Exemption/exculpatory clauses

Half (50%) of the clients indicated that exemption clauses are not effective, 71.4% of the project managers considered the clause is effective as did 80.6%, of consultants and 58.2% of contractors. It seems that clients did not entirely agree with the perception of other target groups on the effectiveness of this. This could be because the clause type does not allow them to escape liability for risk.

Research question	Sub questions
What risk allocation practices are used by contracting parties in the ZCI?	➢ What methods/tools/practices are used to • Identify risk? • Assess risk? • Respond to risk?

7.5 Risk Practices

7.5.1 Risk Identification

The responses suggest that risk identification is widely practiced in the industry and that in the building sector the most utilised method is through a site visit followed by experiences from past projects, the use of local knowledge, expert knowledge and brainstorming. However, these methods are qualitative hence considered subjective, they do not help in identifying all kinds of risk and cannot help to foresee certain risks not encountered on past projects. Moreover, if these practices had to be given a maturity level; the firms using them would be considered novice because according to Cagliano, et al., (2015) and Hilson's (2002) maturity categories, normalised and natural methods are novice.

The results show that particular methods of risk identification were prevalent amongst particular professions/practitioners (see Table 7.25). It appears that use of past projects and sites visits were common across the professions or roles played in identifying risks. Other methods reported for risk identification were work analysis by contractors and cash flow analysis by some project managers and quantity surveyors.

Use of past projects for risk identification seems to be widely applied (Table 7.25). We can infer that experience is valuable. Site visits are also widely utilised however, these in the absence of geotechnical investigations may not give a full appreciation of the risks pertaining to a site.

Table 7.25 Risk identification methods

Method of identification	Quantity surveyor	Engineers	Client	Architects	Project managers	Contractor grade 1	Contractor grade 2	Contractor grade 3	Total	Percentage
Brainstorming	24	15	4	25	8	18	9	21	124	63
Delphi technique	1	2	0	1	0	0	0	1	5	3
SWOT analysis	12	11	1	13	8	7	3	10	65	33
Influence diagram	2	4	0	3	0	1	0	7	17	9
Questionnaire	4	1	1	3	4	2	0	9	24	12
Checklist	19	16	4	23	10	11	9	24	116	59
Flow charts	5	8	1	9	4	5	2	11	45	23
Local Knowledge	27	19	3	24	10	19	11	30	143	72
Interview	15	6	1	9	6	10	6	17	70	35
Expert knowledge	24	23	3	24	12	15	6	28	135	68
Document review	19	19	4	17	10	10	8	20	107	54
Site visit	28	23	6	34	13	18	15	37	174	88
Past projects	28	21	6	34	11	16	14	26	156	79

Table 7.26 Top 5 Risk Identification methods by profession

Profession /Role	1	2	3	4	5
Quantity Surveyor	Past projects	Site visit	Local knowledge	Expert knowledge	Brain storming
Project managers	Past project	Site visit	Expert knowledge	Local knowledge	Document review
Architects	Site visit	Past project	Expert knowledge	Local knowledge	SWOT analysis
Engineers	Past project	Site visit	Expert knowledge	Local Knowledge	Document Review
Clients	Past project	Site visit	Document review	Check list	Brainstorming
Contractor 1	Local knowledge	Site visit	Brain-storming	Past Projects	Expert knowledge
Contractor 2	Site visit	Past project	Local knowledge	Check list	Brainstorming
Contractor 3	Site visit	Local know-ledge	Expert knowledge	Past project	Check list

Table 7.27 Risk identification by years of experience in the total sample

Years' experience	Brain storming	Delphi	SWOT analysis	Influence Diagrams	Questionnaire	Check list	Flow chart	Local knowledge	Intuition	Expert Knowledge	Document Review	Site Visit	Past projects
1-5	63%	3%	34%	8%	12%	46%	25%	72%	34%	70%	49%	94%	82%
6-10	72%	5%	30%	9%	2%	64%	30%	32%	39%	66%	52%	86%	80%
11-15	68%	0%	45%	10%	19%	65%	23%	68%	39%	65%	58%	84%	68%
Over 15	51%	2%	31%	8%	16%	69%	16%	76%	33%	71%	61%	84%	84%

The Table 7.27 above provides evidence that though use of site visit, past projects, the use of local knowledge; expert knowledge and brainstorming are commonly used to identify risk, preferences tended to depend on level of experience. For instance, those with 6-10 years, experience placed more utility on brainstorming than expert knowledge while those with over 15 years' experience placed more utility on checklists than brainstorming.

Further to this point, Appendix 9I demonstrates that there were different preferences in the use of risk identification methods depending on years of experience and role or profession. However, this is not so visible in averaged data because the majority of respondent had experience of 1-5 years. Nevertheless, there were equal proportions of those using questionnaire, checklists and expert knowledge among consultants of 1-5 years and those with over 15 years' experience respectively. For project managers the use of flowcharts was the same as for other methods.

In addition Appendix 9J shows that the majority of the respondents were bachelor's degree level and the cross tabulation indicated that they had the ability to utilise all the risk identification methods. Delphi technique was least commonly used among Master holders as shown in Appendix 9J.

7.5.2 Risk analysis

The Table 7.29 shows that the most common methods used to analyse risk were expert judgement,brain storming, checklists and consulting specialist. These methods are characteristics of novice risk allocation in terms of maturity (Cagliano, et al., 2015) however, few used techniques of normalised or natural risk maturity level e.g Monte Carlo simulation, risk breakdown structure and probability matrix. From the results (Sample size 198) it could be safe to conclude that risk analysis is not a common feature of risk practice in the Zambian building sector. Table 7.28 below shows the top 5 risk analysis methods and provides evidence that only contractors use Expert Judgement risk analysis process most frequently in their risk analysis.

Table 7.28 Top 5 Risk Analysis methods by profession

Profession/Role	1	2	3	4	5
Quantity Surveyor	Expert judgement	Brainstorming	Consult specialist	Check list	Interview
Project managers	Checklist	Expert judgement	Consult Specialist	Brainstorming	Interview
Architects	Brainstorming	Check list	Consult specialist	Expert judgement	Interview
Engineers	Expert Judgement	Brainstorming	Consult Specialist	Checklist	Interview
Clients	Brainstorming	Consult specialist	Expert judgement	Check list	Intuition
Contractor 1	Expert Judgment	Brainstorming	Intuition	Judgement risk analysis Process	Consult specialist
Contractor 2	Brainstorming	Check list	Expert judgement	Interview	Judgement risk analysis Process
Contractor 3	Expert Judgement	Check list	Brainstorming	Consult specialist	Interviews

Table 7.29 Risk analysis methods

Method of Analysis	Quantity surveyor	Engineers	Clients	Architects	Project managers	Contractor grade 1	Contractor grade 2	Contractor grade 3	Total	%
Brainstorming	18	12	5	25	6	14	9	21	110	56
Probability Impact matric	3	5	1	4	4	2	1	8	28	14
Checklist	13	11	3	22	10	7	7	22	95	48
Expert Judgement	23	17	3	14	9	16	6	28	116	59
Risk Break down structure	4	1	1	3	3	3	2	5	22	11
Interviews	10	7	1	9	5	6	6	15	59	30
Consult Specialist	15	14	3	22	8	7	4	17	90	45
Risk Premium	2	3	0	0	0	3	3	6	17	9
Intuition	5	6	2	7	3	8	5	8	44	22
Judgement Risk Analysis Process	8	5	0	5	3	8	6	16	51	26
Probability Distribution	1	3	1	4	4	2	2	6	23	12
Sensitivity analysis	8	4	0	5	1	2	2	10	32	16
Monte Carlo simulation	2	1	0	0	1	2	0	1	7	4

Brainstorming, checklist and expert judgment seem common on all levels of experience as shown in Table 7.29B. The Table in Appendix 9K shows cross tabulations between risk analysis method and years of experience. It shows that those with 1-5 years experiece opt for brainstorming, 6-10 years experience opt for brainstorming and expert judgement, 11-15 years experience prefer brainstorming and those over 15 years experience prefer expert judgement . The least utilised method of risk analysis was Monte Carlo simulation and expert judgement was utilised by most by those with over 15 years experience.

Table 7.29B Methods of risk analysis/years in experience

Years' experience	Brain storming (%)	Probability impact method (%)	Check list (%)	Expert Judgment (%)	Risk Break down structure (%)	Interview (%)	Consult specialist (%)	Risk premium (%)	Intuition (%)	Judgement Risk Analysis process (%)	Probability distribution (%)	Sensitivity analysis (%)	Monte Carlo simulation (%)
1-5	56	11	42	5	11	29	49	4	25	25	12	21	7
6-10	59	16	59	59	11	36	55	11	16	25	11	11	11
11-15	71	10	32	52	19	29	35	16	13	29	6	16	0
Over 15	39	20	45	71	6	29	39	8	14	27	14	14	20

Appendices 9K and 9L show the different portions using risk analysis by years of experience and level of education respectively. The results show that respondents with 1-5 years experience used several risk analysis methods as could respondents holding bachelor degrees.

7.5.3 Risk management abilities

Contractors perceptions of Risk Management Abilities

Generally, contractors believed that their risk management abilities were adequate as, shown by the modal response of 4 which represents "very adequate". However, a mean of 3.37 for risk communication against 2.94 for risk control suggests lower ability to control risk which could be why risks impact negatively on project performance.

Clients Perception of Risk Management Abilities

Clients reported that their risk management abilities are adequate, with modal response of 4 which represents "very adequate". However, again, a mean of 3.83 for ability to analyse risk against 2.67 for their ability to control risk suggest that clients' abilities to control risk are not very adequate.

Project Managers perception of Risk Management Abilities

Project managers reported that their abilities are greatest in risk communication with mean of 4.08 and least in risk controlling with mean of 3.77. While the mean score for risk analysis standard deviation (S.D) 1.36) and risk controlling (S.D 1.166) were the same at 3.77; the risk analysis had a smaller standard deviation indicating a closer consensus.

Consultants Perception of Risk Management Abilities

Consultants indicated that their risk management abilities are adequate, with mode score of 4 which represents very adequate. Nevertheless, a mean of 3.41 indicated that their abilities are more in risk communication. Consultants scored their ability to responding to risk at 3.18. However, published performance indicators of time, cost and quality indicate otherwise (Auditor general reports, 2006-2015).

7.5.4 Risk severity by source

Participants' understanding of the severity of risk and their input is important as it directly hints on participants' understanding of the consequence of their actions. If a participant asserts that their role does not affect performance then this perception may be reflected in how they contribute to a project. The severity perceived by respondents was ranked and the results are shown below.

7.5.4.1 Severity of Source of risk Contractors perception

Contractor seemed to think that their input is the least severe on project performance with mean of 2.833. They perceive that risks for project performance related to clients are the most severe with a mean of 3.974, followed by external factors (mean 3.628) with consultants and project managers in third and fourth plan with mean of 3.795 and 3.325 respectively. This could imply that contractor blame their non-performance on other players in the project other than themselves.

7.5.4.2 Severity of Source of risk Consultants perception

Consultants considered Client (mean 3.457) and External (mean 3.860) related risks as being the more severe on project performance and contractors' (mean 3.060) related risks as least severe. Project managers had a mean of 3.359 while consultants mean was at 3.140. However, the factors affecting performance on the building sector are mostly internal factors originating from consultants as will be later shown.

7.5.4.2 Severity of Source of risk Clients perception

Clients saw external risks as being the most severe on project performance with a mean of 4.14 and the least severe source being their own role with a mean of 3.286. Project managers were ranked second with a mean of 3.923 and consultants as the fourth severe source with mean of 3.500. This ranking implies that nearly all participants are to blame for performance.

7.5.4.3 Severity of Source of risk Project manager's perspective

The severity of risk source according to project managers' perspective was that they rated external (mean 4.143) related risks as the most severe on project performance and contractor (mean 3.214) related risks as the least severe. PM ranked second with mean of 3.923 and the client had a mean of 3.286.

7.5.4.4 Risk by source summary.

In summary external related risks were identified as the most severe for project performance. The implication of this is that project participants focus on averting external risks and may pay less attention to risk that they perceive as not severe. However, the ranking done in the content analysis section below suggests that the majority of risks affecting project performance are internal. This shows that perceptions of risk severity by source, qualifies to be described as misguided. This could be contributing to poor risk allocation practice in the industry.

7.5.5 Contractors Risk Response

Contractors utilise many methods to respond to risk. Clearly, from the literature and the content analysis done, different risk types have different response measures. Typically contractors respond to risk by adding premiums to preliminaries (Mean 2.519) adding percentages to unit rates (mean 2.696), and by using sub-contractors (mean 2.760), claims (mean 2.987) and insurance (mean 3.4430). Measures not frequently used include site abandonment (mean 1.304), Slowing down work on site (mean 2.330).

7.5.6 Risk allocation

<u>Risk allocation considerations by consultants</u>

Consultants were asked to illustrate whether a consideration is used when allocating risk using a scale of 1 (never considered) to 5 (exceptionally considered). A mean average score was calculated to rank the considerations as shown in Table 7.30. Understanding of risk was highest and the least was foreseeability of risk by party. It can be seen that clients' preference is moderately considered. Nevertheless, from the interview data and qualitative data it was found that some of the modifications made to contract e.g. omission of escalation clause, favours the client.

Table 7.30 Risk allocation considerations-consultants

Consideration factor with Rank	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Foreseeability of risk by party (6)	3.176	0.851	-0.348	0.253	0.092	0.500
Clients preference (5)	3.239	1.031	-0.376	0.251	-0.031	0.498
Ability to sustain the consequence (4)	3.312	0.977	-0.168	0.250	-0.024	0.495
When risk occurs risk is on the party (3)	3.352	1.015	-0.237	0.253	-0.234	0.500
Ability to control risk (2)	3.447	0.887	0.400	0.249	0-.601	0.493
Understanding of risk (1)	3.489	0.992	-0.443	0.249	-0.182	0.493

Table 7.31 Risk allocation considerations by Clients

	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Ability to control risk	3.000	0.711	.000	.910	2.000	2.000
Ability to sustain the consequence	3.800	0.451	-2.240	.910	5.000	2.000
When risk occurs risk is on the party	3.800	0.450	-2.240	.910	5.000	2.000
Foreseeability of risk by party	3.000	0.000	.	.	.	.
Clients preference	3.000	1.220	1.360	0.910	2.000	2.000
Understanding of risk	3.400	0.550	0.610	0.910	-3.330	2.000

Clients considered *when risks occur risk is on the party* first and *ability to sustain the consequence* second. The least consideration was for client's preference. This demonstrates why most risk allocation has its rationale based on responsibility as other considerations that transcend responsibility such as ability to control are moderately considered.

7.6 Perceptions on various environmental factors and persons repository factors

7.6.1 Clarity of roles and performance expectations in contracts

The results show that roles and performance expectations for clients, consultants, project managers and contractors are clearly defined in the contracts used. This was reported by 90.3 % of respondents. It shows that everyone involved in a project knows what they are supposed to do. This could further imply that all internal risks are known by individual project participants.

7.6.2 Adequacy of Feedback

Information from the interviews and open questionnaires showed that feedback is given on progress and performance related issues such as quality, payment, project schedule in an untimely matter. Feedback is given on projects as affirmed by 75.5% respondents. However, 5 % were unsure about the adequacy of the feedback while 6.5% felt it was not adequate.

7.6.3 Adequacy of information given to contractors to make decisions on risk

Decisions about risk need to be based on information on various aspects of projects. Majority (60.6%) of respondents considered that adequate contract information was given, 12.8% were unsure of the adequacy of information and 25% disagreed that information is adequate to make decisions on risk. Amongst contractors in grade 3, 41% (the modal class) considered that information is not adequate. Does this constitute evidence that contract documents prepared for this group of contractors 41% of the time does not have adequate information?

7.6.4 Adequacy of the Level of sub-contracting

The current level of subcontracting was considered adequate by 60.3% of respondents while 19.6 % were unsure and 20.1% disagreed. The level of subcontracting could be said to be adequate. It reflects the capacity of the contractor to undertake various works on their own. The level of subcontracting should be decided on a project-by-project basis as the subcontracting needs tend to differ from project to project.

7.6.5 Clarity of contracts used on risk allocation and responsibilities

Majority (74.7%) of respondents considered that contracts used could be described as very clear in their allocation of risk and responsibility, 10% were unsure while 15.3% disagreed on the clarity of documents and responsibility. Consultants, clients and project managers appeared to be more confident of the clarity of risk allocation and responsibilities in contract documents.

7.6.6 Adequacy of Incentives offered

Less than half of the respondents (45.1%) indicated that incentives for carrying risks in projects are adequate. A fifth (22.5%) were unsure while 32.4% considered the incentives inadequate. Scrutinising the results closely, contractors were the most likely to consider incentives inadequate. If clients and consultants consider incentives adequate while contractors do not agree, there is a need for the client and consultant to find how to motivate the contractors better.

7.6.7 Capacity of project teams in relation to project characteristics

Various projects need professionals of various skills and experience. It was important to establish whether those engaged on building projects were suited for the projects in which they were engaged as a way of checking for capability. A clear majority of participants (64.9%) were in agreement that those engaged were suited for the job. However, this was not unanimous as 16.7 % disagreed on suitability while 18.3 % were unsure if this was the case, suggesting that there are some projects for which those engaged are not suited. Suitability could be viewed in terms of capabilities of those involved.

7.6.8 Awareness of Opportunities to increase knowledge on risk allocation

Risk allocation could be learnt from experience but knowing about opportunities for learning about risk allocation is vital for improved risk allocation. The findings were that 66% of respondents were aware of opportunities for knowledge increase on risk allocation, 18.8% were unsure of the opportunities and 15% disagreed that there are opportunities to learn. This provided evidence that some of those engaged in the building sector do not have knowledge of where they can learn about risk allocation. This indicates that though they would be aware of a deficiency in their knowledge they did not know what to do to remedy that, resulting in limited risk allocation knowledge.

7.6.9 Perception on risk allocation in relation to project performance

Most (91.4%) of the respondents asserted that appropriate risk allocation improves project performance, 6.01% are unsure while 2.52% disagreed. These results highlight the importance players in the building sector place on risk allocation.

7.6.10 The ease of obtaining insurance

The responses generally showed that obtaining insurance is relatively easy as 11.64% strongly agreed, 34.39% agreed, 17.99% were unsure, 32.28% disagreed while 3.70% strongly disagreed. However these statistics pooled the views of consultants, clients and project managers and consultants, whereas insurance for works is mainly obtained by the contractor of whom slightly less than half (33/79) considered that obtaining insurance for works is not relatively easy while 29/79 considered easy and 15/79 were unsure. The evidence also showed that lower contractor grades find insurance more difficult to obtain.

7.6.11 Adequacy of contingency sums

Contingency sums are normally provided to cover for uncertainties. Nearly equal proportions of respondents considered provision adequate (40.4%) and inadequate (41.5%) while 18.1% were unsure. These results suggest that some projects have adequate sums provided while others do not. The highest proportion of respondents who considered contingency funds inadequate were contractors (32%). This implies that contractors consider that contingency sums provided by consultants are inadequate.

7.6.12 Adequacy of time for project execution

Slightly more than half (55.8%) of respondents considered that the time allowed for project execution is adequate, 14.4% were unsure of the adequacy and 29.8 disagreed with the adequacy of time allocated for project execution. time for projects is decided either by the client or the contractor. Although most respondents considered the time frame adequate projects are rarely executed on time, suggesting that risks that could eventuate on a project are not factored in when setting the duration of the project. Scrutinising the responses closely, more contractors (21% of 29.8%) found the time allowed for project execution to be inadequate.

7.6.13 Adequacy of monitoring of risk

Projects are monitored for various performance parameters e.g. cost, quality, schedule, safety compliance etc. Slightly fewer respondents found risk monitoring adequate (42.6%) as inadequate (43.6| %) while 13.9% were unsure. This suggests a need to monitor risks more. The dissatisfaction was more pronounced amongst contractors.

7.6.14 Adequacy of resources for risk allocation

More than half (59.5%) of the respondents considered they have adequate resources for risk allocation, 26.7% disagreed and 13.8% were unsure. Considering the simplistic methods of risk identification and risk analysis used one can infer that the resources do not require more than skilled persons can apply. Additionally, means for risk allocation are mostly qualitative in nature rendering them subjective.

7.7 Pertinent risks impacting on performance in the ZCI

Many factors influence performance in the Zambian building sector. Fifty-five risk factors identified by source (client related, contractor related, consultant related or external risks) were used in the questionnaire to determine the risk factors in the building sector (see questionnaire in Appendix 7F for a complete list of risks in each category). A 5-point Likert scale was used where 1 meant not important and 5 exceptionally important. For interpretation 1-2 was low importance, 3 moderate importance and 4-5 high importance. The categories of interest are high importance risks. The Relative importance index as described in section 7.4.8 was used to rank the risk factors. A Reliability test using Cronbach's alpha was calculated for the 55 items and the reliability test scored 0.957. According to Reynold and Santos (1999), a Cronbach's alpha value greater than 0.7 implies that the instrument is acceptable. Therefore, based on the results, the questionnaire was judged reliable.

Appendix 10G shows the risk factors impacting on performance in the ZCI arranged with descending means. The risk factor with the highest mean is clarity of drawings and technical specifications (mean 4.33) while the least mean is in risk factor unavailability of storage sufficient storage space around or on site (mean 3.073) (Appendix 10G). Since arranging the risk factors using means does uncover the relative importance of risk factors a relative importance index was calculated for each factor to determine this. To recap The Relative importance index RII value has a range of 0 to 1 (0 not inclusive); the higher the RII, the more important is a risk factor in affecting performance. The RIIs was then ranked, and the results are shown in Table. 7.32 The same procedure was conducted to show the differences in rank risk factors of the sub-groups of the clients, consultants and contractor as shown in Table 7.32.

Table 7.32 showing the ranking of risk factors

No	Risk Factor affecting performance	Overall		Contractors		Consultants		Clients	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank
1	Delay in Payment Process by the Client	0.910	1	0.803	9	0.813	11	0.600	13
2	Clarity of Drawings and Technical Specifications	0.866	2	0.864	2	0.862	2	0.950	1
3	Contractor's Underestimate of Construction Cost	0.862	3	0.839	3	0.872	1	0.867	2
4	Client's Financial Stability	0.851	4	0.892	1	0.857	3	0.733	8
5	Contractor's Financial Difficulties	0.831	5	0.834	4	0.817	9	0.833	3
6	Defective Workmanship and Rework	0.825	6	0.816	5	0.819	8	0.867	2
7	Poor supervision -consultants	0.821	7	0.794	11	0.838	4	0.760	6
8	Poor supervision on site	0.821	7	0.794	11	0.838	5	0.760	6
9	Poor quality materials	0.813	8	0.811	7	0.819	8	0.833	3
10	Errors and Omissions in Design Drawings	0.811	9	0.794	11	0.796	14	0.833	3
11	Unclear scope of works	0.811	9	0.778	15	0.763	26	0.800	4
12	Poor Labour Productivity	0.809	10	0.783	13	0.816	10	0.767	5
13	Inadequate site investigation	0.807	11	0.760	20	0.834	6	0.800	4
14	Poor coordination and communication	0.807	11	0.780	14	0.819	8	0.700	9
15	In adequate budgeting and contingencies	0.803	12	0.789	12	0.808	12	0.800	4
16	Poor planning of resources -materials, labour, equipment	0.802	13	0.805	8	0.794	15	0.700	9
17	Lack of inspection of works	0.798	14	0.759	21	0.825	7	0.733	8
18	Delay in Consultant's Approval of Materials Submission	0.796	15	0.805	8	0.766	24	0.667	11
19	Inadequate specification	0.795	16	0.789	12	0.788	17	0.800	4
20	Escalation in Material Prices	0.795	16	0.814	6	0.779	19	0.760	6

Table 7.32 showing the ranking of risk factors continued

		Overall		Contractors		Consultants		Clients	
	Risk Factor affecting performance	RII	Rank	RII	Rank	RII	Rank	RII	Rank
21	Lack of Coordination among Design Disciplines	0.793	17	0.768	18	0.796	14	0.767	5
22	Delay in Contractor's Payment Certification by the consultant	0.791	18	0.797	10	0.779	19	0.700	9
23	Omission in design contract documents	0.787	19	0.794	11	0.779	19	0.800	4
24	Holding key decisions in isolation	0.782	20	0.780	14	0.794	15	0.667	11
25	Delay in Consultant's Approval of Shop Drawings	0.781	21	0.780	14	0.781	18	0.733	8
26	Delay in Consultant's Response to Requests for Information	0.780	22	0.775	15	0.767	23	0.767	5
27	Unstable exchange rates	0.779	23	0.769	17	0.792	16	0.600	13
28	Ineffective monitoring of risks	0.771	24	0.721	30	0.798	13	0.733	8
29	Late Delivery of Materials	0.770	25	0.769	17	0.771	22	0.767	5
30	Lack of Experience in Similar Projects	0.767	26	0.729	28	0.792	16	0.800	4
31	Frequent Change Orders by Client	0.765	27	0.750	22	0.775	20	0.667	11
32	Lack of interest on delayed payment	0.759	27	0.749	23	0.771	22	0.733	8
33	Non-compliance to tender requirement on site (labour and Equipment)	0.757	29	0.766	19	0.754	28	0.767	5
34	Shortage in Technical Staff and Skilled Labour	0.751	30	0.759	21	0.754	28	0.567	14
35	Unsafe work environment	0.751	31	0.740	25	0.767	23	0.700	9
36	Slow Decision Making Process by Client	0.750	32	0.708	32	0.761	27	0.800	4
37	Unrealistic Contract Duration of the Project	0.748	33	0.721	30	0.771	22	0.833	3
38	Unforeseen Ground Conditions	0.747	34	0.731	26	0.774	21	0.700	9
39	Suspension of work	0.743	35	0.722	29	0.763	25	0.667	11

Table 7.32 showing the ranking of risk factors continued

	Risk Factor affecting performance	Overall		Contractors		Consultants		Clients	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank
40	Insufficient protection of works	0.740	36	0.730	27	0.752	29	0.667	11
41	Construction accidents	0.730	37	0.741	24	0.729	31	0.633	12
42	Delay in Statutory Approvals and Permits	0.727	38	0.707	33	0.649	39	0.760	6
43	Delay in mobilisation	0.725	39	0.721	30	0.733	30	0.733	8
44	Inclement Weather	0.708	40	0.700	35	0.724	32	0.667	11
45	Delay in site handover	0.708	40	0.717	31	0.711	34	0.680	10
46	Unavailability or Shortage in Specified Materials	0.702	41	0.721	30	0.702	36	0.700	9
47	Frequent Changes in Statutory Regulations	0.699	42	0.674	38	0.649	39	0.750	7
48	Unavailability of Equipment Required	0.697	43	0.701	34	0.709	35	0.567	14
49	Delay in resolving disputes	0.659	44	0.630	41	0.677	37	0.633	12
50	Delay in submitting invoices	0.657	45	0.674	36	0.635	42	0.633	12
51	High taxes	0.655	46	0.701	34	0.647	40	0.500	17
52	Difficulty in getting insurance cover	0.655	46	0.682	37	0.647	40	0.520	16
53	Criminal acts vandalism, theft	0.658	47	0.662	39	0.655	38	0.533	15
54	Site Orientation and Restricted Access	0.636	48	0.633	40	0.643	41	0.533	15
55	Unavailability of Sufficient Storage Space around or on Site	0.615	49	0.629	42	0.625	43	0.667	11

The formula below was used to calculate Relative Importance Index (RII)

RII=∑ (Pi*Ui)/ (N-n), Where Pi = Respondent's rating Ui = Number of respondents placing identical rating, N = Sample size and n = Highest value on Likert scale.

7.7.1. Test for Normality

From Appendix 10H values for Skewness and Kurtosis are not zero implying that the distribution my deviate from normal (Hatcher, 2013). A normality test was applied to verify. The test statistic used a hypothesis of $H_{a:}$ The sample comes from a normal distribution and the alternative H_b the sample does not come from a normal distribution. The significance $\alpha = 0.05$ using a single tail test. Therefore to reject the null hypothesis using Shapiro Wilk test at 0.05 the p-value should be less than the threshold. Appendix 10H shows Shapiro-Wilk test ranging from 751 to 910 ($DF = 99$, $p = 0.000 < 0.05$). There is therefore strong statistical evidence that the population from which the sample is drawn may not be normally distributed.

The relative importance index revealed that the relative importance of factors contributing to performance in the ZCI differ among contractor, client and consultants. Tests were carried out to check for statistical significant of risk factor importance overall, using two groups contractor and consultant as clients were not randomly selected and the difference in risk factor importance for different years of experience, various contractor groups and various consultant groups. Firstly, the one sample Wilcoxon tests to determine whether the median of the sample is equal to the hypothesised value of 4. Secondly since only two samples for the consultants and contractors a Mann Whitney U test was conducted to test the hypothesis. Then the Kruskal Wallis one way tests were conducted for determining significant differences for those with different years of experience as these formed 4 subgroups, various contractor groups (3 subgroups) and various consultant groups (3 subgroups) and various qualification for contractors (4 subgroups) and consultants (3 subgroups).

7.7.2 Overall- Consultants and Contractors

A preliminary test was done at hypothesized median of 3. All risk factors were found to be statistically significantly higher than the hypothesized median after correction for multiple hypothesis testing mean except for unavailability of sufficient storage space around or on site (t= 3,994, $z = 1.402$, $p = 0.161$). However, the research question was to investigate high risks. The hypothesis formulated to test significance for the one sample Wilcoxon test was H_2: The median for risk factors (1-55) is equal to 4. This was done using a confidence interval of 95%

with critical value 0.05. The Holm- Bonferroni correction was done to decide on a specified critical value as shown in Appendix10I. The one sample Wilcoxon test suggest that there is significant statistical evidence that the population median significantly differs from the hypothesized median for several risk factors shown in Appendix 10I shown in Blue. The majority of risk factors viewed differently are external (10) followed by contractor (8) related and client (6) related. The least were project management (1) related. Of these clients financial stability ($t = 3,939$, $z = 4.167$, $p = 0.001$, $r = -0.313$) signifying a medium effect, clarity of drawing and specifications ($t = 4,040$, $z = 4.807$, $p = 001$, $r = -0.375$) signifying a medium effect and contractors underestimate ($t = 4,357.50$, $z = 4.374$, $p = 0.001$, $r = -0.32$) signifying a medium effect were significantly higher than the hypothesised median. External risk factors impact on different project participants differently depending on their role. This could be due to a difference in how the risks are managed. Therefore there is a difference in perception as to how statistically significant risks impact performance. This can also be attributed to difference in project characteristics and client type.

There is a possibility that non- compliance to tender requirements on site ($t = 2,303.00$, $z = -2.993$, $p = -0.003$, $r = -0.224$) with small effect, lack of interest on delayed payment ($t = 2,092.50$, $z = -2.697$, $p = 0.007$, $r = -0.206$) with small effect, ineffective monitoring ($t = 2,002$, $z = -2.287$, $p = 0.022$, $r = -0.174$) with a small effect and late delivery of materials ($t = 2,182.5$, $z = -2.129$, $p = 0.033$, $r = -0.162$) with a small effect are perceived significantly different by consultants and contractors.

On the other hand there is statistical evidence to show that the perception of consultant and contractor related risk is viewed the same way by majority of professionals and contractors in the ZCI. This is so because the hypothesised median is not significantly different from the hypothesised 30/55 risk factors (Appendix 10I). The view is the same for risk that are consultant related. The results suggest that the perception is that the consultant related risks are not viewed differently in the ZCI.

7.7.3 Contractors

For the contractors, the results show (Appendix 10J) that there is significant statistical difference in the way the risk shown in green are perceived to affect performance. The statistical difference is more evident in external risks (11), the client (5), consultant related (2) and contractor related (4). There is therefore evidence that the perception of consultant related risks and many of the contractor related risks may be similar.

The differences in perception for the external and client related risk could be due to difference in risk management approach, skill, experience, difference in capacity among contractors and nature of client. Therefore, the different skill and experience may to a large extent influence the management of such risks. Measures may differ for differently perceived risk. They may also differ for similar risk accounting for differences in skill experience and resources in form of available response mechanisms. According to Appendix 10J there is a possibility that the following risks are perceived significantly differently by contractors overall namely: client's financial stability ($t = 906.5$, $z = 2.556$, $p = 0.011$ and $r = 0.297$) with small effect, construction accidents ($t = 247.5$, $z = -2.523$, $p = 0.012$ and $r = 0.299$) with small effect and unsafe work environment ($t = 348.5$, $z = -2.473$, $p = 0.013$ and $r = 0.296$) with small effect.

Within the contractors' subgroup, differences in perception for the various grades of contractors 1 to 3 were investigated. The perception of contractors on various risk factors is the same. However, possible differences in perception might exist for: slow decision making between contractor grade 2 and 1 ($t = 22.47$, $z = 3.139$, $p = 0.005$, mean rank grade 1= 47.90, 2 = 25.43); Unrealistic contract duration between contractor grade 2 and 3 ($t = -16.872$, $z = -2.685$, $p = 0.022$, mean rank grade 2 = 26.37, 3 = 43.66), Poor labour productivity between contractor grade 2 and 1 ($t = 20.075$, $z = 2.807$, $p = 0.015$, mean rank : grade 2 = 29.30, 1 = 49.38), poor planning of resources between contractor grade 2 and 1 ($t = -18.714$, $z = 2.595$, $p = 0.028$, mean rank grade: 2 = 29.33, 1 = 38.89), delay in submitting invoices between contractor grade 2 and 1 ($t = 17.8$, $z = 2.482$, $p = 0.039$, mean rank grade 1= 45.50, 2 = 27.70), delay in resolving disputes grade 2 and 1 ($t = 20.72$, $z = 2.819$, $p = 0.014$, mean rank grade 1= 49.52, 2 = 28.80), criminal acts between contractor grade 2 and 3 ($t = 16.393$, $z = -2.554$, $p = 0.032$, mean rank grade 1 = 41.58, 3 = 41) and unavailability of sufficient storage space between contractor grade 2 and 3 ($t = -16.872$, $z = -2.685$, $p = 0.022$, mean rank grade 2 =

25.07, 2 = 41.94). Additionally, there are no statistically significant differences for contractors with various qualifications (Chi-square range = 0.582-5.654, p = 0.082-0.721, d.f = 3) in their perception of risk factors influencing performance.

7.7.4 Consultants

Consultants have a variety of differences in perceiving risks that are impacting on performance in the ZCI. Nevertheless the majority are external in nature. The perception of risks impacting on performance that are consultant or contractor related in nature are the same as they are not difference from the hypothesised mean (Appendix 10K). This shows that consultants perceive risks influencing project delivery for external (11) risks different compared to those that are client (2), contractor (3) or consultant (1) related. Of the risks perceived significantly, different contractors under-estimate (t= 1581, z= 4.074, p = 0.0001 and r= 0.414) signifying a lightly above medium effect and Clients financial stability (t = 1,045, z = 3.66, p = 0.0001, r = 0.37) signifying a medium effect. These were higher than the hypothesised median. Since external risks are viewed significantly different, measures for external risks are expected to vary depending on the perception of a given project team. While mitigation measures for the internal risks may be similar depending on the perceived impact of a given risk.

There is a possibility of insufficient protect of works, shortage in technical staff and skilled labour, delay in statutory approvals and permits, inadequate site investigation, non-compliance to tender requirements on site and poor supervision being viewed significantly deferent by consultants overall (See Appendix 10K). There is also a possibility that various consultants might perceive construction accidents and poor supervision on site significantly differently. For construction accidents a difference might exist between quantity surveyor (QS) and engineer (t = -12.209, z= -1.888, p = 0.034, mean rank: QS = 37.71, Engineers = 58.88) while for poor supervision on site significantly different perceptions might exist for QS and architect subgroups (t = -18.11, z = -2.866, p = 0.042, mean rank: QS = 37.38, Architect = 55.49). Additionally for the consultants with various qualifications (Diploma, Bachelors, and Masters) the perception of risk factors influencing performance is the same except for inclement weather. For inclement weather a significant different might exist between diploma holders' and Masters' holders' (Chi-square = 6.339, p = 0.042, mean rank: Diploma= 23.50, Masters = 44.50).

7.7.5 Differences in perception of risk factors influencing poor performance

In view of the findings, the Kruskal Wallis one way was used to determine if there is a difference in the perception of consultants, and contractors in the consideration risk factors influencing performance. This resulted in the formulation of the null hypothesis H_5 = the perceptions of consultants and contractors with regard to risk factors affecting performance is similar across the different year of experience, and the alternative hypothesis: the perceptions of consultants and contractors with regard to factors affecting performance are not similar across the different years' of experience.

7.7.6 Difference in perception by different years of experience of risk factors influencing poor performance

The test showed that the perceptions for risk factors are similar across the various years of experience in the ZCI for many risks. However, there is a possibility of frequent changes in statutory regulations, omission in design contract documents, delay in consultants' response to information and delay in contractors' payment certificate by the consultant are perceived differently by professionals with various years of experience (Appendix 10L). Delay in consultants' response to information may be viewed significantly different by those with 11-15 and over 15 years' experience (t = 30.16, z = -2.668, p = 0.046). Omission in design contract documents may be perceived differently by 1-5 years and over 15 years' experience (t = 25.125, z = -2.774, p = 0.033). Frequent changes in statutory regulations may be perceived differently by 11-15 years and over 15 years (t = -32.72, z = -2.802, p = 0.033).

7.7.7 Difference in perception by consultant and contractor of risk factors influencing poor performance

Given the difference in ranking of sub-groups it was also important to find out if there was a difference in risk factor perception depending whether one was a consult or contractor. The null hypothesis H_6 the perceptions of construction practitioners with regard to risk factor affecting performance in the ZCI are similar between consultant and contractor and the alternative the perceptions of construction practitioners with regard to risk factor affecting performance in the ZCI are not similar between consultant and contractor. The findings show that all risk factors are not perceived statistically different as shown in appendix 10L. However there is a possibility of inadequate site investigation (U = 5,715, p = 0.015, r = 0.585) showing a small effect, lack of inspection of works (U= 5,502.80, p = 0.008, r=0.203) depicting a large effect, poor supervision (U = 5,412, p = 0.032, r = -0.161) indicating a small effect, lack of experience in similar works (U = 3,128.00, p = 0.046, r = -0.151) indicating a small effect), Poor supervision on site (U = 2,786.50, p = 0.011, r = 0.038) indicating small effect, unforeseen ground conditions (U = 5,998.00 , p = 0.042, r = -0.156) indicating a small effect and ineffective monitoring of risks (U = 2,926.00 , p = 0.013, r = -0.189) indicating a small effect being significantly perceived differently by consultant and contractor (Appendix 10M). These risks seem to be perceived more differently by consultants

7.7.8 Correlations between risk factors

Correlations were computed among 55 risk factors for a sample of 178 respondents (See Appendix 10N). This was to determine the association between risks as it has been established in the literature that risks some risks can increase or decrease the probability and impact of others risks depending on the risk interdependencies (Tah & Carr, 2000, Yilz et al, 2012). The results suggest that 2,111 out of 3,025 correlations were statistically significant, $p < 0.05$ two tailed. However 298 were greater or equal to, r_S (113) +0.40, $p < 0.05$ two tailed showing a positive moderate correlation. Of these 28 correlations were greater or equal to, r_S (113) +060, $p < 0.001$ two tailed showing strong or very strong correlation.

The following very strong positive correlations were observed as significant (two tailed) between:

i. Poor coordination and communication; and holding key decisions in isolation r_S (170) = +0.82, p = 0.000

ii. Delay in consultants approval of shop drawings and delay in consultants approval of materials submission r_S (173) = +0.82, p = 0.000.

The statistically significant strong correlations for risk factors were as follows

a) Delay in consultants request for information and delay in consultants approval of shop drawings r (172) = +0.657, p = 0.000.

b) Delay in consultants' response to request for information and errors and omissions in design drawings r_S (171) = +0.628, p = 0.000

c) Errors and omissions in drawings and lack of coordination among design disciplines r_s (167)= +0.639 p = 0.000

d) Poor supervision and lack of inspection of works r_S (161) = +0.624, p = 0.000

e) Poor labour productivity and late delivery of materials r_S (169) = +0.648, p = 0.001

f) Poor planning of resources(materials, labour and equipment) with poor quality materials r_S (173) = +0.613, p = 0.000

g) Insufficient protection of works and unsafe work environment r_S (169) = +0.641, p = 0.000

h) Unavailability of sufficient storage space on site and shortage of specified materials r_S (168) = +0.608, p = 0.000

i) Ineffective monitoring ; and poor coordination and communication r_S (172) = +0.708, p = 0.000

j) Holding key decisions in isolation and ineffective monitoring r_S (171) = +0.705, p = 0.000

k) Unavailability of sufficient storage space around or on site and site orientation and restricted access r_S (167) = +0.609, p = 0.000

l) Unviability of required equipment and Unavailability of sufficient storage space around or on site r_S (167) = +0.607, p = 0.000

m) Shortage of specified materials and Unavailability of sufficient storage space around or on site r_S (168)= +0.608, p = 0.000

There were several moderately positive statistically significant correlations shown in Appendix 10N. Of interest were factors with $r_s > 0.500$ as they are likely to influence performance more than the risks with r_s less than 0.5. Some of these factors were also statistically significantly moderately correlated to several others.

1. Delay in consultants response to request for information has moderate correlations with delay in consultants' approval of materials submission (r_S (176) = +0.585, p = 0.000), delay in contractor's payment certificate by consultants (r_S (172) = +0.544, p< 0.000), lack of coordination among design disciplines (r_S (169) = +0.502, p = 0.000) and omission in design contract document (r_S (168) = +0.570, p = 0.000).

2.Inadequate site investigation has moderate correlations with errors and omissions in design drawings (r_S (166) = +0.561, p = 0.001), omissions in design contract documents (r_S (164) = +0.504, p = 0.000), inadequate budgeting and contingencies r_S (169) = +0.545, p = 0.000, lack of inspection of works r_S (166) = +0.522, p = 0.000), poor supervision (r_S (163) = +0.502, p = 0.000 and lack of coordination among design discipline (r_S (164) = +0.515, p = 0.000)

3.Lack of coordination among design discipline has moderate correlations with omissions in design contract documents (r_S (164) = +0.504, p = 0.000), inadequate specifications (r_S (169) = +0.568, p = 0.000),' lack of inspection of works (r_S (166) = +0.522, p = 0.000), inadequate site investigation (r_S (164) = +0.515, p = 0.000)

4.Contractors underestimate has moderate correlations with defective workmanship and rework (r_S (172) = +0.536, p = 0.000) and poor labour productivity (r_S (171) =+0.501, p = 0.000).

5.Poor quality materials has moderate correlation with late delivery of materials (r_S (170) = +0.578, p = 0.000), poor labour productivity (r_S (170) = +0.543, p = 0.000 and poor supervision on site r_S (168) = +0.545, p = 0.001)

6.Clarity of drawings with delay in consultants approval of material submission (r_S (164) = +0.506, p = 0.000)

7.Delay in payment process by the client with client financial stability (r_S (174) = +0.548, p = 0.000)

8.Delay in consultants approval of shop drawing with delay in contractors payment certification by consultants (r_S (165) = +0.505, p = 0.000)

9.Delay in mobilization with : poor planning (r_S (170) = +0.543, p = 0.000) and delay in submitting invoices r_S (171) = +0.548, p = 0.000

10.Delay in statutory approvals with frequent changes in statutory regulation (r_S (165) = +0.524, p = 0.000)

11.Delay in resolving disputes with: difficulty in getting insurance cover with r_S (169) = +0.584, p = 0.000) and criminal acts (theft, vandalism) r_S (170) = +0.515, p = 0.000).

12.Criminal acts with unavailability or shortage of specified materials r_S (167) = +0.541, p = 0.000).

To summarize, all the above positively statically significant associations; when there is decrease in one risk factor it means the other risk factor with which it is significantly correlated is decreased for example when there is sufficient protect of works there is a reduced risk of an unsafe work environment similarly when there is lack of coordination among design disciplines the risk of errors and omissions in drawings is likely to increase. This means that for risk factors that have a significantly positive association a decrease in the likelihood of one decreases the occurrence of the other. In practice care must be taken to mitigate risks that have various positive associations for as long as the associations are significant.

7.8 Document Analysis (Qualitative Analysis) –Contract Documents

Document analysis was used to answer the research question shown below. However, the starting point of the document analysis was provided by the questionnaire survey where pertinent risks were identified. The aggregate of risk factors identified as important for each sub group identified as consultants, clients and contractors were used as a basis for conducting a document analysis for each project (see Tables 7.33). The pertinent risk factors based on the relative importance index necessitated the inclusion of key participants on projects such as client and project manager perspectives whose data was collected using a simple census. This approach is also used as it directly identifies were much efforts may be applied by participants to mitigate risks as these are their perceived high risks. Additionally, this approach acknowledges the fact that risks may be may be pertinent to a given subgroup not necessarily to the whole industry. Therefore an aggregate of high risks is used as shown in Table 7.34.

Research Question	**Sub-questions**
How are risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?	➢ To who is the risk allocated? ➢ What risks are misallocated? ➢ What method is used to allocate risk? ➢ What method is used to treat the risk? ➢ Which type of contract provision is used?

Table 7.33 Descriptive statistics for pertinent risk factors ranked using RII.

No	Risk factor	N	Mean	Std. Deviation
1	Clarity of Drawings and Technical Specifications	180	4.328	0.775
2	Contractor's Underestimate of Construction Cost	194	4.309	0.793
3	Client's Financial Stability	197	4.254	0.787
4	Contractor's Financial Difficulties	191	4.157	0.904
5	Defective Workmanship and Rework	193	4.124	0.767
6	Poor supervision	184	4.103	0.878
7	Poor quality materials	193	4.067	0.872
8	Errors and Omissions in Design Drawings	192	4.057	0.875
9	Unclear scope of works	185	4.054	0.901
10	Inadequate site investigation	191	4.037	0.902
11	Poor coordination and communication	192	4.036	0.808
12	Poor supervision on site	190	4.016	0.826
13	In adequate budgeting and contingencies	194	4.016	0.907
14	Poor planning of resources -materials, labour, equipment	195	4.010	0.919
15	Delay in Payment Process by the Client	194	3.990	0.845
16	Lack of inspection of works	189	3.989	0.881
17	Delay in Consultant's Approval of Materials Submission	197	3.980	0.926
18	Inadequate specification	194	3.974	0.890
19	Escalation in Material Prices	191	3.974	0.986
20	Poor Labour Productivity	192	3.937	0.890
21	Lack of Experience in Similar Projects	194	3.835	0.860
22	Unrealistic contract duration	195	3.742	0.072
23	Slow decision making process by client	195	3.743	0.063

Of the important risk factors presented in Table 7.33 only clients financial stability, slow decision making by the client, clarity of drawings and technical specification, contractors underestimate and unrealistic contract duration are perceived significantly different as high risk by contractors and consultants (excluding project managers) as shown in Appendix 10I. While the rest are perceived significantly different as moderate to high risks by contractors and consultants (excluding project managers)

Table 7.34 shows the pertinent risk factor by source of perception

No	Pertinent Risk Factors	Industry overall	Clients	Consultants	Contractors
1	Delay in Payment Process by the Client	*		*	*
2	Clarity of Drawings and Technical Specifications	*	*	*	*
3	Contractor's Underestimate of Construction Cost	*	*	*	*
4	Client's Financial Stability	*		*	*
5	Contractor's Financial Difficulties	*	*	*	*
6	Defective Workmanship and Rework	*	*	*	*
7	Poor supervision consultants	*		*	
8	Poor supervision on site	*		*	
9	Poor quality materials	*	*	*	*
10	Errors and Omissions in Design Drawings	*	*		
11	Unclear scope of works	*	*		
12	Poor Labour Productivity	*			*
13	Inadequate site investigation	*	*		*
14	Poor coordination and communication	*		*	
15	In adequate budgeting and contingencies	*	*	*	
16	Poor planning of resources -materials, labour, equipment	*			*
17	Escalation in Material Prices				*
18	Delay in Consultant's Approval of Materials Submission				*
19	Lack of inspection of works			*	
20	Unrealistic Contract Duration of the Project		*		
21	Inadequate specification		*		
22	Lack of Experience in Similar Projects		*		
23	Slow Decision Making Process by Client		*		

Project details are given and the parameters of methods of construction, insurance/bonds, subcontracting, contingency provision, and monitoring/supervision/inspection, procurement strategy and misallocated risks are highlighted in relation to the project. Table 7.34 shows the aggregated list of risks viewed as important by the subgroups.

7.8.1 Pertinent risk factors affecting performance

The risks affecting performance in the building sector were mostly internal by nature and mostly client / consultant and contractor related. They were classified by proportion as follows: - managerial (34.8%), technical (26.1%); design (17.4%); financial (17.4%) and economic (4.3%) (See Table 7.36). Most of the risks clearly originated in the construction phase (52.2%).

The document analysis targeted projects that had been implemented or had been open for tender since 2010 and used Joint Liaison Committee (ZIA), ZPPA open national Bidding, ZPPA open international, (FIDIC) ZPPA small works contracts. For documentation to qualify it had to be a complete set as presented at tender stage. A total of twenty documents were collected/ offered for analysis. Two complete contract documents were needed for each standard form identified. Most of the participants were not willing to avail documents that had been priced or for projects where there were issues in dispute. Consequently, the data collected was based on documents used at tender stage. Furthermore, some projects documents were not complete. The distribution of collected documents is shown in Table 7.35.

Table 7.35 Analysis of the Document Collection

Standard form	**Number collected**	**Lacked BOQ / specification / drawing / pages / conditions**	**Complete**	**Documents analysed for study**
Joint Liaison Committee (ZIA)	5	3	2	2
ZPPA open national Bidding	6	3	3	2
ZPPA open International	2	0	2	2
ZPPA small works	7	4	3	2
Total	20	7	10	8

Table 7.36 Pertinent risk factor by categorisation

No	Pertinent Risk Factors	Internal Risk	External risk	Risk Mitigation stage	Risk Category
1	Delay in Payment Process by the Client	X		Construction	Managerial
2	Clarity of Drawings and Technical Specifications	X		Pre-contract	Design
3	Contractor's Underestimate of Construction Cost	X		Pre-contract	Financial
4	Client's Financial Stability	X		Project cycle	Financial
5	Contractor's Financial Difficulties	X		Project cycle	Financial
6	Defective Workmanship and Rework	X		Construction	Technical
7	Poor supervision consultants	X		Construction	Managerial
8	Poor supervision on site	X		Construction	Managerial
9	Poor quality materials	X		Construction	Technical
10	Errors and Omissions in Design Drawings	X		Pre-contract	Design
11	Unclear scope of works	X		Pre-contract	Design
12	Poor Labour Productivity	X		Construction	Technical
13	Inadequate site investigation	X		Pre-Contract	Technical
14	Poor coordination and communication	X		Construction	Managerial
15	In adequate budgeting and contingencies	X		Pre-Contract	Financial
16	Poor planning of resources -materials, labour, equipment	X		Construction	Managerial
17	Escalation in Material Prices		X	Construction	Economic
18	Delay in Consultant's Approval of Materials Submission	X		Construction	Managerial
19	Lack of inspection of works	X		Construction	Managerial
20	Unrealistic Contract Duration of the Project	X		Pre-Contract	Technical
21	Inadequate specification	X		Pre-contract	Design
22	Lack of Experience in Similar Projects	X		Pre-contract	Technical
23	Slow Decision Making Process by Client	X		Construction	Managerial

7.8.2 Project 1: ZIA

The project was the construction of a warehouse with associated external works for a private sector client (see Appendix 8A for details) with duration 18 months. Contract value was slightly above ZMK 820,000. The programme duration was decided by the client. The contract did not provide for any joint ventures or any sub-contracting. Drawings were supplied to contractor at the time of tender. No risk plan was requested.

Methods of construction: Details of how work should be executed was detailed in the documents. The documentation had a section for specifications of materials included in the works.

Insurance/bonds: 10% of contract sum to be used for performance security of works, and equipment/property. No insurance of the works was to be done under this contract as clause 20 was cancelled (waived) from the contract.

Subcontracting: no subcontracting allowed under the contract.

Contingency provision: contingency sum of 10% provided for. No prime cost or provisional sums were provided for.

Monitoring/supervision/inspection: a consultant was employed to supervise the contractor.

Procurement strategy: method of procurement was the traditional method using competitive shortlisted contractors for contractor selection.

Misallocations evident in documents: Inappropriate allocations of risks on this project were the risk of 1.unstable exchange rate, 2. escalation in material prices and 3. Inadequate site investigations as waiver clauses were used to escape these risks by the client. In addition, delay-related risks (e.g. delays in consultant’s response for information) for this contract were not well covered which could result in resource misallocation due to response periods not being stated. There was no clear channel for communication or decision making process indicated in the contract though the architect was contract administrator and client’s site representative was the clerk of works. Therefore, if poorly managed the lack of communication channels could lead to poor coordination and communication leading to risk escalation which could result in resource misallocation in terms of time and costs for either party. In addition, the risk of poor quality materials could be worsened seeing that materials to be incorporated in the works did not need approval from the client, descriptions in the bills of quantities were to be relied upon in the absence of detailed specifications yet the bill of quantities were not very detailed in providing specifications for materials to be used in the project. For the risk of delay for information, requests and drawings for time periods were not given within which consultants should act, this could result in resource misallocation. There was possibility of financial difficulty of contractor as subcontracting not allowed and no advance payment given to contractor. Inclusion of these mechanisms could help contractors' financial situation.

7.8.2.1 Risk Allocation project

Various methods of risk allocation are used in the construction industry. Nevertheless specifically on this project the most common methods used to allocate risk were through risk retention/acceptance and risk transfer (Table 7.37). The risks transferred were those that are supposed to be shared or client owned (escalation/ exchange rate changes). The risks affecting performance were mostly those that were the responsibility of the consultants followed by the contractor. In addition, risks naturally impact more on time followed by cost and very few risks were noted that impacted on quality. In terms of reimbursement most of the risks in terms of the contract used led to cost-plus payment while some risks did not entertain any form of reimbursement as highlighted in the contract data (see Appendix 8A).

7.8.2.2Types of clauses used to allocate pertinent risks and Risk Response

The Tables 7.38 and 7.39 indicate the types of clauses used to allocate risk and the available risks response measures for risk in project 1. The majority of the risks under this contract were highlighted in the contract documentation however there were no clear guidelines given in the contract as to what the consequences should be or what the response was supposed to be. This was not surprising as several of the interviewees in the first part of the research said that "most of the contract clauses are open to interpretation" and others said even though all the risks are there it is not clear in terms of liability and consequences. The document analysis confirms this.

78.3 Project 2: ZIA

The project was for the construction of a communication centre for a private sector client. The contractor was to decide on the contract period and had an annual turnover of ZMK 1000,000, and annual construction volume of ZMK 3,000,000. Preference was for unqualified tenders. The contract documents had forms of tender, special conditions and BOQs. Claims for insurance of imported materials would not be entertained under the contract. No claims would be made for any delay event regardless of cause (Clause 14). The tender was fixed price with no escalation clause (Clause 18). No risk management plan was requested.

Methods of construction: no methods of construction were specified in the document and there was no demand for methods statement to be submitted.

Insurance/bonds: No special stipulations were made in the special conditions of contract

Subcontracting: Subcontracting was allowed at the approval of architect or project manager

Contingency provision: A contingency sum of US$ 50,000 was provided under the contract and provisional sums were provided as follows: plumbing-US$ 12,000, Electrical installations, US$, 32,000, air-conditioning US$22,000, fittings US$3,000

Monitoring/supervision/inspection: The project manager/architect was to fulfil this role although the contract provided for a clerk of works.

Procurement strategy: the tender was on a selective basis using the separated procurement.

*Misallocations evident in documents***:** Inappropriate allocations of risk on this project were the risk of 1. escalation in material prices and 2. Inadequate site investigations as waiver clauses were used to escape these risks by the client. Additionally, risk of design in terms of clarity of drawings and technical specification was transferred to the contractor by clause modification when no drawings were given to the contractor at the time of tender as follows "Clause 12(II) *Client shall not be liable for any deficiency or ambiguity in the design drawings*". Furthermore, no compensation would be given to the contractor for delays in accordance with Clause 14 *No claims would be made for any delay event regardless of cause.* In addition, no time was allocated for action on delays, omissions and clarification to be given to the contractor by the client. For the risk of clarity of drawings and technical specifications, no drawings were given to contractors at the time of tender; this could lead to resource misallocation, incomprehensive risk identification and use of inappropriate mechanisms to deal with risks. Lack of drawings also escalated the risk of poor planning of resources, inability to detect errors and omissions in design drawings, inadequate specification, omissions in design documents resulting in resource misallocation. Risks under the contract that could lead to time resource misallocation were those of delay for responses to requests for information and approval of drawings for drawings by consultants due to lack of period being stated for responses to be delivered.

7.8.3.1 Risk Allocation

The most common response allocation method(s) for project 2 for pertinent risks were risk retention /acceptance and risk transfer as shown in Table 7.37. Risks affecting project performance on this project were consultant and contractor related.

7.8.3.2 Types of clauses used and Risk Response Measure according to contract documentation (ZIA contract project 2)

The project made use of an equal number of obligatory and implied clauses (see Table 7.38). Tables 7.38 and 7.9 indicate the types of clauses used to allocate risk and the available risks response measures. The majority of risks under this contract were highlighted in the contract documentation. However, additional clauses were introduced in the specific contract data to ensure that the consequences were well understood by the contractor (see Appendix 8B). The common risk response measures included contingency sum; monitoring and supervision and regular communication in form of letters/meetings.

7.8.4 Project 3: ZPPA Open international Bidding/ FIDIC Red Book

The ZPPA open international bidding document is based on the FIDIC red book; a harmonised edition of FIDIC 2005. The project was for the design and construction of a 20,000 seating capacity stadium and auxiliary facilities covering 625,000 square meters. Joint ventures were allowed and the construction period was fixed at 24 months by the client. There was no mandatory site visit. No pre-bid meeting was allowed, submissions were to be made in a tender box and no electronic submission allowed. Alternative times for completion were not allowable under this contract. There were no alternative technical solutions permitted and the contract price not subject to price adjustment. International companies interested in bidding for this project had to partner with a local company. The required annual turnover was ten million kwacha in the past three years for a single entity. The required experience for the contractor was outlined in terms of one contractor having been involved before in construction of 2 stadia of similar capacity. Years of experience of architect, civil and structural engineer, quantity surveyor, electrical engineer, water and drainage engineer, project manager for both consulting and construction team on average consultants team should have had 8 years' experience while contractor's team needed 5 years' experience on average. The equipment and numbers required was tabulated. A technical proposal comprising site organisation, method statement, design schedule, construction schedule and equipment schedule and personnel schedule had to be prepared. No risk plan was required.

Methods of construction: the consortium formed to carry out design-build was to detail the construction methods

Insurance/bonds: this was to be done by the contractor according to clause 18.2 for not less than the full reinstatement cost including the cost of demolition, removal of debris and professional fees and profit. The client was to hand over the site and be given the complete project after approval of design.

Subcontracting: this was at the discretion of the design and build company. According to Clause 4.4 subcontractors were not to sub-contract all the works.

Contingency provision: This was to be decided by the consortium company as the client wanted a contract price for design and build.

Monitoring/supervision/inspection: to be done by Consortium Company and the client was to be handed a complete facility design and built according to specification.

Procurement strategy: Design and build through open tender process for group 1 building contractors and international contractor in joint venture with local contractor.

Misallocations evident in documents: lack of escalation for material prices, cover for unstable exchange rates for a contract of 24 Months (2 years), inadequate site investigation was to be the risk of the design and build team. In addition, resource misallocations could occur since time periods for client to give approvals for drawings and request for information was not stated (design not fully agreed especially finishes; contract data stated these would be agreed upon during construction). The latter added to the risk of underestimation or overestimation due to uncertainty in the whole design in terms of finishes.

7.8.4.1.1Risk allocation

Under this project the main method of risk allocation was transfer due to the procurement method of design and build. The consortium (contractor and consultants) had to bear most of the risks as the client had transferred these risks to them (see Table 7.37).

7.8.4.2 Types of clauses used and Response mechanism - ZPPA open international bidding

The consortium was both contractor and consultant. The consortium being responsible for most risks had to closely monitor, inspect and supervise works being carried-out by the various parts in its organisation. It would generally be penalised for non-performance thereby requiring contingency sums to deal with risks. This project made most use of obligatory clauses and had quite a good number of waiver clauses as a means of allocating risk, as shown in Table 7.38.

7.8.5 Project 4 ZPPA Open international Bidding- FIDIC Red book

The project was the construction of a sports facility to provide community in locality with a sports facility and also be a place for hosting international games. The facility was fully operational in 2012 but was commissioned in January 2011. The site is approximately 14 ha. Several modifications were made to the FIDIC contract in terms of which the Engineers role would be replaced by the project manager. Mediation was included as a method of dispute resolution (clause 20.2). The contractor was expected to know specific regulations and restrictions regarding site access as a result no claims regarding access would be entertained under the contract. The contractor was expected to have examined the drawings, visited the site and satisfied himself with regard to the site and to make allowances for local conditions, the supply of water, electricity, accessibility of works, full extent, nature of the operations, supply of all labour and fulfilment of any condition affecting labour employment, the execution of the contract and overcoming any difficulties in carrying out the works. It was also highlighted in the contract documents that no claim would be entertained arising from neglect of the precautions mentioned. There was an indication that changes would be made at tender stage, the general description being “the project description reflects a detailed level of completion. Both the suggested technical solutions as well as the sizes described will be verified and could be modified as the project evolves into construction documents. Plans and sections of the works were provided.

Methods of construction: for specification (Clause 4.9) no alternatives would be accepted unless approved by the engineer.

Insurance/bonds: the insurance was to be as in the contractual provisions of the FIDIC to be provided by contractor, no special conditions were given under the contract.

Subcontracting: subcontracting was allowed only by permission from the project manager under Clause 4.4

Contingency provision: a contingency sum of 10% was provided

Monitoring/supervision/inspection: this was to be the role of the project manager under the project manager.

Procurement strategy: traditional procurement through competitive open bidding.

Misallocations evident in documents: no claim would result from site access according to a waiver clause by the client, while the design was still evolving after the tender stage and award of contract. No claims as a result of design related issues would be entertained by the client despite the design being incomplete at time of tender. This was achieved by means of waiver clause and contractor would be charged for deviation from any design related issue. Furthermore, inappropriate allocations of risk on this project were the risk of 1. escalation in material prices and 2. Inadequate site investigations as waiver clauses were used to escape these risks by the client. Incomplete designs added to risk of clarity of drawings and technical specifications, contractor's underestimation of construction cost, identification of errors and omissions in drawings, omissions in design contract documents and inadequate specifications which could result in resource misallocation. Resource misallocation could also result due to lack of response period for project manager for delay for information on design, approval of drawings and request for information. The risk of frequent changes were eminent on the project due to the right to vary in Clause 13.1 and the incomplete design therefore the mechanism to procure by lump-sum contract could be termed inappropriate. Furthermore, incomplete design made it difficult for contractor to adequately plan, leading to resource misallocation by poor planning.

7.8.5.1 Risk allocation

The methods of risk allocation for pertinent risks were risk transfer and risk acceptance/retention. Risk allocation was mainly retention by consultants and transfer to the contractor. Additional clauses were introduced to transfer risks, see Appendix 8C.

7.8.5.2 Types of clauses used- Project No 4 Based on ZPPA open international Bidding

A common clause under the project is "obligatory" meaning that if everyone carried out their role then very few risks would eventuate as shown in Table 7.38.

7.8.5.3 Risk response according to contract documentation

The measures for response included provision of monitoring/inspection/supervision and contingency sum and float as shown in Table 7.39. Most risks were clearly defined under this contract.

7.8.6 Project 5 ZPPA Open National Bidding

The project was a construction of office blocks and high cost houses with associated external works in a particular district. The programme duration was to be decided by the contractor. At the time of tender joint ventures were also allowed as a method of improving capacity among contractors. Drawings were not given to tenderers at the time of tender. Clause 37.5 indicated that no payment for cost could result from variations if early warning was not given however; there was no time stipulation for such warnings. Rates could only be changed if in the final analysis the rate would be higher by more than 25% and exceeding 1 % of initial contract sum. The rate of 25% percentage is rather too high and could result in bid being high to cover for such risk as material prices was one of the pertinent risk factors identified. A maximum period for liquidated damages was at 100 days and a daily rate of 0.1% of contract sum. An advance payment of 10% of the contract sum was payable to the contractor. In the information to bidders it was stated that no bonus was applicable under this contract though it is standard practice for early completion and the contract was firm fixed price with no applicable escalation clause for changes in labour or material rates. Retention amount was set at 5% of contract sum. The visit to site was at the discretion of the contractor

Methods of construction: no methods of construction were suggested in the tender documents. Bills of quantities suggested the materials to be used and specifications. The contract also permitted the contractor to suggest alternative methodologies for carrying out the work (ITBB. 4).

Insurance/bonds: insurance of works, plant and materials amounts was set at 10% of tender amount, damage/loss of property to be insured at ZMK 20,000, injury to persons insurance at

ZMK5, 000. The insurance guarantee required for this contract was 40% of contract sum. No insurance provision was made in the contract for professional negligence.

Sub-contracting: sub-contracting was allowed under this contract with the approval of the Project manager. There were no indicated percentages of subcontracting in relation to the contract sum.

Contingency provision: a contingency of ZMK 150,000 was provided under the contract however there were also provisional sums as follows electrical works, ZMK 200,000, kitchen units: ZMK 86,00; air-conditioning :ZMK 200,000 and extension works: ZMK 80,000, labour: ZMK 15,000 and materials ZMK 15,000. Clearly there were too many provisional sums. In some instances these could have been avoided by quantifying and describing what was needed by having specialised contractors' price the requirements. When there are too many provisional sums for works that are not measured this may contribute to the contingency sums being inadequate.

Monitoring/supervision/inspection: This was to be done by any professional assigned by the employer to supervise the execution of the works and administer the contract

Procurement strategy: this was procured in a competitive bidding process using the traditional system of open tendering.

Misallocations evident in documents: Escalation clauses were not applicable yet the project was 18 months resulting in inappropriate allocation of the risk of changes in material prices and unstable exchange rates though these are important as most materials are imported and the local currency is usually unstable. Additionally, no time for action for delays, omissions and clarification to be given to the contractor by the client. The client seemed to prefer performance guarantee being sourced from the bank at 10% of contract sum which reduced the liquidity of the contractor and banks normally hold cash or require collateral which may constitute machinery for use on the project. That would result in resource misallocation and constitute an inhibiting mechanism for covering for the risk. On the other hand insurance bonds normally require premiums which very often allow more liquidity to the contractor however in this instance 40% of contract sum would discourage contractors from obtaining guarantees from insurance houses. Resource misallocation could occur from frequent change orders by client as exclusion Clause 37.5 stated that no payment would result from variations if early warning was not given, yet the specific time period for early warning was not stated in the clause making this provision ambiguous or open to interpretation.

7.8.6.1 Risk allocation

The methods of risk allocation for the pertinent risks in this project were risk retention and transfer as shown Table 7.37. These were either retained by the consultants and client or risk was owned by the contractor.

7.8.6.2 Types of clauses Project No 5 Based on ZPPA open national Bidding

The Project made use of escalation clauses, obligatory clauses and some issues were implied. See Table 7.38.

7.8.6.3 Risk Response Measure according to contract documentation

The risks under this project were mostly outlined in the contract document with no clear indication as to the consequences of action. Penalty clauses were used in some instances to show the consequence of action (see Appendix 8E). For most of the risks, early warning was supposed to be given for compensation or exemption clauses to be applicable.

7.8.7 Project 6: ZPPA Open National Bidding

The project was for the construction of police division headquarters, four-storey office block and associated external works (18 months). The client organised a site visit meeting with a pre-bidding meeting. The contractor was to set time for execution of works and alternative times for completion were accepted but not alternative bids. Prices quoted were not subject to price adjustment. The tender process was reserved for citizen influenced, citizen empowered and citizen owned companies only. Personnel required were stipulated in terms of numbers and years' experience. Equipment required was also indicated in terms of numbers and description of equipment. No bonus was allowed on this contract. The contractor submitted a technical proposal comprising construction schedule, mobilisation schedule, method statement, site organisation, list of personnel and equipment. No risk plan was requested.

Methods of construction: methods of construction were to be as prescribed in tender documents and alternative technical solutions were not allowed.

Insurance/bonds: a bid bond was indicated, performance bond and 20% advance payment security against bank guarantee. For performance security there was an option of bank guarantee of 10% or insurance guarantee of 30 %. Insurance for loss or damage to works, plant and materials to be 10% of tender sum, loss and damage to property 10% of tender sum, for loss or damage to property ZMK 20,000, personal injury or death ZMK 5,000.

Sub-contracting: clause 7.1 provided that the contractor may subcontract with the approval of the project manager.

Contingency provision: 10% provision made.

Monitoring/supervision/inspection: This was to be done by any professional assigned by the employer to supervise the execution of the works and administering of the contract.

Procurement strategy: traditional procurement using an open national bidding.

Misallocations evident in document: Inappropriate allocations of risks on this project were the risk of 1.unstable exchange rate, 2. escalation in material prices. Additionally, no time was allocated for action for delays, omissions and clarification to be given to the contractor by the client. The risk to contractor's financial stability was worsened by the performance guarantee preference of the client which required a 10% bank guarantee or 30% from an insurance house. Furthermore risk of financial difficulty of the contractor was a possibility as the client stated that they would not be liable for payment until 56 days after completion. Resource misallocation could result from delays in consultants request for information which had no time limit for action. In addition early warning was to be given for inadequate specification yet time bars for applicability of the early warning were unclear.

7.8.7.1 Risk allocation

Risk retention/acceptance and risk transfer were the main methods of risk allocation as shown in Table 7.37.

7.8.7.2 Types of clauses used on project 6- ZPPA Open National

Obligatory clause and implied clauses were the most common measure used, see Table 7.38.

7.8.7.3 Risk Response Project 6 on ZPPA Open National

Contingency sums, early warning and monitoring were the common risk response measure on this project (see Table 7.39), implying that good faith was required of both parties. Early warning is only beneficial if the parties involved are able to foresee and identify risk. However early warning is a relative term and sometime caps need to be put on some issues to ensure that the contractor is not disadvantaged.

7.8.8 Project 7: ZPPA Small works

The project was the construction of an ablution block to upgrade an existing hospital (see Appendix 8G for more detail on pertinent risks) with expected duration of less than 6 months. The bidding was national and competitive. The employer was to organise a site visit which was mandatory for all bidders. Any request for information was to be made 14 days prior to bid submission. The price was not subject to price adjustment according to clause 14.6. The process was subject to preference treatment according to statutory instrument 36 of 2011 which made it clear that the contractor should be 100% locally owned. The project documentation comprised architectural drawings, structural engineering drawings, electrical engineering and mechanical engineering drawing comprising plumbing, soil drainage and air-conditioning installations. Joint ventures were allowed on the projects. The contract document did not have special instructions to bidders but sections 1-3 referred to ITB not in the document.

Methods of construction: alternative technical solutions or methods were not allowed under this bid.

Insurance/bonds: A bid declaration form was provided. This allowed the contractor to carry out work without obtaining any bonds or insurance. Nevertheless, should they not perform then the contractor was to be deregistered for a period of 5 years

Subcontracting: This was allowable in clause 7 with the approval of the project manager

Contingency provision: contingency sum was set at 10% of contract sum. Provisional sums under the contract were as follows: circuit breaker ZMK 62,000, toilet cubicles ZMK 12,000 and window panes ZMK 50,000. All the aforementioned are items that are easily quantifiable and did not warrant the use of provisional sums. Additionally there was a provisional sum for labour at ZMK 50,000.

Monitoring/supervision/inspection: The project manager and his team were to monitor, inspect and supervise.

Procurement strategy: The method was the traditional system with a competitive national bidding applying the preferential bidding policy.

Misallocations evident in documents: for risk of unclear scope, delay in consultant approval of material submission, omissions in design contract documents, delay in consultant's approval of shop drawings/request for information and frequent change orders by client were considered as compensation events provided early warning was given yet there were no time bars for which early warning should be given. The risk of having an inexperienced contractor was possible as experience required for the contractor was not specified.

7.8.8.1 Risk allocation

Risk reduction and transfer were common modes of risk allocation used (see Table 7.37). However, though the clients/consultants retained most risk there was hardly any penalty for default (See Appendix 8G). Risk response was mainly based on responsibility. Those responsible should closely monitor and give early warning of emerging risks.

7.8.8.2 Types of clauses used -Project 7 ZPPA Small works

Obligatory clause was the most common allocation method and only 2 waiver clauses were used (see Table 7.38).

7.8.8.3 Risk Response according to contract documentation Project 7- ZPPA Small works

The common risk response features in view of pertinent risks identified were the contingency sum and monitoring or supervision as shown in Table 7.39.

7.8.9 Project 8: ZPPA Small works

The project was for the construction of a false roof and emergency staircase. The project/contract manager needed to have 10 years' experience, site/manager/engineer/agent at least 5 yrs. and general foremen 5 years' experience. Essential equipment was also identified. Alternative proposals were not permitted. The project was not subject to price adjustment. The advance payment was to be 30%. A risk management plan was requested in terms of Health and Safety.

Methods of construction: works were to be carried out as described in the contract documents. A detailed section was included on the methods of construction to be used and the quality of materials. Clause 27 provided that the program should also highlight method of the works to be carried-out.

Insurance/bonds: performance security was to be 10% of contract sum. Insurance for works, plant and materials; personnel injury, damage to property and equipment not already covered was to be obtained but amounts or percentages were not indicated.

Subcontracting: according to clause 7.1 the contractor was allowed to subcontract with the approval of the project manager.

Contingency provision: 10% contingency sum was provided for under the contract.

Monitoring/supervision/inspection: The project manager and his team were to monitor, inspect and supervise. It is also implied that the contractor would carry-out this role for works to be constructed as described.

Procurement strategy: traditional procurement with an open tender to group 3 and 4 contractors in the building category.

Misallocations evident in documents: For risk of unclear scope, delay in consultant approval of material submission, omissions in design contract documents, delay in consultants approval of shop drawings/request for information and frequent change orders by client and late delivery of materials were considered as compensation events provided early warning was given yet there were no time bars for which early warning should be given could result in resource misallocation. The risk of having an inexperienced contractor was possible in competitive bidding where the lowest bidder normally wins a bid, seeing that the experience required for the contractor was not specified.

7.8.9.1.1Risk allocation and Types of clause used in Project 8 ZPPA Small works

The main modes of allocation were retention and transfer (See Table 7.37 and Appendix 8G). The most common type of clause used was the obligatory clause (see Table 7.38); however given the performance of projects there was need to attach some time frames and punitive measures to ensure that obligations were diligently carried out.

7.8.9.2 Risk Response Project 8 ZPPA Small works according to contract documentation

The most common measure to be used was that of contingency to cover the risks following by monitoring risks (see Table 7.39).

7.9 Risk Misallocations across the 8 projects

Analyses of the contract documents showed inappropriate allocation of risks for, escalation in material prices (Project 1,2,3,4,5,6), inadequate site investigation (projects 1,2,3) and design related issues e.g. omissions and unclear specification (Project 2,4,7). These were risks transferred to the contractor using waiver clauses. Imperfect mechanisms were used for contractor's financial difficulty (project 1, 4, 5) where client either did not allow subcontracting or showed a preference for bank guarantees. Imperfect mechanisms were also related to delay-related events which contractually entitle a contractor to compensation (Project 1, 4, 5, 6, 7, 8) due to absence of notification periods in the clauses resulting in ambiguity in application of the clause. Finally, resource misallocation could occur through delay in providing requested information, frequent changes in scope (Project 3, 4,5,7), poor resource planning due to incomplete designs or non-provision of drawings (Project 3,4,5,7) and during pricing which could also lead to estimation related risks (Project 3,4,5,7).

7.10 Method of risk allocation across projects

Table 7.37 shows the methods of risk allocation for the pertinent risks across projects subjected to documents analysis. Figure 7.14 shows that risk retain and transfer account for 89.13% of method of allocation for the highly important risks.

The analysis shows that the allocation to the contractor was risk transfer to the contractor through the use of waiver clauses and contract modification. Accepted (mainly financial) risks seldom have measures for mitigation in place apart from the contingency sum. Method of risk allocation seemed to be uniform except for a few cases (see Table 6.38). Some allocation was influenced by the procurement method and others seem clearly to be the choice of the client as they modified the risk allocation of certain clauses from the standard form.

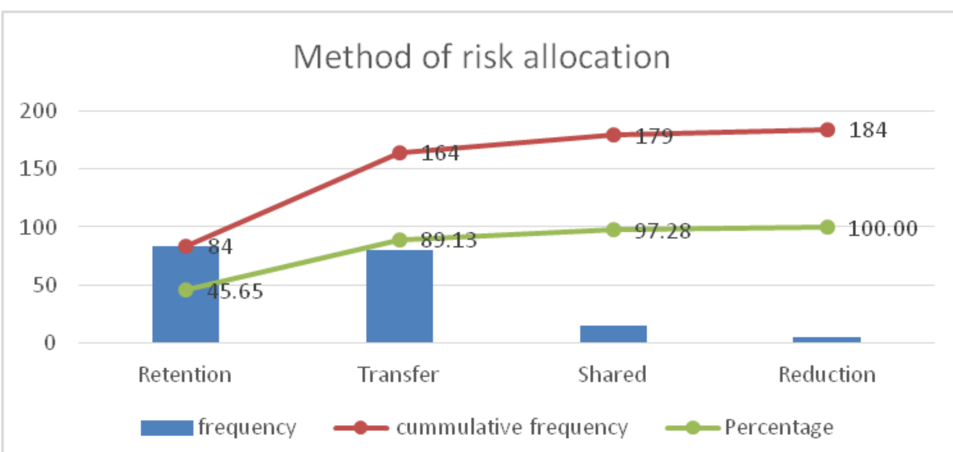


Figure 7.14 Methods used to allocate risks across projects for pertinent risks

Table 7.37 Method of risk allocation across projects

Risk Factor	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Project 7	Project 8
Clarity of drawings and technical specifications	1	3	3	1	1	1	1	1
Contractor's underestimate of construction cost	3	3	3	3	3	3	3	3
Client's financial stability	1	1	1	1	1	1	1	1
Contractor's financial difficulties	5	5	5	5	5	5	5	5
Defective workmanship and rework	3	3	3	3	3	3	3	3
Poor supervision of contractor	1	1	3	1	1	1	1	1
Unclear scope of works	1	1	1	1	1	1	1	1
Poor quality materials	3	3	3	3	3	3	3	3
Errors and omissions in design drawings	1	3	6	1	1	1	1	1
Poor coordination and communication	5	5	6	6	6	1	1	1
Inadequate site investigation	1	3	3	1	1	1	1	1
Poor supervision on site	3	3	3	3	3	3	3	3
In adequate budgeting and contingencies	1	1	3	1	1	1	1	1
Poor planning of resources -materials, labour, equipment	3	3	3	3	3	3	3	3
Delay in payment process by the client	1	1	1	1	1	1	1	1
Lack of inspection of works	1	1	3	1	1	1	1	1
Delay in consultant's approval of materials submission	5	5	6	1	5	5	1	1
Inadequate specification	1	1	3	1	1	1	1	1
Escalation in material prices	3	3	3	3	3	3	3	3
Poor labour productivity	3	3	3	3	3	3	3	3
Lack of experience in similar projects	3	3	5	3	3	3	3	3
Unrealistic contract duration	3	3	3	3	3	3	3	3
Slow decision making process by client	1	1	1	1	1	1	1	1

1-Retention/acceptance, 2- Elimination, 3-transfer, 4- Ignore, 5- Reduction/mitigation, 6-shared

7.11 Types of clauses used to allocate risks across projects

Various clause types were used in allocating risks in the projects in the sample (See Table 7.38). Figure 7.15 shows, over 80% of the clauses for highly pertinent risks are obligatory, implied, escalation and penalty. This shows reliance on explicit clauses and these were tied to responsibility. Others included penalty clause, waiver clause and exclusion clause as shown in Figure 7.15. The obligation based risks and implied risks were mainly applied to managerial and technical risks while penalty, escalation and waiver clauses were for financial risks. The majority of clauses used to allocate the prevalent risks are either obligatory clauses (merely outlining a duty with no consequence for not carrying out the duty), waiver clauses (stating that though the clause is part of the standard form is not applicable under the contract) or implied (the clause is not stated but implied by the role of the project participant). Various risks could be said to have a universal preferred clauses (e.g., inadequate specification, escalation in material prices).

Table 7.38 Types of clauses used across projects

Risk Factor	**Project 1**	**Project 2**	**Project 3**	**Project 4**	**Project 5**	**Project 6**	**Project 7**	**Project 8**
Clarity of drawings and technical specifications	5	5	5	2,5	5	9	5	5
Contractor's underestimate of construction cost	9	9	5	5	9	9	9	9
Client's financial Stability	9	9	5	5	5	5	5	5
Contractor's financial difficulties	9	9	5, 10	5,10	9, 10	9, 10	9, 10	9,10
Defective workmanship and rework	1	1	1	1	1	1	1	1
Poor supervision of contractor	5	5	9	9	9	5	9	9
Unclear scope of works	2	2	5	5	2	5	5	5
Poor quality materials	5	5	5	5	5	9	5	5
Errors and omissions in design drawings	5	5	5	5	5	5	5	5
Poor coordination and communication	9	9	5	5	9	9	9	9
Inadequate site investigation	8	8	8	8	8	2	5	5
Poor supervision on site	5	9	5	5	5	9	9	9
In adequate budgeting and contingencies	5	5	8	5	5	5	5	5
Poor planning of resources -materials, labour, equipment	1, 9	1, 9	5	5	5	9	5	9
Delay in payment process by the client	5, 10	5, 10	1, 10	1, 10	2, 10	3, 10	2, 10	1,10
Lack of inspection of works	5	5	5	5	1, 5	5	1	5
Delay in consultant's approval of materials submission	5	5	5	5	2	5	1	5
Inadequate specification	5	5	5	5	5	5	5	5
Escalation in material prices	8	8	8	8	8	8	8	8
Poor labour productivity	5	5	5	5	2	2	2	5
Lack of experience in similar projects	9	9	5	5,2	5	5	9	9
Unrealistic contract duration	9	9	2	2	2	2	2	2
Slow decision making process by client	2	2	2	2	2	2	2	2

1- Penalty clause, 2- Escalation clause, 3- Exclusion clause, 4- Assignment Clause, 5- Obligatory clause, 6- Force majeure clause, 7-Idemnification clause, 8- Waiver clause, 9- implied provision, 10- termination clause

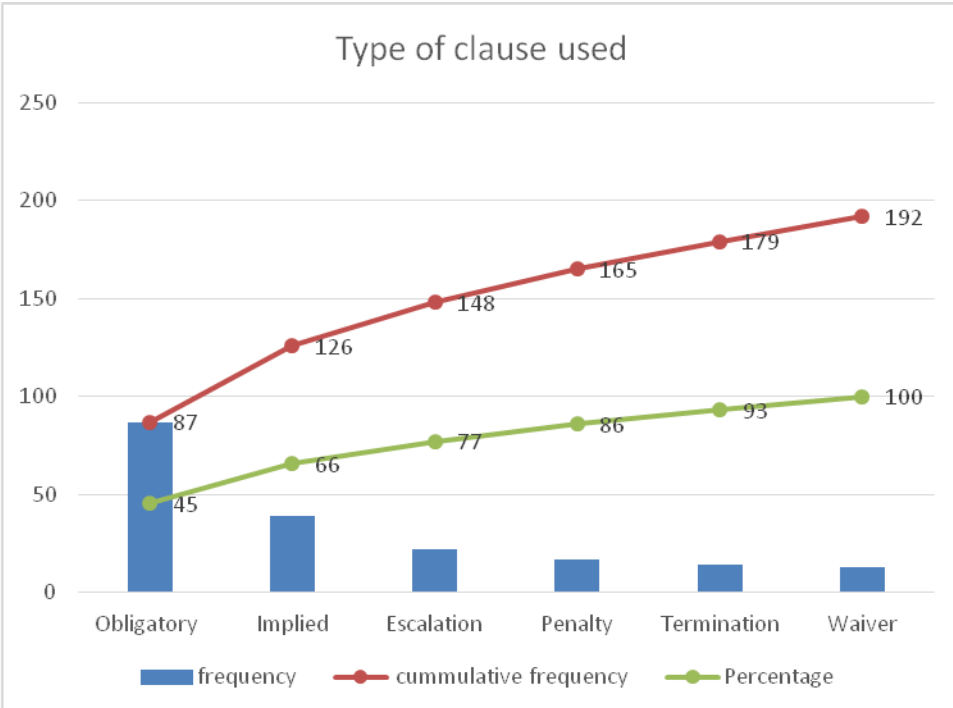


Figure 7.15 Types of contract clauses used for important risks for pertinent risks

7.12 Risk response measures across the 8 projects

The findings show that some risks had various response mechanisms associated with their mitigation while others had only one (See Table 7.39). The response methods accounting for 80% of the highly pertinent risks include contingency, monitoring/supervision, expertise (sub-contracting and joint ventures), early warning, checking of design and selection of stable supplier (Figure 7.16). These should be the focus for better project delivery.

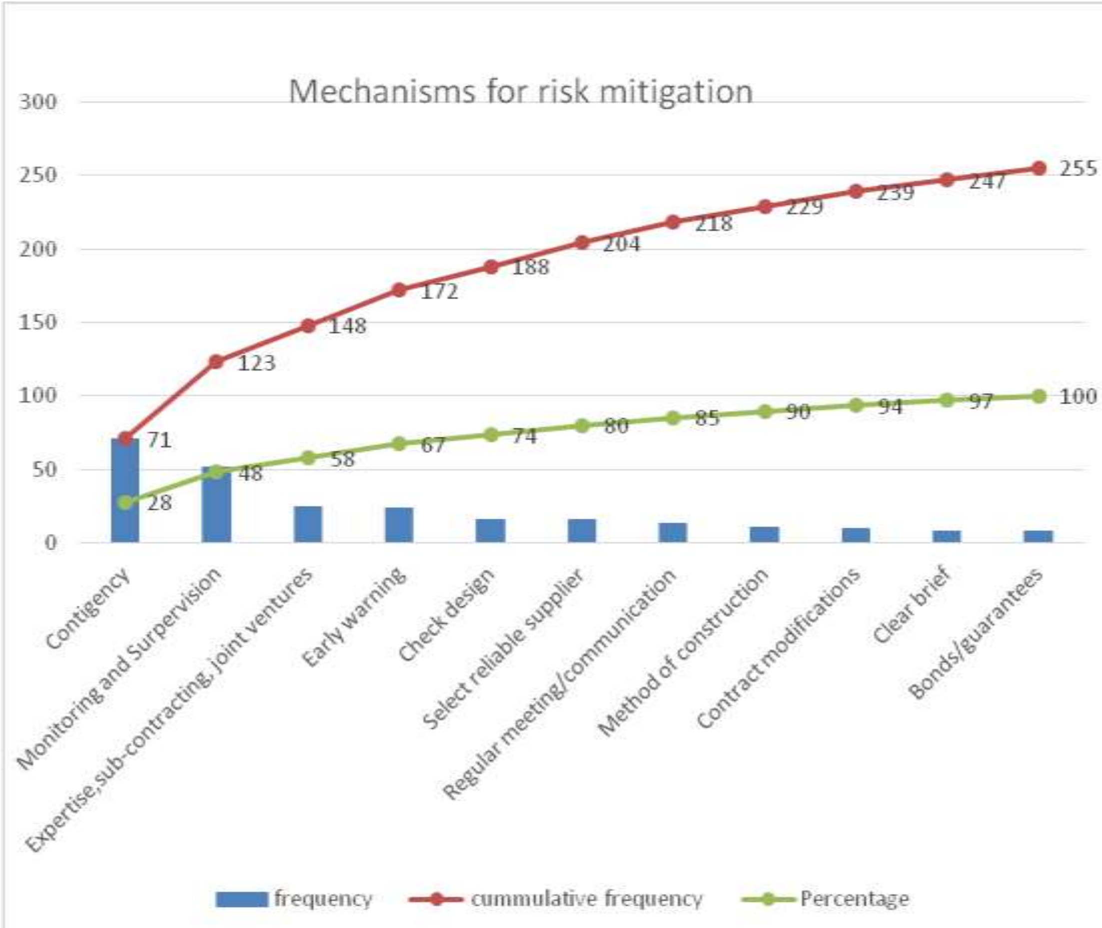


Figure 7.16 Mechanisms used for important risks for pertinent risks

Response measures seemed to be common across the different building project types and across the different standard forms of contract e.g. delay in payment, lack of coordination among design disciplines, poor supervision of contractor, unclear scope of works. However, some contract types offered more response measures to risks than others. Some risks e.g. defective workmanship, contractor's financial difficulty triggered several response mechanisms. For instance, contract types allowing for variation in methods of execution, joint ventures, subcontracting, advance payment, and early warning procedures had added avenues for the mitigating risk.

Table 7.39 Risk responses used across projects

Risk Factor	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Project 7	Project 8
Clarity of drawings and technical specifications	3	1	3	3	3	3	3	3
Contractor's underestimate of construction cost	6,15	6,15	6	6	6	6	6	6
Client's financial stability	6	6	6	1,6	6	6	6	6
Contractor's financial difficulties	9,6	9,6	9,6, 16c 16b	9,6, 16c 16b	9,6, 16c 16b	9,6, 16c 16b	9,6, 16c 16b	9,6, 16c 16b
Defective workmanship and rework	6,12	6,12,15	6,12,15,16c, 16b	6,12,15, 16b	6,12, 15, ,16c, 16b	6,12,15,16b	6,12,15,16b	6,12,15,16b
Poor supervision of contractor	15	15	15	15	15	15	15	15
Unclear scope of works	6,13	6,13	6,13	6,13	6,13	6,13	6,13	6,13
Poor quality materials	4,12	4,12	4,12	4,12,15	4,12	4,12	4,12	4,12
Errors and omissions in design drawings	3	3	3,10	3,10	3,10	3,10	3,10	3,10
Poor coordination and communication	14,15	14, 15	14, 15	14, 15	14,15	14,15	14,15	14, 15
Inadequate site investigation	12	6	1,6	6	6	6	6,15	6,12
Poor supervision on site	12,15	12, 15	12	12	12	15	15	15
In adequate budgeting and contingencies	6	6	6	6	6	6	6	6
Poor planning of resources -materials, labour, equipment	4,15	4,11,15	6,11,15	4,15	4,11, 15	4,15	4,15	4,15
Delay in payment process by the client	6	6	6	6	6	6	6	6

Table 7.39 (continued) Risk responses used across projects

Risk Factor	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Project 7	Project 8
Lack of inspection of works	12	12	12	12	12	12	12	12
Delay in consultant's approval of materials submission	14	14	8	10	10	6,8	6,8	6,8
Inadequate specifications	3,14	3,14	3,10	3,10	3,10	3,10	3,10	3,10
Escalation in material prices	1,6	6	6	1,6	1,6	1,6	1,6	1,6
Poor labour productivity	15	11, 15	11,15	15	11,15	15	15	15
Lack of experience in similar projects	15,16a,	15, 16b,16a	15,16b,16c	15, 16b	15,16b,16c	15,16b	15,16b	15,16b
Unrealistic contract duration	16a, 14,11	16a,14,11	16b, 16c, 11	16b,16,11	10,16b,11,16c	10,16b,11	10,16b,11	10,16b,11
Slow decision making process by client	14	14	10	10	10	10	10	10

1-Modification of contract, 2-claim, 3-check design before tender, 4-selecting stable supplier, 5-insurance, 6- contingency sum, 7- contingency resources, 8- contingency float, 9- bond/ guarantee/warrantee, 10- early warning, 11- methods of execution, 12- testing/inspection, 13- clear brief from client, 14- Regular meetings/communication, 15- monitoring/supervision, 16a-employ expert with expertise/16b-subcontracting/16c-joint venture.

7.13 Summary of findings based on Objectives of the study

There are three research questions (RQs) covered in this chapter. The summaries of findings are represented based on each research question.

7.13.1 RQ 1: What factors influence the choices of contract forms on building projects to influence risk allocation?

This research question was mainly centred on finding out the instrumentation used in the ZCI. To find out what environment support, tools in form of contracts are used for building construction in the Industry and what considerations e.g. motivation, incentives, interests or consequences, are considered in the selection. It was also to investigate who has the most power in the decision on the form and type of contract for use on a building project.

To answer the question, the starting point was to find out the type/nature of building projects and the contracts available for use. Type of projects can be broadly categorised into residential, commercial and industrial (see Table 7.1 and section 7.46). The nature of the work is new construction, renovations, extensions, refurbishments and occasional rebuild and demolition as shown in Figure 7.11 and in section 4.0 of Chapter 4. The mentioned works are normally executed using formal standard contracts chosen by the client. The implication is that clients with consultants have power to put conditions that suit their interests which in most cases do not favour the contractor (Section 7.15 and 7.2.5).

The contracts in use are Zambia public procurement Agency suites, FIDIC, ZIA, ADB for the public sector (Figure 7.13). The implication is that contracts are chosen based on price as shown in Section 7.1.1). The private sector contracts include ZIA, JBCC, NEC and some based on the American system. Contracts used are shown in section Figure 7.1.1, and 7.4.7). The contracts are chosen based on client or consult motivated factors in the private. The contracts are based on the separated procurement although there is evidence of the utilisation of integrated procurement (project 3 section 7.7.6 and section 7.1.2). The NEC (2005) option has contract options for integrated procurement yet there is evidence of only option A based on priced bill of quantities being used.

Factors considered for contract selection vary between public and private sector as shown in Tables 7.2 and 7.22. The major difference being the consideration of public benefit for the public sector. Section 7.4.8 shows selection factors for project managers, quantity surveyors, architects, engineers and clients individually and overall with the relative importance of each factor. Clearly, there is a difference in perception between the subgroups (Section 7.4.8). Additionally the factors (method of price determination, procurement method and incentives, complexity of requirements) that contribute to risk allocation as suggested by the literature in section 4.4 are not considered as important overall. The factors considered in contract selection clearly show that the client is more interested in reducing their liability since lump-sum contracts are used for projects were design information is inadequate (Tables 7.14 and 7.3). The literature suggests that to use this type design should be complete (Section 3.5.1.1 in Chapter 3) but is not always the case in the ZCI.

Additionally, there is a difference in perception as shown in Appendix 10B-10D of the importance associated with selection of contract selection factors within the subgroups and in the building sector as a whole. There is no significant difference on how different consultants of varying years of experience rate the importance of contract selection factors Selection (See Appendix10 E and 10F). Factors that influence risk allocation such as status of design, method of price determination, procurement method and incentives are not considered of high importance as selection factors as shown in Table 7.23.

Correlations between contract selection factors were computed to determine the direction of the relationships. Several statistically significant moderate positive relationships were found to exist within the factors (Table 7.24). This implied that an increase in one positive correlated selection factor could lead to an increase in the consideration of another with the same positive relationship. To illustrate the consideration of method of price determination as a selection factor would increase the consideration of status of design, financiers' preference and flexibility of design as these are a positively moderately correlated.

To conclude, from the contract selection important factors that could influence risk allocation such as method of price determination, procurement method, status of design, incentives, and complexity of requirements are not considered as highly important consequently this results in risk allocation not being fully addressed. This results in use of inappropriate contracts (section 7.7.6) and modifications resulting in incomprehensive allocation (section 7.7.6 and 7.1.4), resource misallocation and inappropriate allocation (due to deficient contract portfolio) if, modifications are not carefully done.

7.13.2 RQ 2: What are the risk allocation practices used by contracting parties in the ZCI?

This research question was mainly centred on finding out the personal attributes of contracting parties (agency). To find out what, perceptions, skills, knowledge, capacity, Work and effort, creativity, information and motivation characterises project teams in the ZCI.

The perception of risk in the ZCI is mainly negative as shown in section 7.2.4 not different from section 3.1 in Chapter 3. This implies that building sector is aware that risks result in negative project outcomes. Section 7.5.4 shows the ranking of severe sources of risk in the industry. The right perception on risk sources should have been that risks origin from within the project teams (consultants, clients and contractors) (Section 7.8.1). However, the perception is that the severe risks are mostly external in nature (Section 7.5.4). There is significant statistical evidence that though the perception is that external risks are influencing poor performance, the rating of the level of importance for external factors differ within the consultants and contractors as shown in Appendix 10J and Appendix 10L respectively.

The majority of project participants in the ZCI have a Bachelor's degree (section 7.4.2 and Table 7.1). Therefore the level of education is acceptable. The contracting parties in the ZCI have some skills in some risk allocation practices such as risk identification, communication and qualitative risk analysis as shown section 7.6.7, Section 7.9.8, section 7.5.1 and section 7.5.2. However, there is evidence of monitoring needing attention as shown in section 7.6.13 and quantitative risk analysis (Section 7.2.6 and 7.5.2). The practice of risk identification is conducted with unsophisticated tools such as brain storming, expert judgement, and local knowledge (Table 7.25 and Table 7.6) and check list, expert judgement for risk analysis (Table 7.29). This implies that most have skill in using these tools. In terms of capacity Section 7.2.3 and 7.4.3 shows than many have not had any training in risk management though in section 7.6.7 there is a perception that consultants are shown to match the skills needed on a project. Furthermore, there is statistical evidence that different role players and those with various years of experience are more knowledgeable and skilled in given methods of risk identification (Table 7.27) and analysis (7.29B and Appendix 9I to9L).

Section 7.5.3 shows that the clients, consultants and project managers perceive to have adequate abilities in varying aspects of risk allocation related practices. Clients ability is least in risk control and adequate in risk communication. Consultants perceive to have adequate abilities in communication compared to risk control. While contractors perceive to have the least abilities in control and most in communication. Risk control and analysis are not areas were projects teams have abilities in.

Work and effort is utilised to reduce risk by consultants, contractors and clients. This is assumed to be common practice for those who engage in construction projects regularly. lessons learnt from previous projects (see section 7.2.10 and Table 7.10) includes client and project selection, and how to respond to risk better for contractors. Consultants put more work and effort in risk planning, identification and contract documentation. While the client learns to plan better for risk (Table 7.10 and Appendix 9C). Risk monitoring and Planning is an area that is not concentrated on by the project participants as few really point to monitoring and risk analysis as an area were more work and effort is put for future projects. Work and effort on risk allocation in the ZCI is undermined by lack of formal systems for risk management by majority of firms (section 7.3.9)

Creativity is demonstrated by changing legislated payment period in Project 6 to minimise disputes related to payment. It is also demonstrated in the modification of contract terms for project 3 by adapting a traditional procurement contract (FIDIC red book1999) to fit an integrated approach where contractor is expected to design and build.

Information used to allocated or appreciate risk liability in the ZCI result from inadequate site investigation and design (inadequate detail on drawings and omissions in contract documents Section 7.1.4). The aforementioned risks are viewed as risk factors affecting performance as shown in Table 7.3, Table 7.6 and Table 7.14. To exacerbate the situation on public sector projects contractors are hardly given opportunity to negotiate areas of concern especially lower grade contractors (section 7.3.4). This shows that clients have more power were information is concerned. In addition, feedback though given almost always (Section 7.6.2) is not given in a timely manner according to section 7.3.5.

Motivation to perform in the ZCI is through use of clauses such as penalty clause as shown in sections 7.1.5 and 7.4.9. The penalty clause is seen to be effective when clients have owned up to their obligation of payment. Incentives are not used to motivate contractors as they are not considered important as a contract selection criterion (Appendix 10A, Table 7.23 and Section 7.6.6). Team members are motivated by financial gain for those who are more experienced and by experience by those with less than 5 years' experience (see Table 7.17).

From the practice of risk allocation in the ZCI various issues are contributing to risk misallocation namely lack of: risk monitoring and control, quantitative risk management, incentives, adequate information, training in risk management and unjustified contract modifications.

7.13.3 RQ 3: How are risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?

This research question was mainly centred on finding out the instrumentation used by contracting parties. To find out what, risk mechanism, clauses and allocation methods are used by contracting parties in the ZCI and their possible deficiencies for risk allocation.

The identification of risks perceived as important by contracting parties (parties' client/consultant and contractor) was used as a starting point for the document analysis. These were determined through the calculating of relative importance index as shown in Table 7.32. The majority of the pertinent risk factors are internal and managerial in nature (Table 7.36) and some consequently lead to time, cost and quality shortfalls as shown in Appendix 8A-8H.

Due to differences in rating of the sub-groups further statistical tests were conducted namely one sample Wilcoxon test (Appendix 10I-10K), Kruskal Wallis one way test (Appendix 10L) and Mann Whitney U (Appendix 10M) tests. The tests reviewed possible statistical differences in the rating of risk factors whether grouped by role (consultants and contractors) or years of experience or within group. Correlations for the 55 risk factors were also computed and findings show several significant positive moderate correlations (Appendix 10N). The implication of this is that regardless of risk owner if there is positive correlation the mitigation has to be carefully done to reduce increasing the possibility of occurrence of a positively correlated risk. For instance section 7.7.1.6 shows that increase in the risk of lack of coordination among design discipline increase the risk of errors and omissions in drawings due to the significant positive correlation.

To answer how pertinent risks are allocated: misallocated risks, risk allocation method, type of contract clause, and response methods were analysed in the document analysis. Common risk misallocation resulting from waiver clauses was observed. Risks resulting from use of waiver clauses include escalation in material prices for projects that extended beyond a 12 month period, inadequate site investigations and errors and omissions in designs. Use of imperfect mechanism such as sub-contracting with cap of 20%, inadequate risk monitoring and resource misallocation resulting from incomplete designs (section 7.7.3) were also found.

The methods used for risk allocation are retention and transfer under section 7.7.4 and Figure 7.14. The clauses used to allocate the pertinent risks were based on express obligation or implied obligation as shown in section 7.7.5 Figure 7.15). The response mechanisms tied to the risk factors were mainly contingency, monitoring and supervision. Other mechanisms are checking of drawings, early warning and use of expertise/joint ventures and sub-contracting as shown in Figure 7.16. The mechanisms were common across projects though some contract forms have additional response measures such as early warning procedure, joint ventures and methods of construction suggestions.

In view of the main question, differences in perception of risks affecting performance influences allocation (Lehtiranta, 2014). This could result in incomprehensive allocation. Use of imperfect mechanisms or non –implementation of mechanisms (monitoring and supervision) or carrying out of obligations contributes to risk misallocation. Since some of the risks are not contractual but are implied non-mitigation of these risks adds to risks consequently adding to resource misallocation. Waiving of clauses unbalances the allocation thereby contributing to risk misallocation.

7.14 Chapter Summary

The findings for the research have been presented under qualitative and quantitative analyses. The findings were analysed qualitatively using content analysis of responses to open-ended questions in the questionnaires in the industry survey, professionals in the ZCI and the expert Delphi panel. Qualitative document analysis was done using content analysis and interpretive analysis. For the closed questions in the survey and validation process, descriptive statistics were used. The findings show that risk misallocations in the building sector exist and their nature are unbalanced risk allocation, resource misallocation and use of imperfect mechanisms. Practices contributing to risk misallocation are from contract practice and risk allocation.

For contract practice, it was found that the selection of contracts does not prioritize price determination and procurement methods; factors which the literature highlight as very important in allocating risk. Contract documents normally contain errors and omissions. Additionally, the standard contract forms are modified to shift risk liability from the client to the contractor or waiver clauses are used to escape liability.

Risk practice is characterised by lack of skill in some risk practices (quantitative risk analysis and risk monitoring), inappropriate instrumentation (absent formalised and systematic methods of conducting risk management and consequently risk allocation). These deficiencies result in reactive rather than proactive risk management. The next chapter discusses the findings arrived at by considering the qualitative and quantitative data findings together and positioning the findings within the existent literature.

CHAPTER 8-DISCUSSION

8. Introduction

This chapter discusses the key findings from the semi-structured interviews, questionnaire survey and document analysis, and places them in a larger context using the existent literature. The chapter also provides a summary of why risk misallocation is a persistent weakness in the Zambian building sector. According to Patton (2015) the organising and reporting of data can take storytelling approaches (chronology, historical sequence, flashback, retrospective approach), case study approaches (people, critical incidents, various setting) or an analytical framework approach (processes, issues, questions/objectives, sensitizing concepts). In this study, an analytical approach was adopted by use of research questions. Below are the questions covered in this chapter:-

Main research question

Why is risk misallocation a recurrent cause for project failure in the Zambian construction industry and what aid can be devised to aid risk allocation?

Sub-questions

- What factors influence the choices of contract forms on building projects to influence risk allocation?
- What are the risk allocation practices used by contracting parties in the ZCI?
- How are risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?

8.1Theoretical lens for the study

The study utilised two theoretical perspectives: 1. Structuration theory (ST) to understand how structure and agency influence risk allocation and 2. Gilbert's Management Theory (GMT) to explain current risk allocation by understanding what information [information and knowledge], instrumentation [resources and capacity] and motivation [incentives and motives] are currently used by environmental and person's repository factors in the Zambian building sector as outlined in Chapter 5.

Structuration theory in this study is applied to understand how theory illuminates empirical understanding on work and effort, materiality, agency and creativity, interest and power and knowledge as discussed in section 5.3.1 as theory is applied to risk management and consequently risk allocation. In theory, "structuration processes characterise a range of social behaviours where individuals or groups of people have thought about their own and others actions and judged them rationally; where they have learned and are using formal and informal rules and resources for interactions and are reaffirming them both for others and themselves; and where they have experienced consequences from their actions, but are contributing all the time to a relatively stable, system like pattern of interactions in time and space" (Phipps, 2001, p. 189). Gilbert's management theory provides a way to systematically identify barriers to individual or organisational performance (Chevalier, 2003) as a problem solving approach (Krapfl, 1982). The theory illuminates the understanding on a person's repertory of behaviour (what the individual brings to the performance equation) and environmental supports (the work environment factors that encourage or impede performance) as outlined in section 5.3.2. of Chapter 5.

8.2 Question one: What factors influence the choices of contract forms on building projects to influence risk allocation?

The motive behind this question was to understand how contract selection is done, with a view of understanding how risk allocation fits into the contract selection process. Contract types in the ZCI are selected mainly by the client. The semi-structured interviews revealed that this is majorly influenced by the type of client whether private or public (see section 7.1.1 in Chapter 7). Existent literature shows that clients in these organisations have different goals; private organisations aim to achieve mid-to-long term goals to improve bottom line performance and the public organisation aims to achieve socio-economic benefits (Chapman, 2014). Private clients show evidence of using a varied suite of contract forms but generally, the fixed priced type of contract is the most utilised following a design-bid-build format or unit price contract format as shown in section 7.1.1. of Chapter 7 whereas this framework of contracting is not necessarily unique to the Zambian construction industry it is very common in the construction industry globally (Serpel et al., 2015a). Private clients show that they are more flexible in their selection as they use a variety of contracts, namely New Engineering Contract (NEC), American contracting system contracts (ACSC), Joint Building Contracts Committee (JBCC), Joint Contracts tribunal (JCT) Joint Building Contract 1998, Joint Liaison Committee JCT commonly known as ZIA (Zambia Institute of Architects) and African Development Bank (ADB) building contract forms as shown in Sections 7.1.1 and 7.4.7 of Chapter 7. Of these, the most common in the private sector is the ZIA contract. While the public client uses the Zambian Public Procurement Authority (ZPPA) suit of contracts which include Open international, Open National and Small Works Contract. The starting point in contract selection is the selection of the appropriate type of contract (Murdock & Hughes, 2008). This should consider the nature of work, remuneration method, and method of procurement (Hackett et al., 2007). The nature of work and the type of client are the factors given the greatest consideration when selecting a contract type in the building sector while status of design, procurement method, method of price determination and incentives are not considered highly in terms of important factors (Sections 7.4.8 & 7.1.1 and Tables 7.2 and 7.23 in Chapter 7).

The offering of incentives is hardly considered in contract selection (Table 7.23 in Chapter 7 and Appendix 10A). The existent literature seems to suggest that public clients are not in a position to offer incentives due to the hierarchical accountability structure in government (Ling et al., 2014) which might imply that private clients do give incentives. However from the findings, there is no evidence that private clientele in the ZCI sector do offer incentives to contractors although there is reasonable evidence that incentives are appropriate as motivation for shouldering a risk for the contractor (Bajaj et al., 2010). Using Gilbert's Management Theory as a lens it could be concluded that both private and public sector clients rarely motivate the contractor to carry risk. While from a structuration viewpoint, the current structure of operations could be termed as constraining seeing that contractors (agents) are not motivated to complete projects before the expected time as there is no incentive to do so. From the questionnaire results shown in Table 7.23 in Chapter 7 the factors considered important for contract type selection in order of high consideration overall are . Type of work undertaken, type of development and status of design. The other considerations are moderately considered such as the size of the project, the complexity of the requirements/ specifications, risk preference (whether the client is prepared to take the risk or be risk averse), 6. Type of documentation (complete with drawings, schedules, specification or just a list of requirements). Type of development, financiers' preferences, and procurement method. The least consideration is incentives. From the foregoing, the contractor appears to be encouraged to voluntarily assume risks due to the lack of incentives. Public sector clients select contract type based on value ranges as shown in section 7.1.4 in Chapter 7 as follows: ZPPA Open national bidding contract -K500, 000-20,000,000, ZPPA Open international bidding contract over K20, 000,000 and ZPPA small works bidding contract –below K500, 000. This prescription of value based contract selection could be limiting consultants (agency) from being creative or putting in more work and effort to arrive at the most suitable contract strategy for carrying out a project.

The contract selection is tied to the expected value of the project regardless of procurement method except for PPPs which use bespoke contracts (based on the PPP Act of 2008 guide lines on the PPP policy and legal framework) based on lump-sum payment method. This could be viewed as a constraint in structure (contract practice). The interviews (sections 7.1.1 and 7.3.9 in Chapter 7) and document analysis of projects 1 to 8 revealed that varied procurement approaches are the norm in the sector. However, there is no evidence of an integrated type of contract in use that has design and construction in one single contract. This suggests that the contract portfolio currently in use is limited. Likhitruangsilp and Ioannou (2009) found that use of contracts for different types of work and procurement normally results in incomprehensive risk allocation and inappropriate allocation. There is a need for adopting an integrated contract form, which should clearly address the risk liability of each party.

Gordon (1998) outlined drivers of contract selection as client drives, project drives and market drives; this demonstrates that there is a lack of appropriate contract availability for integrated procurement when it comes to market drives. The market currently utilises integrated modes of procurement but lacks a corresponding suitable contract form in the contract portfolio used in the ZCI building sector especially in the public sector. Moreover, Hughes and Maeda (2002) underscore that any contract operates in the context of its legislation environment and current working practice. The contractual portfolio in the ZCI needs to be all-encompassing, reflecting influences from the current sectorial practices to improve risk allocation. The public sector legislation needs to be updated to include integrated procurement contracts. Nevertheless, the private sector continues to work beyond the parameters of outdated legislation by using ill-suited contracts designed for separated procurement in integrated procurement. In practice, this has resulted in biased contract modifications leading to cases of risk misallocation.

Interestingly selection criteria, at least in the public sector, considers ways to institute socio-economic benefit by authoring modified contracts or contracts with special conditions to empower the local community or specific grades of local contractors (as shown in Table 7.3 and projects 7 and 8 in Chapter 7). This practical application of procurement strategy was generally evident in the small works and open national contract type during the document analysis.

Project owners often allocate more risks to contractors when structuring a contract (Zhang et al., 2016; Mead, 2007; Peckience et al., 2013). This is reflected in the current contract selection criteria used in the ZCI due to limited options and widespread contract modifications. This demonstrates that clients use their power (structuration theory) to avoid risks and they are at most, risk averse. The results provide evidence that clients modify contracts to be able to avoid liability for risk, which they should ordinarily bear (see section 7.1.1 in Chapter 7). The findings about clients' averseness to risks are congruent with those of Alsalman and Sillars (2013). Risk averseness should be used appropriately to improve risk allocation.

Theoretically, a principal-agent relationship with a master-servant slant is utilised in contract selection. The Principal (client) engages the Agent (the contractor) and decides the conditions/terms of the exchange. Additionally, once the contract selection has been done, some conditions are modified to supposedly lower transaction costs for the client. However, the contractors through experience or industry knowledge give high bids even for risks that do not eventuate. This is contrary to the findings of Laryea and Hughes, (2009) from a developed context that used a case study approach and found that contractors did not inflate their prices as a response to amendments, which would reduce their chances for winning the work. On the contrary, the contractors' behaviour is because they expect the principal to be opportunistic using a principal-agent reasoning and the contractor reacts through a high bid viewing from an expectancy theory and learning curve theory lens.

Clearly the ZCI building sector is not at a stage where its building contracting system could be said to be fully neoclassical as the nature of construction contracts in Zambia is generally autocratic rather than organistic, which would create a cooperative environment so as to achieve project goals (See Sarker & Khan, 2013 for neo-classic contracting). However, some neoclassic tendencies discussed in Section 4.3 of Chapter 4 are evident in that when clients themselves are not fully compliant to contract conditions, they find it hard to implement penalty clauses. This shows that clients realise that contractors are social beings who should not be disadvantaged.

Section 7.4.8 shows that there is a difference in perception of consideration of contract selection factors among the various consultants. This from a structuration theory view point is affecting contract selection negatively depending on who among the consultants select a contract means some factors may not be considered. Furthermore, several positive correlations exist with the factors as shown in 7.4.8.4. This means that if certain factors are not considered the selection may disregard certain risk issues resulting in the non-consideration of some factors.

The contract practice could be described as a neoclassic contract practice because contracts selection is for a fixed duration or task to be completed with anticipated future cooperative opportunities (Cheung et al., 2006; Sarker & Khan, 2013). Opportunities are mainly expected by contractors from the clients. However, the contracts used lack the flexibility offered by neoclassic contracts resulting in the use of contracts meant for design-bid-build being used for design-build projects. Clients seem to be exhibiting opportunistic behaviour in their allocation as they shift risks to the contractor and fail to adhere to contractual provisions that favour the contractor. This diminishes the effectiveness of contracts to allocate risk as this leads to opportunism from the client (Zhi & Lumineau, 2015) using a principal-agency lens. In the final analysis, current contracts on occasion are not effective as they contribute to transaction costs. Zhi and Lumineau, (2015); and Chang, (2014) suggest that the effectiveness of contracts can be explained by Transaction cost theory to underscore that appropriate contracts should be adopted. In summary, current contract selection can be said to be contributing to risk misallocation through ill-selection and modifications resulting in inappropriate risk allocation. The aforementioned could be avoided to improve risk allocation.

8.3. Question Two: What are the risk allocation practices used by contracting parties in the ZCI?

8.3.1 Resources

8.3.1.1 Experience, Knowledge, Capacity and Skill

The qualitative data (Semi structured interviews-Table 7.1 in Chapter 7) and quantitative data (questionnaire survey- Section 7.4.1 in Chapter 7) demonstrates that the Zambian building sector has practitioners with many years of experience in various types of building projects. From the perceptions of risks presented in the interviews (See section 7.2.4 in Chapter 7); there is a clear demonstration that knowledge about risk exists. The majority view risk as negative in that risk events impact on projects negatively while very few view risk as an opportunity to better their service. When materiality is mainly negative opportunities that risks present can hardly be harnessed from a structuration perspective while it simultaneously shows a lack of knowledge on opportunities presented by risk from both a structuration and behavioural engineering perspective.

The most prevalent risk-related skills in the industry are risk identification and risk communication (See Sections 7.2.7, and 7.5 in Chapter 7). However, once the identification has been done very little is done to monitor or provide response mechanisms aside from contractual provisions (section 7.5.3 and 7.6.13 in Chapter 7 in Chapter 7). A study by Amundurud and Aven (2015) underpin that for one to understand and acknowledge risk one has to have knowledge on the subject. They further state that knowledge is based on data and information and they differentiate between *Know-how*: normally acquired through training and *acquaintance knowledge* gained through experience. The interview (Section 7.2.3) and questionnaire survey (Section 7.3.8 in Chapter 7) provide evidence that there are a good number of project players in the ZCI who have not had any form of risk training; instead the knowledge they possess is acquaintance knowledge acquired through experience. The questionnaire survey revealed that project team members are recruited on projects based on project characteristics (See section 7.6.7 in Chapter 7). This means that the necessary skill needed on a project is identified and thus matched with required skill set.

Additionally, the questionnaire survey provided evidence that the personnel chosen meet the project requirements implying they have the capacity to do the work they are assigned under the project. Moreover, the document analysis (Projects 3,4,5,7 and 8 in Chapter 7) provides evidence that during documentation stage key personnel to be engaged on a project are clearly identified by required years of experience in addition to having worked on similar projects. This shows that steps are taken to ensure that the necessary skill with matching capacity is available on a project. However, the limited knowledge in an area such as quantitative risk analysis (Section 7.2.7 and 7.5) and monitoring (Section 7.2.8.a, and 7.6.13 in Chapter 7) negatively affect risk allocation as not all pertinent risks may be given the needed attention resulting in resource misallocation and incomprehensive allocation. Moreover Serpell et al (2015b) argues that knowledge is needed to carry out many of the risk management task. Training in the mentioned areas should be done as Hosseini et al. (2016) point out that this is a critical success factor in any risk management system thus risk allocation. Additionally, firms should practice some form of knowledge capture so that past risks are not reproduced on future projects to improve risk allocation.

8.3.1.2 Data, Information and Feed Back

The quantitative results showed that feedback and information are given on building projects (Section 7.6.2 and 7.3.5 in Chapter 7). This is also congruent with findings from the interview (Section 7.2.8.a); nevertheless, the interviews show that despite feedback being given, it is untimely. Untimely, feedback contributes to risk escalation and project delay. Furthermore, data for making decisions on risks is normally inadequate for instance designers (engineers and architects) sometimes complete designs without ever having been to site or carrying out relevant site investigations (See Table 7.17 in Chapter 7). Similarly, contractors price projects without site visits and sometimes base pricing on incomplete drawings and specification on occasion (See section 7.3). Additionally the pertinent risks (Section 7.2.1 and 7.8.1 in Chapter 7) provide evidence that feedback and information are inadequate because a good number of the pertinent risk factors are due to delay resulting from information or feedback. Delay in information or should be avoided to improve risk allocation.

The questionnaire survey revealed that one of the biggest challenges in information is that of design information on drawings or specification either lacking detail, missing or delayed feedback on requested information (Section 7.6.3, and Table 7.14 in Chapter 7). Incomplete information raises transaction costs (Guo, et al 2016). Therefore, using GMT as a lens it can be concluded that decisions on risk allocation are hampered in the industry due to inadequate data and information. This leads to misallocation of resources and incomprehensive risk allocation. Moreover, it could still be argued that if monitoring in the industry is inadequate (according to interview and quantitative results) how can any form of feedback contribute to appropriate risk allocation? Furthermore, an analysis of the pertinent risks shows that a good number of risks affecting the building sector are as a result of delayed feedback on requests for information, clarifications, errors and omissions (Table 7.14 in Chapter 7); clearly feedback and information are not given in a timely manner further leading to misallocation of resources. This is in line with Johansen and Rausand (2014, ab) who point out that timely information is needed to inform decision-making process in risk assessment. Timely information could improve risk allocation.

8.3.3 Processes

8.3.3.1 Risk identification

This is the most common risk practice in the building sector (Table 7.6 and 7.25); and the starting point in risk allocation (Barlish, et al., 2013; Tserng, et al., 2009). Prevalent methods include (Table 7.25); experiences from past projects, use of local knowledge, expert knowledge, and brainstorming. Risk identification methods are subjective and could be said not to identify consequential risks. Therefore, other qualitative methods could be used such as risks maps and influence diagrams. This shows that in the area of instrumentation, more tools and techniques need to be used and there is a need to increase knowledge about tools and techniques available for risk identification especially for identifying consequential risks. Moreover, from a structuration perspective the work and effort advanced on past projects should be used as a baseline for the effectiveness of tools and techniques used. The existent literature suggests that most of the methods used for risk identification are qualitative in nature (Barlish, et al., 2013; Dziadosz & Rejment, 2015). When consequential risks are not identified, full appreciation of the severity of risks is limited and might lead to incomprehensive risk allocation and resources misallocation if the tools/techniques and resources used remain unchanged. Therefore, identification of consequential risks should be done to improve risk allocation

8.3.3.2 Risk analysis

Questionnaire survey (Section 7.5.2 and Table 7.25 in Chapter 7) and interviews (Table Section 7.2.7 and Table 7.6) reveal that risk analysis is not common in the Zambian building sector. Nevertheless, when it is done prevalent methods (Table 7.25 in Chapter 7) include expert judgement, brainstorming, checklists and consulting a specialist; while it may not be clear what methods a risk specialist would use. The top five methods are qualitative in nature. Qualitative analysis techniques do not encourage recording of risks, issues, and actions taken to resolve them as well as lessons learned so that they can be used in development of new projects (Hubbard, 2009; Serpel, et al, 2015; Tah et al., 2001). There is need to include quantitative methods of risk analysis to avoid risk misallocation and ensure that risks considered are those which are more severe and probable. Notwithstanding, the fundamental purpose of risk analysis is to provide information that enables informed decision making in cases of uncertainty (Johansen & Rausand, 2014b) and risk is uncertainty that can be measured (Dziadosz & Rejment, 2015). Current methods used in the ZCI are not objective. This is in line with the findings of Lee, et al., (2013). Additionally, risk analysis practice could be described as novice as very few firms use advanced techniques. This could result in incomprehensive allocation and use of inappropriate response mechanisms. For complex projects sophisticated risk analysis should be carried out (Lehtiranta & Juunonen, 2014). In summation, risk analysis needs to be given the importance it deserves in the construction industry to achieve appropriate and improved risk allocation. Current work and effort (ST) or work environment (GMT) could be said to have constraining and de-motivating agency as there is no systematic approach in conducting risk analysis.

8.3.3.4 Learning

Learning is vital for risk allocation to ensure that risks are identified and response measures evaluated. Dirkmen, et al. (2008) and Serpella, et al. (2014) advocated for learning from past projects as a means of improving risk management process which includes risk allocation. Analysis of responses to an open question in the questionnaire survey (summary shown in Appendix 9B) revealed lessons learnt as an emergent theme. It was made clear that generally, past risks are learning experiences for those involved. This is true among contractors, architects, project managers, quantity surveyors and engineers. Their learning involves risk identification, risk avoidance/reduction, performance and delivery improvement. This therefore in terms of theory provides evidence of their following a learning curve in risk allocation practice in the ZCI since repeated processes leads to gaining skill and knowledge from experiences. Furthermore, it could be argued that learning brings about increased capacity (GMT) and increased knowledge (ST and GMT). In spite of this, applications of lessons learnt can be said to be role/profession specific (see section 7.2.10 under learns learnt in Chapter 7) and are constrained by contracts in use. The learning is often not documented (is tacit in nature) thereby increasing the possibility of misallocation practices by those who do not have direct experience of the lessons learnt or if the ability to remember is diminished. ST posits that knowledge is normally tacitly known which is congruent with current knowledge on risk practice in the ZCI. Documented knowledge could improve risk allocation.

8.3.3.5 Documentation

In their quest to better allocate risk possible project team members reveal that there is a need to have clear and detailed documentation and specifications; have clauses that are in line with market conditions, update standard forms, and add clauses to clarify risk allocation (See section 7.2.10 in Chapter 7). Moreover, contract modification is a common practice (Laryea & Hughes, 2009; Mooney & Mooney, 2013; Hughes & Maeda, 2002; Hackett et al., 2007), indicating that current standard forms are inadequate in some areas hence the need to be modified. This is in line with responses to the question on deficiencies and adequacy of contracts in use (See section 7.1.4 and 7.3.3 in Chapter 7), which demonstrated that current instrumentation (GMT) are inadequate in terms of current conditions. The questionnaire survey responses indicated that of the various modifications are made by the client some are favourable, others not (Sections 7.1.3 and 7.3.1 in Chapter 7).

Unfavourable modifications majorly include escalation and fluctuation clause waivers instituted by clients in their position of power (ST) to avoid risk (GMT) leading to risks being inappropriately allocated. Inappropriate risk allocation resulting from contract modifications was affirmed by Mooney and Mooney (2013) and Mason (2016). However, alterations or modifications effect an increase in construction cost (Rybka & Bondar-Nowakowska, 2013) resulting in resource misallocation (finance). The interviews (Section 7.1.4 in Chapter 7), questionnaire survey (Section 7.3.3 in Chapter 7) and document analysis (projects 2,4,5 and 6) all attest that contract documents have deficiencies especially to do with design. Li et al. (2015) argued that gaps in contract documentation result in post-contract adjustments and opportunistic behaviour by the contractor. It therefore is clear that more effort has to be made to make contract documents relatively complete and clear thereby improving risk allocation.

8.3.3.6 Risk Monitoring

Risk monitoring is done throughout the project cycle but it is more serious in the construction phase to ensure that the project is being produced safely, on time, to the required quality and within budget. The data in the interview (Section 7.2.8.a and Table 7.7 in Chapter 7); questionnaire (Section 7.6.13 in Chapter 7) and document analysis (Project 1 to 8) all point to inefficient risk monitoring; a deficiency in instrumentation (GMT) and work and effort (ST). However, this is more pronounced on public sector projects due to lack of funds for consultants to closely monitor projects. This has led to reactive management of risks. Furthermore, risk misallocation results from inadequate risk monitoring. This suggests that agency and creativity (ST); work and effort (ST) and instrumentation in form of resources (GMT) are inadequate in the area of risk monitoring. Moreover, Turner (1986) posits that agents who do not monitor their actions, decisions and interactions or the conduct of others are not capable of producing or reproducing rules and resources. This could explain why the ZCI has been experiencing unsatisfactory project delivery as depicted in the Auditor General report from 2006 to 2015. Additionally as Busco (2009) argued, in performing routinized patterns of behaviour, individuals avoid monitoring and reflecting upon all the possible choices available for action. Argued from a ST standpoint, this restrains risk allocation.

8.3.4 Practices

8.3.4.1 Perception

According to the Merriam-Webster dictionary perception is understood as the way one thinks about or understands someone or something. In the construction industry perception is then the way risk events or occurrences are seen to affect or influence a project or a decision maker's assessment of the risk inherent in a situation (Wang, et al., 2016). Perception is a distorting factor in considering the allocation of any risk as those perceived to be of medium to high impact will be given attention (Lehtiranta, 2014; Mullai, 2006). Aven (2016) argued that decisions on risk are strongly dependent on perception (Lu & Yan, 2013). One rarely allocates risks which are perceived to be less important or thought to be unlikely to occur.

In the duality of structures in Giddens' (1978) seminal works, it was argued that it is only a knowledgeable agent who can influence structure or perhaps the way risks are allocated. ST posits that accurate materiality affects how risks are managed in the final analysis. Interviews (Section 7.2.4 in Chapter 7) revealed that some risks are not prepared for in terms of contingency resources e.g. fluctuation in material price, because the perception is that an event is not risky or could not have been seen to possibly occur. Further, the perception of risk severity by various respondents suggests that they tend to view the other party as a contributor to risk even when the risks identified as pertinent suggest otherwise (See section 7.5.4 in Chapter 7). From a structuration point of view, lack of or materiality in the Zambian construction industry of certain risks is leading to misallocation. Naturally, agents (consultants and contractors) cannot allocate or monitor what they do not perceive to be a risk. Hence, risk monitoring should be done to improve risk allocation.

8.3.4.2 Consequences

It is important for agents to fully understand the consequence of their action or lack of action (Giddens, 1978). ISO 31000 states that the consequences of risk materialising may be negative (hazard risks), positive (positive risks) or may result in greater uncertainty. The interviews (for instance clause modifications section 7.1.3 in Chapter 7 and the rationale for risk allocation section 7.2.5 in Chapter 7) provide evidence of clients do not fully analyse the consequences of some actions. This may result in consequential risk, which may not be identified resulting in incomprehensive allocation. This view is support by Groton and Smith (2010). The example given below is the consequences of late payment. The only risk clients foresee is interest on late payment however, other risks result as in Figure 8.1 below.

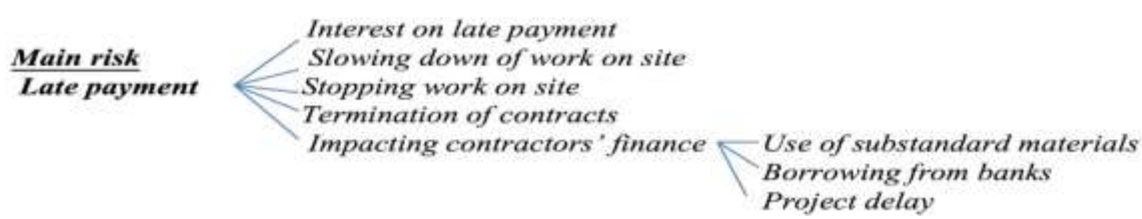


Figure 8.1 Consequential risks of late Payment risk

From the documents analysis it is evident that the majority of pertinent risks faced are due to lack of action several project participants (See Table 7.23 in Chapter 7) and there seems to be no clear set consequences of such omissions of action in the contract documents especially for consultants because the clauses are obligatory in nature. Drawing from GMT, this could be interpreted as non- appreciation of consequences for actions or as simply a lack of corresponding motivation, It could also be interpreted as a lack of work and effort or agency creativity, to ensure that all possible risks resulting from an eventuating risk are mitigated (ST). This lack of action mostly results in misallocation of resources e.g. interest on late payment, and to avoid this, tools such as influence diagrams, flow charts, cause and effect diagram, risk paths and maps should be used (Yildiz, et al., 2012.). Moreover, the perception of professionals and client as shown in section 7.5.4 showed that all project team members consider other members as responsible for severe risk, meaning they hardly consider the consequences of their own input or lack of action. Consideration of one's inputs is key to improving risk allocation

8.3.4.3 Incentives

For one to carry risk one has to have an incentive for doing so (Ashworth, 2006; Hany, 2011; Hackett et al., 2007). The consideration criteria for contract selection do not significantly include incentive provision as shown in Table 7.23 in Chapter 7. Further to this, the method of payment is lump sum and also does not offer incentives (Gallagher, 2012). One of the interviewees mentioned that even when a contract has clearly stated incentives such as a bonus for early completion, incentives are not dispensed (See section 7.1.4 in Chapter 7) and bonuses are considered as a motivation yet are not given (Section 7.3.6 in Chapter 7). Therefore, it could be said that clients do not offer positive incentives to contractors, which may affect their productivity. However, the survey (Section 7.6.6 in Chapter 7) indicated that incentives are considered adequate for one to perform. From the qualitative data it seems that these incentives take the form of penalties. The document analysis provided evidence of penalties in the contract provisions (Projects 1 to 8). Moreover, from both the qualitative and quantitative data, penalty clauses were indicated to be very effective (Section 7.1.5 and 7.4.9 in Chapter 7). Notwithstanding, Chevalier, (2003) argued from a GMT perspective that when incentives are negative the overall work environment could be termed as negative with no opportunity for fulfilment of employees or organisation's needs. Lack of positive incentives could be interpreted as the lack of creativity of agency where incentives are not fully used as a means to achieving desired project outcomes (ST) and improved risk allocation.

8.3.4.4 Motivation

Giddens (1978) suggested that when agents/workers are poorly motivated they do not perform their functions properly even when they possess the skill and have the capacity to perform. The majority of players in the construction industry are motivated by financial gain (Section 7.3.6 and Table 7.17 in Chapter 7) as corroborated in the quantitative results. However, it is unclear whether the financial remunerations currently available are adequate. In addition, other forms of motivation reported include gaining experience and gaining knowledge (prevalent among those with 1-5 years' experience), career development (prevalent among those with 1-5 and 6-10 years' experience) and satisfaction of achievement/excellence (prevalent among those with 6-10 and over 15 years' experience). Motivation is commonly construed as positive; the negative form of motivation is expressed through penalties. In the construction industry penalty clauses are used to achieve motivation. Whilst these could be seen as effective in distributing risk; their very presence is enough to enforce certain behaviours. However, the majority of pertinent risks are allocated through the use of obligatory clauses (See Table 7.38). In the current analysis no motivating penalties were discovered which could enforce certain expected behaviours. In addition, clients and consultants rarely provide incentives to contractors as a form of motivation. This could be constraining risk allocation.

8.3.4.5 Agency and creativity

Structuration theory presumes that when practice is difficult to change but in dire need of change (Giddens, 1978), agents will find creative ways of overcoming challenges in line with practice. Some aspects of creativity were found in the industry practice. Firstly, in the document analysis due to the risk of delayed payment (standard contract indicates 28 days of submission from contractor) 56 days payment period was indicated because from experience this is when most payments are actually made on a project (see project 3, 4, and 6-Appendices 8C, 8D, 8F). Secondly, when applying penalties consultants also consider client's adherence to contract provisions before enforcement; and when a client has been non-adherent, penalties are not enforced (see section 7.1.5 in Chapter 7), presumably to avoid counter claim(s) from the contractor. A third aspect of creativity was found during the document analysis. Project 3 was a design and build public sector project which used a separated procurement contract that was heavily modified to suit this mode of procurement due to unavailability of such a contract in the suite used for public works. These are examples of creativity where agency is not constrained by current practice. Notwithstanding, the creativity in agency is mostly bounded by contract and other provisions such as legislation.

8.3.4.6 Interest and power

The aspect of interest and power was not investigated directly in this study; however the use of incentives and motivation; and contract practice in terms of modifications, negotiation and adherence to conditions have all been used as proxies to understand interest and power exercised by the client. Similarly the contractor's response to these can also be used as proxies to understand their interest and power.

When clients consider what contracts to use they do not consider giving incentives to the contractor even when they have the power to do so and although standard forms of contracts allow for such provisions (Section 7.1.2 and 7.4.8 in Chapter 7). Similarly when they exercise their power to modify, rarely do so in the interest of the contractor (Section 7.1.5 in Chapter 7). They waive or omit e.g. fluctuation and escalation clauses, which are beneficial to contractors considering the environment where the local currency is particularly unstable in relation to foreign currencies. Additionally, most construction materials are imported. Clients and particularly public clients, rarely provide a platform for contractors to negotiate conditions even when it could be in the client's interest to allow it, as negotiation could provide an opportunity for risk allocation analysis (Section 7.3.4 in Chapter 7). This type of contracting is contract of adhesion (section 4.2.3 in Chapter 4). Finally, the client exercises their power by not adhering to all contract provisions for example; only providing for extension of time when the contract clearly states that costs should also be given. This results in unbalanced risk allocation demonstrating that the right motivation is not applied and this consequently results in poor project delivery as pointed out by Baloi and Price, (2003); and Alsalman and Sillars, (2013).

Contractors on the other hand are not seen as having much power yet are creative (ST) in attaining the desired outcomes for their survival. Interview data provided evidence that when contractors are entitled to extension of time with costs on all public projects, to maintain a relationship with the client and so secure jobs in the future they do not claim for costs (see section 7.1.3 in Chapter 7). Here, it is demonstrated that entitlements could be forgone to secure their future as contractors. Li, et al, (2014) suggest that a good relationship between the owner and a contractor helps to reduce transaction costs. Similar responses were given for late payment. From an expectancy theory perspective, they foresee that if they make claims on their contractual entitlement, they risk losing future job opportunities. However, when the future of contractors is threatened they take measures to secure it by slowing down work on site and on rare occasions they abandon site (Section 7.5.5 and section 7.2.10 –Table 7.8 in Chapter 7). Therefore, contractors protect their interest more when their existence is threatened.

It is clear from these actions that client's actions are self-interested and slanted towards risk aversion which on occasion leads to unfairly passing the risks to the contractor. This interpretation is confirmed by Guang-Xing and Yan-Hong, (2008) who argued that risk aversion does not foster fair risk allocation, also Hanna et al., (2013) pointed out that a risk averse mentality often results in risk being allocated to a weaker party where power relations are lopsided. Therefore, the motivation of the client should be able to put forward contract conditions that motivate the contractor positively (GMT). Risk misallocation in the ZCI could be occurring from the client's exercise of power (Groton & Smith, 2010). In order to cover themselves against this inordinate risk shouldering, contractors overprice when they bid for projects. Resource misallocation occurs due to the fact that most times the risk(s) that contractors cover themselves for do not eventuate.

8.3.4.7 Planning

Risk planning is an important aspect of the risk management process (Project Management Institute, 2004). In construction, based on past work and effort; general planning for projects is done by clients and contractors and their respective representatives. Planning is done for resources to use, possible risks to be faced, safety precautions and achieving realistic estimates for works. This is one of the themes that arose from responses to an open-ended question in the questionnaire survey (See Appendix 9C and section 7.2.10. in Chapter 7). Additionally, the interview provided evidence that events or practices such as feasibility studies and site investigations are rarely done (Section 7.2.10 in Chapter 7). These should by right be done in the planning stages of a project to give a full understanding of possible risks thereby improving risk allocation.

The pertinent risks identified in the questionnaire survey demonstrated that planning is not adequately done. Risks such as; inadequate specification and inadequate contingencies by the consultants/client, late payment by the client and poor planning of resources by the contractor all are consequences of inadequate planning.

From a GMT perspective the evidence of inadequate planning in the ZCI demonstrates that planning is not adequate for information needed instrumentation (resources and capacity) and motivation (considering consequences) that need to be put in place for project organisations to perform well. It also demonstrates that 1. Knowledge and accurate materiality may be lacking, 2. The work and effort applied to planning is inadequate, 3. Agency and creativity are not used correctly to influence desirable project outcomes. These deficiencies lead to resource misallocation and selection of inappropriate response mechanisms. Notwithstanding, the success of a project depends on the quality of planning and resource allocation (Gollenbeck & Schultmann, 2010).

8.3.4.8 Formality of Risk Practices

Both interview (Section 7.2.6 in Chapter 7) and questionnaire data (Section 7.3.8 in Chapter 7) suggested that risk identification, risk analysis and response are not formalised in practice. There are very few firms that have formalised systems and policy (Table 7.19 in Chapter 7). Nevertheless, risk identification and communication are prevalent practices (Section 7.5.3 in Chapter 7). Literature suggest that for risk management and consequently risk allocation to be beneficial to organisations, management practices have to be systematic and formalised moreover, the very definition of risk management implies formality and systematic practice (Australian & New Zealand Risk Management Standard-AS/NZS 436, 1999; Project Management Institute, 2004). This indicates that for risk practices to be able to alleviate risk misallocation, they have to be systematic and formalised. The absence of systematic and formalised RM system in many organisations demonstrates shortcomings from a ST underpinning of the adequacy of work and effort conducted on projects and from a GMT perspective the flaws in an environmental support which lacks the desired process results in poor project delivery. Serpell et al., (2015a) argued that risk management in developing countries is inadequate, lacks a systematic and formal approach and often produces poor results. This condition undoubtedly applies in the Zambian context. Nonetheless, Zambia is not the only developing country with un-formalised and unsystematic risk management practices and subsequently allocation (Vissler & Joubert, 2008; Shunmugam & Rwelamila, 2014; Perera et al., 2014; Szabo et al., 2008; Siang & Ali, 2012; Zaini et al; 2010 and Kululanga & Kuotcha, 2010). Lack of a formal and systematic approach results in lack of identification of consequential risks, incomprehensive risk allocation and resource misallocation. It further diminishes the ability of firms to evaluate their risk management performance as there is no set process (Serpell et al., 2015b). Formalised practices may improve risk allocation.

8.3.4.9 Risk mitigation and avoidance

Risk mitigation is aimed at reducing the probability of threat, alleviating the impact or doing both (Rybka & Bondar-Nowakowska, 2013) while risk avoidance is concerned with eliminating the threat altogether (Project Management Institute, 2004). In GMT theory risk mitigation and avoidance are considered in the instrumentation and motivation stage while in ST they are considered under work and effort and under agency and creativity. Risk mitigation and avoidance are important aspects of the risk allocation process. Project participants reported using various risk mitigation and avoidance practices as a result of experience gained from past projects. These were indicated in the questionnaire survey in an open-ended question analysed thematically (See section 7.2.10- risk mitigation in Chapter 7).

Engineers indicated that they are able to transfer risk more cost effectively; quantity surveyors, architects, project managers and contractor point out that past risks faced, help them to foresee, plan and manage projects and so they handle risks better in future (see Appendix 9). Contractors made it clear that experience influences the type of clients and projects to work for and engage in respectively. Generally, realistic cost and time frames are arrived at based on past projects. It is can be concluded that various strategies are employed to mitigate or avoid risks by various professionals depending on their role yet the project outcomes of cost/time overruns, quality shortfalls and rampant project abandonment suggest that more should be done. Aside from this and from a ST underpinning, efforts are being made to transform the current risk situation by agents although the corresponding environment supports (GMT) seem to have inertia and constrain risk allocation especially in terms of the rules/contracts.

8.3.4.10 *Risk allocation and response*

Risk allocation is primarily done by the client as they are the ones who choose the contract types and prepare the contract documentation (Hackett, et al., 2007). On the other hand contractors respond to risk in various ways as they act upon the clients' allocation of risk. According to the questionnaire survey (Section 7.5.5 in Chapter 7) clients consider the significant factors to consider when allocating risks to be the ability to sustain the consequence, the party to whom the risk occur and understanding of the risk and foreseeability while their agents (engineers, architects and quantity surveyors) consider understanding of the risk, ability to control and the ownership of the risk as significant factors for allocation. It is clear that for the client the consequences of a risk are an important factor while consultants place emphasis on control of risk. There needs to be some alignment between the client and consultants on what to consider when allocating risk. From an agency perspective the interest of client and consultant seem not to be aligned in this matter. The document analysis provided evidence that the client (and consultant) base the allocation of pertinent risks on responsibility as the majority of clauses used obligation clauses and risk allocation is linked to responsibility. It appears that the allocation is done without putting mechanisms in place therefore, the acceptance is passive in nature meaning that using a GMT perspective, resources for accepted risks (instrumentation) are inadequate for the client while in terms of ST there is a lack of creativity; and work and effort by the client and their representative.

Once the risks have been allocated; the contractor's role is to price risk (Laryea & Hughes, 2009). According to the survey results the significant methods used to respond to risk are insurance, claims, use of sub-contractors, percentage added to unit rates and premiums added to preliminary and general items (Section 7.5.5). From a GMT view instrumentation used by the contractor could be termed as adequate. However, the interviews provided evidence that when the survival of the contractor is threatened measures such as slowing down of work on site and project abandonment is taken as a means of their showing creativity. Nonetheless, clients and consultants indicated that improvement areas for better risk allocation on future projects are identified from past experience of adequacy of remedies provided on projects, identification of additional remedies and how to better allocate risk in terms of time and cost. This was one of the themes arising from the open-ended questionnaire survey. The qualitative data suggested that risk response is role or responsibility specific (Section 7.2.10 in Chapter 7). Project members majorly apply risk response measures in a way that benefits their role or perceived risk. Identified risk response measures include: use of skilled labour, assigning realistic duration and appropriate resources for projects, allowing for price escalation and demanding more information to be able to assess risks.

In summation risk allocation in the building sector uses passive risk acceptance (client accepting risks without any mitigation measures), unjustified transfer (use of waiver clauses or omitting clauses in documents as a mechanism of transfer) and poor risk sharing (use of waiver clauses or omitting clauses in documents as a mechanism of transfer). These in turn lead to inappropriate risk allocation and inappropriate risk response mechanisms.

8.4 Question Three: How are risks perceived pertinent by contracting parties allocated in the contractual provisions in the ZCI?

Construction industries in different jurisdictions have particular risks that affect their performance. This view was affirmed by Liu, et al. (2014). The question was basically to answer 1. How the identification of pertinent risks as viewed by the contracting parties and 2. How pertinent risks are allocated. The Table 7.33 and Table 7.34 in Chapter 7 shows the pertinent risks identified. These are mainly managerial in nature.

Section 7.7.5 shows that there is a difference in perception of consideration of risk factors between consultant and contactor. This from a structuration theory view point is affecting risk allocation negatively depending on the risks that are prioritised in mitigation. The risks that are not prioritised may increase the possible of occurrence of those one they are positively correlated with as shown in Appendix 10N.

8.4.1 Risk allocation method

Ehsan et al., (2010) found that the most utilised risk response measures in the construction industry are risk elimination and risk transfer. Other studies show that project participants allocate risks by aversion which translates to transfer: owners tend to shift risks to the primary contractor, who in turn transfers them to the subcontractors (Alsalman & Sillars, 2013; Baloi & Price, 2003). In contrast, Osipova and Eriksson (2011) and Lyons and Skitmore (2004) found risk reduction as a common method of risk allocation. Jarkas and Haupt, (2015) found risk retention and mitigation as prevalent methods of risk allocation. From this study the main methods of allocation used for pertinent risks were found to be risk transfer and risk acceptance in the Zambian building sector (Table 7.37 in Chapter 7). These might be used because the client has no risk allocation system. This possibility is supported by El-sayegy and Mansour, (2015) who found that transfer is used for economic and financial risks and is achieved by contract modification and non-adherence to contractual provisions by the client. Moreover, Zhao and Li, (2010) found that risk transfer is not always an optimal solution. The contract documentation analysis showed that the client accepts some risks yet rarely puts mitigation measures proactively in place. From a ST viewpoint this shows lack of creativity and ill absorbed work and effort because the acceptance of risks should be based on the understanding that the party accepting a particular risk is the best placed to manage it. Furthermore, Giddens (1984) argued that agents influence the transformation of structure while taking a reactive role towards accepted risks without implementing preventive or control measures by no means transforms structure but rather maintains the status quo of risks eventuating.

The study discovered that clients do not usually respond to the risk as agreed in the contract documentation; occasionally clients do not comply with contractual provisions. This is congruent with the findings of Kaliba et al, (2009). This was revealed in the interviews when respondents indicated that some delay caused by the client which contractually should make them liable for costs, result in the client granting only extension of time (Section 7.1.6 in Chapter 7). Subsequently, contractors find it difficult to manage such risk and because they want to secure future business, they do not exercise their right to claims when sums in question are not massive. However, when sums in question are unacceptably huge contractors go as far as abandoning the site. The fact that these allocation methods lead to risks eventuating is an indication that 1. The risk transfer method may not be appropriate and risks are transferred to parties not able to effectively manage them or have inadequate response mechanisms (viewed from GMT this would indicate a flaw in the process of allocation) and 2. Risks are retained by parties who cannot adequately manage them mainly because the response mechanisms put in place are inadequate or are passive in nature (in terms of GMT, indicating that capacity is not matched with ability to assume a risk). Moreover, it is argued that lack of risk allocation systems lead to owner transferring the risk to the contractor (El-Sayegy & Mansour, 2015). Therefore, there is a need to provide more response mechanisms for risks faced using a risk allocation system to mitigate pertinent risks and improve risk allocation. For as long as environmental supports for providing the appropriate processes for risk allocation and the persons or organisation repertory behaviour capacity are not appropriately considered, risk misallocation might well continue in the ZCI.

8.4.2 Types of clauses used

The literature has very few discussions based on empirical data on the types of clauses used in the construction industry contracts. Zaghoul and Hartman (2003) stated that the use of disclaimer or exculpatory clauses to transfer risk results in increased contract costs. However, disclaimer or exculpatory clauses are rarely applied in the building sector for pertinent risks (See sections 7.1.7. and 7.4.9 in Chapter 7). In this study the document analysis of building contracts found that allocation of identified pertinent risks is through the use of obligation clauses, penalty, waiver clauses, and escalation clauses (Table 7.38 in Chapter 7). The most utilised for the pertinent risks are obligatory clauses. Secondly, in most instances liability is implied rather than expressly stated in the contract documents. The document analysis found (see projects 1, 2, 3 and 5 in Chapter 7) that though it is implied that contractors have the financial stability to carry out the work however especially when the client is public, an advance payment is normally given to the contractor. It is also implied that the contractor plans for resources to enable the smooth running of the project. Clients attempt to mitigate this by providing a list of required key plant, equipment, and personnel. In certain instances a list of suppliers for some materials are outlined in the bills of quantities (Project 1 and 2 in Chapter 7). This should reduce the risk of poor planning among contractors yet it does result in resource misallocation.

The obligation clauses basically state the person responsible and the act they should perform without stating the time limit for performance. Management, design, and technical issues involving a request for information, clarifications and approvals are mainly allocated by obligatory clause. As a consequence, the role players are not compelled to act resulting in delays emanating from lack of approvals or lack of response for information. This could be an inappropriate response mechanism as it does not compel role players to act. There is a need for the obligatory clauses to have a period for response, specifically for requests for information, clarifications, and approvals. In severe cases, these might be coupled with punitive measures on the role player as an appropriate response mechanism to improve risk allocation.

The document analysis showed that waiver clauses are used to escape liability for site conditions, economic or financial issues (Table 7.38 in Chapter 7). Specifically, site conditions are observed to be a risk that is misallocated (Groton & Smith, 2010) in this manner. The study revealed the use of waiver clauses for unstable exchange rates, price fluctuations, and ground conditions (see Appendix 8). For instance should a contractor abandon site the client views this as a waste of work and effort (ST) because additional efforts have to be done to either make the contractor finish the project or search for a new contractor. All these actions lead to a rise in transaction costs. From a GMT perspective waiver clauses used to disadvantage the contractor are de-motivating elements in the contract and could be contributing to undesired project delivery. The interview phase and open-ended questionnaire provided additional evidence that the exemption/exculpatory/disclaimer clauses are rarely applied (See sections 7.1.7 and 7.4.9. in Chapter 7). This is congruent with the finding of Perez et al. (2016). However, in this research the clients and contractors scored the clause type to be ineffective while project managers and consultants thought it was effective when utilised. It was quite clear that most practitioners did not fully understand the applicability of this kind of clause. This translates into a deficiency in knowledge from both GMT and ST points of view.

Overall, survey respondents seemed to suggest that escalation clauses are effective (See section 7.4.9 in Chapter 7) but contractor respondents suggested otherwise because they are rarely applied by clients even when they should contractually. Contractors and consultants in the questionnaire survey further provided evidence on the non-applicability of fluctuation and escalation clauses which are waived or omitted totally from the contract. It was made clear through responses to the open-ended survey question on the negotiation of clauses that public clients are seldom prepared to negotiate clauses (See section 7.3.4 in Chapter 7) while private sector clients provide an environment where this can be done. In this regard public sector contracts could be termed inequitable in risk allocation because as Shi, et al., (2014) argued, a contract with equitable risk allocation is supported by open discussion of problems among contracting parties. Moreover, a study conducted by Laryea and Hughes, (2009) found that tenders can be qualified and clarified for post–tender negotiation. This would be grounds for disqualification for public tenders in the Zambian building sector. Qualification of bids should be allowed to improve risk allocation.

Penalty clauses were indicated to be effective in the questionnaire survey (Section 7.4.9 in Chapter 7) but in the interviews (Section 7.1.5 in Chapter 7) it was shown that while they are effective when applied, opportunities for applying them are few because clients themselves do not strictly adhere to contract provisions (e.g. late site hand over, delay of approvals or requested information, late payment) making it difficult for them to penalise the contractor. Theoretically a penalty clause is a negative incentive and was very much discouraged by Chevalier, (2003) who pointed out that negative incentives do not promote exemplary performance when analysed from a GMT standpoint.

8.4.3 Risk response methods

Existent literature has identified a number of risk response measures including procurement method, construction method/material, use of insurance or bonds, contingency (time or money), sub-contracting or even collaborative practices (Jarkas & Haupt, 2015; Bakr et al., 2012; Alsalman & Sillars, 2013). In addition, the PMBOK (2004) identified extending the project schedule, reducing scope, stopping the project (risk avoidance), insurance, warranties, guarantees (risk transfer), taking early actions, adopting less complex processes, conducting tests, choosing more stable suppliers, prototyping, redundancy (risk mitigation); and passive acceptance (no action except to document the strategy and leave it to the project team to deal with), active acceptance (establishing contingency reserve for money time and resources (risk acceptance). The risk response methods used have shortcomings(Section 7.2.8 and 7.6 in Chapter 7) such as inadequate levels of sub-contracting on occasion, untimely feedback, poor risk monitoring (supervision and inspection), inappropriate sources of securities and inadequate contingencies, which result in resource misallocation of time, personnel and cost depending on the nature of the mechanism. Perceived from a GMT perspective the mechanisms should be viewed as resources for achieving exemplary performance on projects. From a ST standpoint, work and effort as experienced from past projects should be used to formulate creative ways of mitigating risks, as agents are the ones responsible for transforming a risk event or occurrence into a possible opportunity for achieving desired performance as a means for improving risk allocation.

8.4.3.1 Methods of execution

The qualitative results from the interview (section 7.2.8.b in Chapter 7) and document analysis (projects 1-8 in Chapter 7) show that risk response mechanisms are allowed on projects, depending on the documentation. Detailed documentation is given in some instances on how the work is to be carried out in terms of tools and more rarely, the procedure to be followed. Where this is the case contractors are hardly allowed the opportunity to choose their own methods of execution. This leads to delay in instances where the contractor prefers a change in execution method to gain on time. However, in the absence of a stipulated method for work execution, the contractor is at liberty to employ a method of choice. Notwithstanding, the building construction sector is not highly mechanised. Alternative methods of execution should be allowed provided the project manager approves of the proposed method as a way of improving risk allocation. Current practice places the role of creativity on the contractor to act as a knowledgeable agent as they deploy their work and effort in order to fulfil their role within the structure. The contractor is also generally allowed to determine the right skilled person(s) (capacity) and tool and processes (resources) to carry out the work tasks needed in order to achieved the desired performance targets as required by the project owner.

8.4.3.2 Insurance /bonds/guarantees

The ease of obtaining the required securities helps in responding to risk. The questionnaire survey revealed that project managers, clients, and consultants were of the opinion that contractors find it relatively easy to obtain the mentioned while contractors indicated that they do not obtain these securities with ease (See section 7.6.10 in Chapter 7). The interviews (section 7.2.8.c in Chapter 7) show that the process of obtaining securities is easy yet in practice meeting the requirements for obtaining the sureties is relatively challenging. For lower categories of contractors (4-6) or contractors using the ZPPA Small works contract; alternative measure to obtain securities by signed a declaration form have been instituted, which shows the client's creativity, interest and power in the plight of medium and small scale contractors, helping them to overcome their financial difficulties. Procurement officers indicated that during tender evaluation and commencement of project; contractors are very often not in a position to provide the required securities. Therefore, clients should consider obtaining the securities from insurance houses instead of from banks; because insisting that these securities comes from banks leads to misallocation of the contractors' resources in terms of finances and plant and equipment, which reduces their financial liquidity. This requirement of bank bond and guarantees is exacerbated by the percentages included in the contract documents required. Bank guarantees are normally 10% of contract sum while insurance guarantees are normally 30% -40% (Project 5 and 6 in Chapter 7).

8.4.3.3 Risk monitoring

Risk monitoring is an important part of risk allocation as it necessitates observation of the performance of the response plans put in place to ensure that eventuating risks or poorly handled risks are responded to (Serpella et al., 2014). Risk monitoring was indicated as inadequate using both qualitative (Section 7.2.8. in Chapter 7) and quantitative (Section 7.6.13 in Chapter 7) data, citing inadequate finance and personnel especially in the public sector. These result in poor quality work and project delays. The document analysis amplified this, as a good number of the pertinent risks identified result from lack of or inadequate monitoring (Table 7.38). Toth and Sebestyen, (2015) suggested that the construction industry is in obvious need of effective monitoring conducive to the success of projects. Lack of effective monitoring due to poor instrumentation or resources results in the non-allocation of risks especially in the post-contract phase, more so for non-contractual risks (risks not covered in the contract). Viewing using both ST and GMT, it is evident that more knowledge and skill is needed in the area of risk monitoring so as to improve risk allocation and management.

8.4.3.4 Subcontracting and Joint ventures

Subcontracting as a risk response measure helps to get work done by specialised contractors and also to share risk by sharing financing capacity with others. Sub-contracting helps to obtain the services of skilled labour, specialised equipment while shortening project time and obtaining increased quality and decreasing cost (Polat et al., 2015). The document analysis provided evidence that sub-contracting and joint ventures are allowable practices on most building projects (Table 7.38 in Chapter 7). The quantitative results showed that the current level of sub-contracting is adequate (Section 7.6.4 in Chapter 7). This is because the amount sub-contracted is in line with contractor capacity. However, the interviews revealed that the 20% subcontracting limit allowed by ZPPA contracts for public works is not adequate on some projects which have specialised works that cannot be carried out by the main contractor. At times projects are delayed because the contractor needs to subcontract more than the limit. Moreover, Polat et al. (2015) argued that in construction work, specifically building projects, sub-contracting may make up approximately 90% of the works. Current work and effort suffers as a result of this more often than not inadequate provision. There is evidently a need to revise the sub-contracting criteria for public works on a project to project basis. Inadequate sub-contracting levels result in misallocation of a resource such as specialised personnel, plant and finance. Subcontracting limits should done based on project needs to improve risk allocation

8.4.3.5 Contingency (Float/sum)

Findings from the interviews (section 7.2.8) and questionnaire survey (section 7.6.11 in Chapter 7) both show that contingency sum provided is often inadequate. It is well known that contingency budgets are used to respond to uncertainty and for controlling the project within the original cost and schedule targets (Marco et al., 2016). The interviews (Section 7.2.8 in Chapter 7) showed the need for reducing provisional sums and prime cost sums for items that can be measured accurately might improve risk allocation. The document analysis provided evidence of items that are given provisional sums but can clearly be measured such as window and door frames, air conditioning services and electrical services. As to float, since according to the Auditor General's report (2014), 90% of projects are delayed, it could be concluded that the float provided is inadequate, yet the quantity survey respondents indicated (Section 7.6.11

in Chapter 7) that the time allocated for the execution of projects is adequate. Inadequate resource allocation results in misallocation of time and subsequently funds. Several studies have shown contingency allowance to be inadequate or technically unpredictable, normally proposing 10-19% on consultant's estimate (Bello & Odusami, 2013). Given the foregoing the Zambian building sector is in tandem on acceptable practice yet this is still problematic as the resource allocated generally falls short. This shows that the resources allocated are inadequate.

8.4.3.6 Procurement strategy

The most popular procurement strategy used in the Zambian building sector is the design-bid-build; Zhang et al., (2016) point out that this method of procurement is commonly used in the construction industry. The projects in the document analysis were mainly based on the design bid build system with only one based on design and build (Project. 3 in Chapter 7) .The interviews revealed that very few projects use public-private partnership (PPP) while there seems to be gravitation in the private sector towards design and build (See Figure 7.4-7.6) which could be viewed as an effort to improve resources (instrumentation) and harness the creativity of the client and their representatives towards improving project delivery. It appears that design-bid-build is the most common choice of risk response in the Zambian building sector. However, from the content analysis it seems that project 3 could have been better delivered using a fully integrated approach.

8.4.3.7 Method of Reimbursement

Reimbursement method on a contract is dependent on the type of contract used, which may be fixed price or cost plus type (Hackett, et al., 2007; Hany, 2011). The types of contracts generally used in the building sector are lump-sum contracts (See projects 1 to 8) and do not normally provide for fluctuation or escalation as pointed out by the interviews, questionnaire survey and document analysis. Despite some clauses in the contract documents allowing for payment of costs and profit, according to the interviews these are rarely adhered to by clients and contractors do not pursue their entitlements because they fear losing project opportunities in the future. This is identified as a commonly misallocated risk of no damages for the delay (Groton & Smith, 2010). From an expectancy theoretical standpoint contractors expect clients to deny them work if they make claims hence they do not claim. It is also noted that in this study risks affected by fluctuations or escalation are generally external risks (change in exchange rates and frequent changes in material prices. GMT theory provides an explanation that the current method of reimbursement is inadequate in terms of instrumentation as it hardly provides or produces well delivered projects. Moreover, the fixed price mode of reimbursement is suited for projects with clear design and specification and in the ZCI deficiencies in design and documentation makes this mode of reimbursement method inappropriate. To improve risk allocation only projects with complete designs should use fixed price form of pricing.

8.4.4 Misallocated risks

The most misallocated risks are finance related such as those resulting from increase in material prices, unstable exchange rate and compensation events (See section 7.9 in Chapter 7) needing cost while only time is normally awarded. This is normally achieved with waiver clauses or exclusion clauses. Additionally the risk of inadequate site investigation is normally misallocated in the same manner. Groton and Smith (2010) claimed that it is not uncommon for this risk to be misallocated in this manner. Furthermore, there are risks that result from information delay or error and omissions such as lack of clarity in design, inadequate specification, errors and omissions in the design that are misallocated in terms of compliance because the client would normally be given extension of time with no corresponding cost. The majority of these misallocations are done so that the client can stick to the agreed contract such without any additional transaction costs. Yet this seldom happens as contractors typically respond by slowing done work on site, using lower quality materials or abandoning the site when sums involved are excesses. On other occasions, to ensure future employment, contractors do not claim. From a structuration standpoint, misallocation by the client occurs because of their power position in the project and due to the interest in being risk averse. Alternately using a GMT lens these misallocations occur due to imperfect instrumentation and information without the consideration of consequences.

8.5 Summary in line with the main aim

The study has provided several reasons as to why risk misallocation is prevalent and recurrent in the ZCI using the building sector as a study area. Risk misallocation in the building sector includes unbalanced risk allocation (resulting from contract modification), inappropriate allocation method (unjustified transfer e.g. inadequate site investigation), inappropriate response mechanisms (preference for bank guarantees and imperfect level of allowable subcontracting), misallocation of resources (especially personal and finance resulting from delayed information for design or specification) and allocation of risk to the wrong party (economic risk for period over a 12 months period).

Contract selection is crucial to project delivery (Hackett, et al., 2007; Uff, 2009). However, this study has revealed problems related to contract unsuitability in the ZCI. In addition, the factors considered for contract selection do not to a larger extent take into consideration the issue of risk. For instance price determination is not highly considered when selecting contracts. In addition, current practice by the public sector of using contract values as a contract selection criterion may be viewed as inadequate. Notwithstanding, certain environmental supports such as conditions in the contract, negotiation of the contract and modifications of the contract show that the client has domination which is strongly related to the concept of power. It could be argued that for risk misallocation to be minimised or avoided the client has a legitimate right of some participants to hold others accountable in risk management terms for their action.

Secondly, resources, practices, and processes used have shortcomings. The resources available for risk decision making namely data, information and feedback are not given in a timely manner to those involved and when they are they are not detailed enough. This results in risks such as inadequate planning of resources by contract and delay-related risk. Knowledge and skill are mainly prevalent in risk identification while risk analysis is rarely done and when it is, it is qualitative in nature when most consequences of prevalent risks are either cost or time related indicating a quantitative approach is needed. Response measures are in dire need of attention and notably; supervision and monitoring are not adequately done (resulting in poor quality materials being used on construction sites), the subcontracting mechanism needs to be revisited (to minimise financial difficulty of contractor), preference for sources of bonds and guarantees should be reconsidered to alleviate the contractor's financial difficulty. Perceptions about risk are mostly negative, though creativity and agency are practiced in as far as they are not constrained by contract and other provisions, interest, and power are mainly exercised by the client to protect their interests without considering the full impact of the consequences which result from contractor's reaction. Negative incentives in the form of penalties are provided on projects as opposed to positive incentives such as bonuses. Most players in the construction industry are motivated by financial gain and gaining experience and knowledge. Practices such as contract modification result in unjustifiable risk transfer by the client to the contractor. In a nutshell, on account of the methods employed in risk allocation practice by the majority of organisations in the Zambian building sector, risk management maturity could be said to be at novice level. This is similar to studies done in the south west part of Nigeria on highway construction yet their resources are mature (Salawu & Abdullah, 2015).

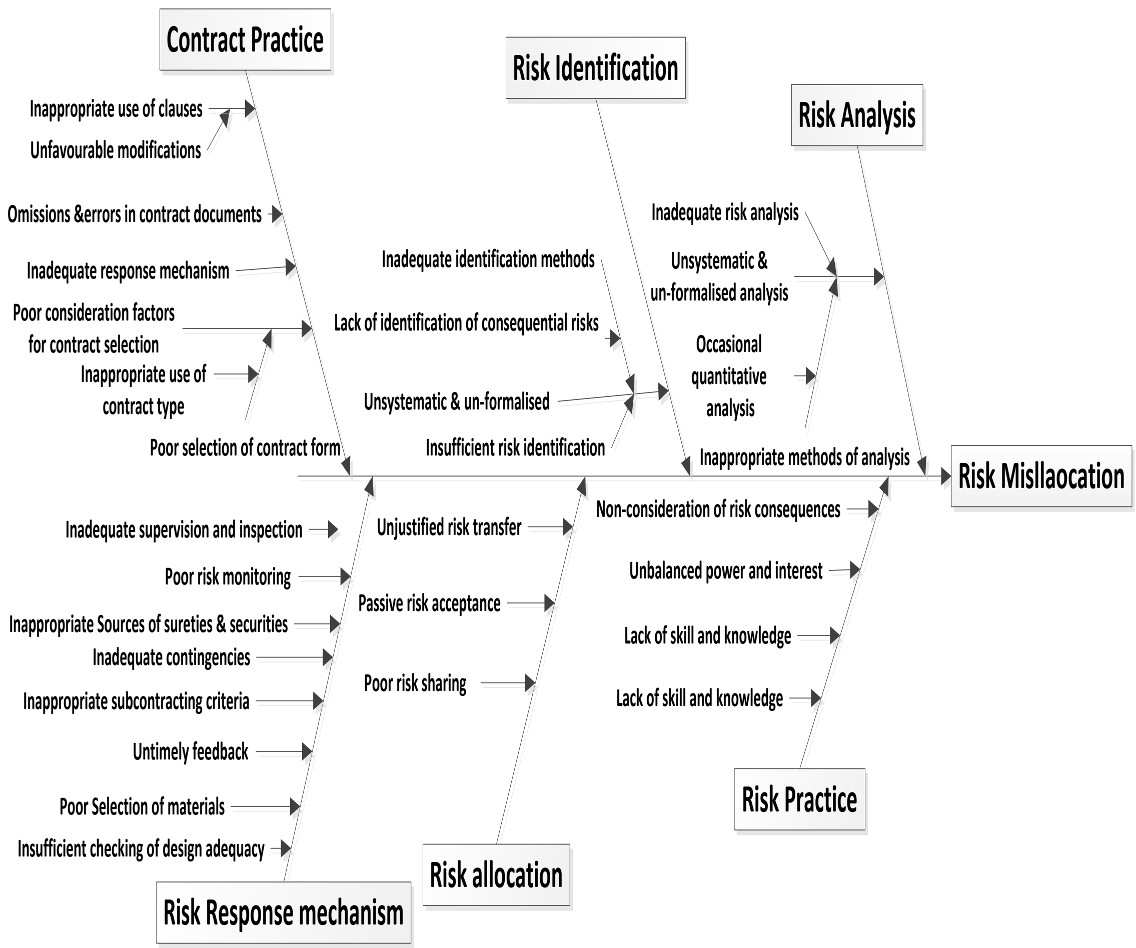


Figure 8.2 Cause and effect diagram- showing Causes of Risk Misallocation

Thirdly, the methods used to allocate pertinent risks are mostly transfer and acceptance using obligatory clauses and on occasion waiver clauses. These do not motivate for risk liability and are undesirable modes of allocation to foster appropriate risk allocation as most times their action periods are unmentioned especially for the ZPPA suit of contracts (Small works and

Open national only). Since the contracts used are lump-sum some risks attract a penalty mostly for the delay which is difficult to implement due to client non-compliance. Escalation clauses are rarely implemented by clients on risks that should be provided for in this manner such as delayed payment, changes in exchange rates and changes in material prices.

The many issues contributing to risk misallocation are summarized in a cause and effect diagram shown below in Figure 8.2. The items constituting misallocation are shown graphically by using causal networks (See Figures 8.3-8.8 in Chapter 8). Miles, et al. (2014) described a causal network as an abstract, inferential picture organising field study data in a coherent way showing how one thing led to another in a linear yet interwoven pattern. This mainly is from interpretive judgement of each node in the cause and effect diagram. The constructing of a causal network involves a list of antecedent (start variables), mediating variables and outcomes (Ibid). To recap, risk misallocation has been defined for this study as allocation of risks wrongly or inappropriately (Hanna et al., 2013) in terms of imperfect method of allocation and/or imperfect response method and/or allocated to the wrong party between client and contractor and/or allocation of imperfect resources or lack of allocation/ incomprehensive allocation.

Sections 8.4.1 to 8.4.6 below use casual networks to show how the areas of contract practice, risk identification, risk analysis, risk allocation, risk response mechanism, and risk practice as shown in the cause and effect diagram above currently result in risk misallocation in the ZCI. This are formulated from interpretive judgement of the qualitative and quantitative data. The starting variable is process oriented while outcome variable is the nature of the risk misallocation. The mediating variables are as identified on the cause and effect diagram (Figure 8.2) associated with each process or area.

8.5.1 Mapping of Causal Networks-Risk identification

Table 8.1 shows the components of the causal network. These include risks identification as a starting point and the outcomes which show the nature of the resulting misallocation.

Table 8.1 Misallocations resulting from Risk identification

Antecedent or start variable	**Mediating Variables**	**Outcomes**
Risk identification	Unsystematic and un-formalised risk allocation, Inadequate risk identification methods, Insufficient risk identification Lack of identification of consequential risks	Resource misallocation, Incomprehensive risk allocation

As shown in Figure 8.3 risk identification could contribute to risk misallocation through resource misallocation and incomprehensive risk allocation.

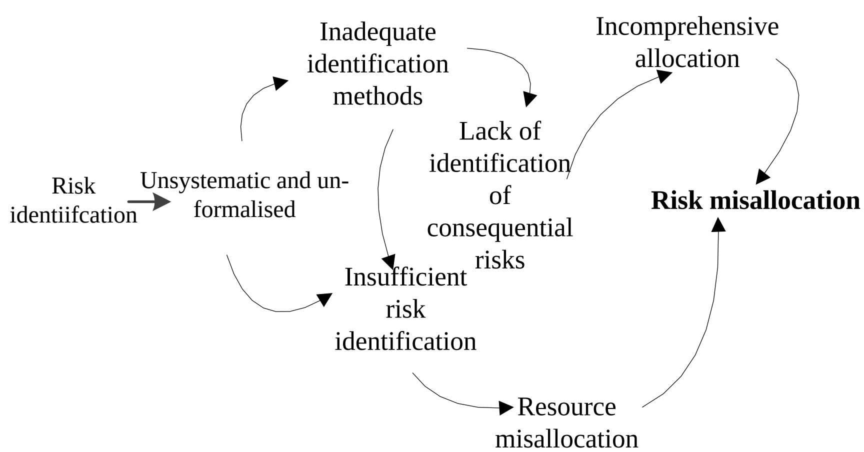


Figure 8.3 Misallocations resulting from risk Identification

8.5.2 Mapping of Causal Networks Risk analysis

Table 8.2 shows the components of the causal network. These include risks analysis as a starting point and the outcomes which show the nature of misallocation.

Table 8.2 Misallocations resulting from Risk analysis

Antecedent or start variable	**Mediating Variables**	**Outcomes**
Risk analysis	Unsystematic and un-formalised analysis Inappropriate methods of analysis Occasional quantitative analysis	Resource misallocation Incomprehensive risk allocation Inappropriate response mechanism

As shown in Figure 8.4, risk analysis could contribute to risk misallocation through resource misallocation, incomprehensive risk allocation and inappropriate response mechanism

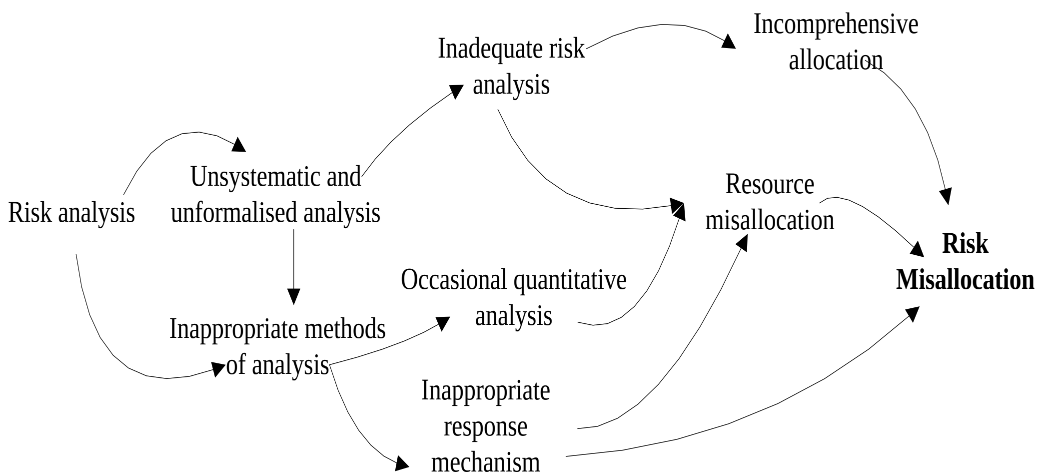


Figure 8.4 Misallocations resulting from Risk analysis

8.5.3 Mapping of Causal Networks -Risk response mechanisms/Treatment

Table 8.3 shows the components of the causal network. These include risks response mechanisms as a starting point and the outcomes which show the nature of misallocation.

Table 8.3 Misallocations resulting from Risk response mechanism

Antecedent or start variable	Mediating Variables	Outcomes
Risk response mechanism	Sources of securities and sureties, inadequate contingencies, Untimely feedback, poor selection of materials, Poor checking for design adequacy, poor monitoring (resource and inspection)	Resource misallocation, unbalanced risk allocation, inappropriate risk response

As shown in Figure 8.5, risk response mechanisms could contribute to risk misallocation through resource misallocation, inappropriate response mechanism and unbalanced allocation.

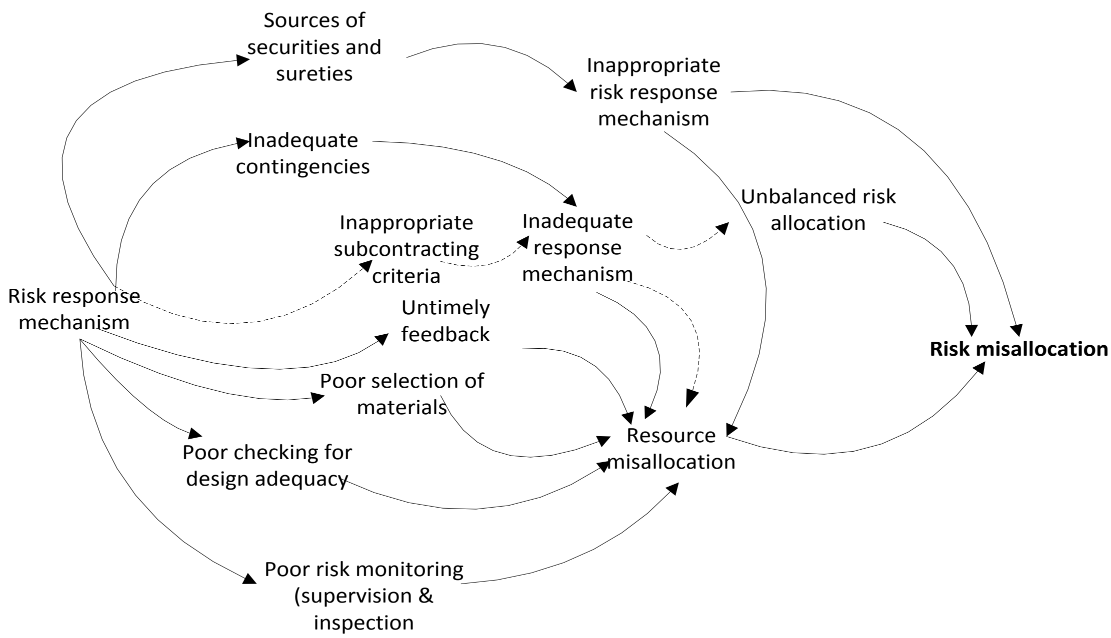


Figure 8.5 Misallocations resulting from Risk response mechanism

8.5.4 Mapping of Causal Networks -Risk allocation

Table 8.4 below shows the components of the causal network. These include risks allocation as a starting point and the outcomes which show the nature of misallocation.

Table 8.4 Misallocations resulting from Risk allocation

Antecedent or start variable	Mediating Variables	Outcomes
Risk allocation	Passive risk acceptance Unjustified risk transfer Poor risk sharing	Inappropriate response mechanism, Inappropriate risk allocation

As shown in Figure 8.6 above risk allocation could contribute to risk misallocation through inappropriate response mechanism and inappropriate risk allocation.

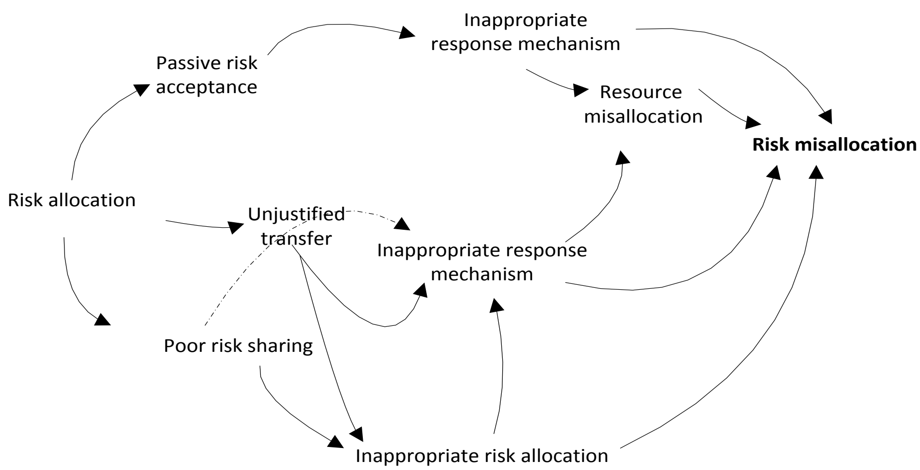


Figure 8.6 Misallocations resulting from Risk allocation

8.5.5 Mapping of Causal Networks -Risk practice generally

The Table 8.5 shows the components of the causal network. These include risk practice generally as a starting point and the outcomes show the nature of misallocation.

Table 8.5 Misallocations resulting from Risk Practice generally

Antecedent or start variable	**Mediating Variables**	**Outcomes**
General risk practice	Poor risk perception, Lack of skill and knowledge, unbalanced interest and power, poor consideration of risk consequences, unfavourable risk allocation, unfavourable bids, inadequate risk assessment reporting and monitoring	Resource misallocation Inappropriate allocation method Inappropriate response mechanism Incomprehensive risk allocation

As shown in Figure 8.7 general risk practice could contribute to risk misallocation through resource misallocation, incomprehensive risk allocation, inappropriate response mechanism, and resource misallocation.

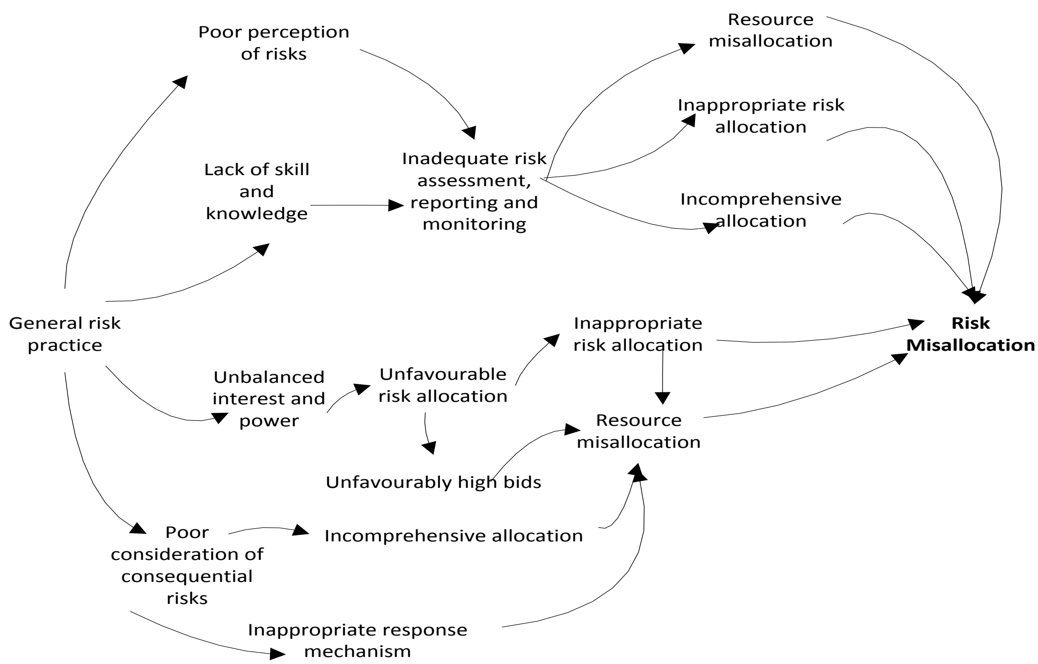


Figure 8.7 Misallocations resulting from Risk Practice generally

8.5.6 Mapping of Causal Networks- Contract practice

As shown in Table 8.6 and Figure 8.8, contract practice could contribute to risk misallocation through resource misallocation, inappropriate risk allocation, inappropriate response mechanism, and resource misallocation.

Table 8.6 Misallocations resulting from Contract practice

Antecedent or start variable	**Mediating Variables**	**Outcomes**
Contract practices	Inadequate response mechanism Omissions and errors in documents Poor selection of contract form Poor consideration factors in contract selection, Inappropriate use of clauses Unfavourable modification Inappropriate contract type Unfavourable bids	Resource misallocation Inappropriate risk allocation Inappropriate risk response mechanism

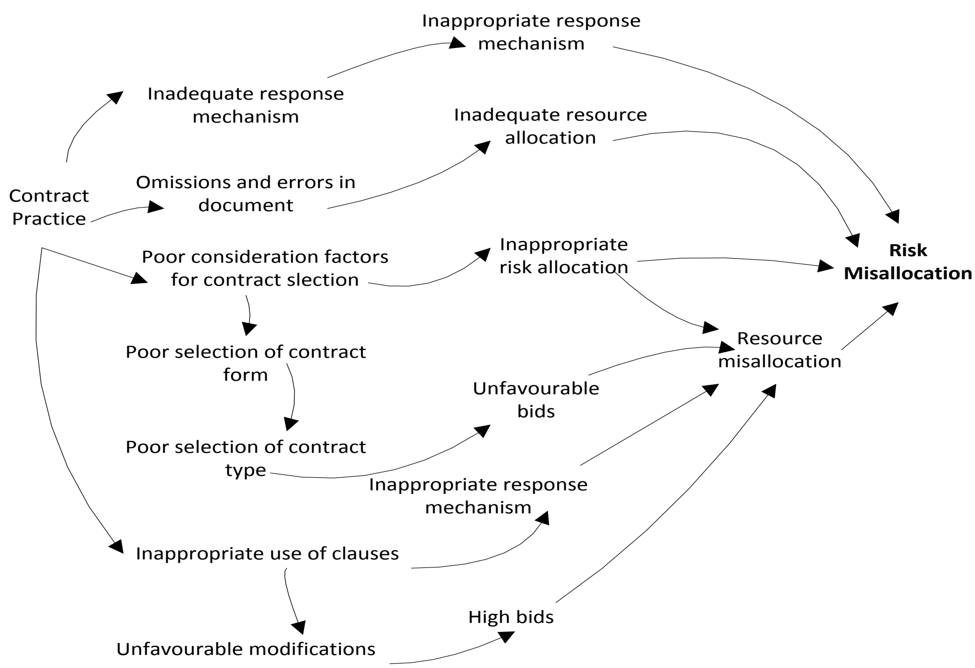


Figure 8.8 Misallocations resulting from Contract practice

Given the above summaries, based on the interpretive judgement of the researcher, it can be concluded that the current risk practice, contract practice, risk identification, allocation, risk analysis and treatment are why risk misallocation is recurrently contributing to project failure in the Zambian Building sector. The next part of the main research question is to devise a mechanism for risk allocation which is also the last objective: *What mechanism can be devised to aid risk allocation in the ZCI?* The tool needed might militate against risk misallocation. This is an opportunity to identify origins, occurrences, and consequences of risk misallocation. Hilson (2004) argued that the appropriate risk allocation prevents risky events from escalating into a risk process. The next Chapter documents the current and the proposed process improvement practice.

8.6 Chapter Summary

This chapter has offered a discussion on how the first three objectives set for the study were achieved and gives a summary of how the main research question has been answered. The next chapter documents the development and validation of a risk allocation process model.

CHAPTER 9 –DEVELOPMENT AND VALIDATION OF PROCESS MODEL

9. Introduction

This chapter documents the current practice, proposed practice, and validates the proposed practice. The chapter answers the question "What mechanism can be devised and verified to aid risk allocation in the ZCI". Having established the sources of risk misallocation in the Zambian building sector in Chapter 8 summarised in a causes and effect diagram (Figure 8.2) and modelled using causal networks shown in Section 8.5 of Chapter 8; it is important to develop a process model and framework to alleviate risk misallocation in the building sector by modelling both current and proposed risk allocation. Since it is argued that current methods of risk practices are problematic therefore risk practice need to be developed towards a simple and digestible methodology that sums up; provides guidance and can be taught and applied easily (Szabo et al., 2014). It is hoped that the proposed criteria will measure up to these requirements.

For risk allocation to be done a sequence of processes needs to take place namely risk identification, analysis and identification of treatment options to arrive at the most appropriate allocation method. At each stage monitoring and communication/reporting need to be done. As risk allocation is a process, a process improvement approach will be used to propose a means for reducing risk misallocation.

Process improvement is the task of identifying, analysing and improving upon existing processes within an organisation/work flow for optimisation and to meet new quotas or standards of quality (Siha & Saad, 2008). Various processes exist in the literature for improving processes such as; process mapping, process flowcharting, force field analysis, cause and effect diagrams, Pareto analysis, statistical process control, control charts, matrix analysis (Kendrick, 2010). Nevertheless, the nature of the problem dictates the applicable method for use. The study did establish that although usually undocumented, the Zambian Building Sector does use some processes to allocate risks, albeit deficient. The methodology to be used to develop the process improvement mechanism is that proposed by Kendrick (2010).

This method is closely related to DRIVE (Define, Review, Identify, Verify and Execute). Kendrick (2010) outlined the following methodology for process improvement:

1. *Plan*: Identify poorly performing processes and set the improvement target

2. *Establish process baseline*: describe the current process using a flow chart or a detailed description of the present standard operating procedure (SOP). Identify root causes or problems as the process is.

3. *Develop changes*: develop option(s) for the new process.

4. *Implement*: Document new standard operating procedure using flow charting.

5. *Measure results or verify*: Compare original process to new one

The steps in this process will now be applied.

9.1 Plan

The planning stage identifies poorly performing processes and setting an ideal target. The cause and effect diagram as shown in Figure 7.2 shows all the identified poorly performing processes and practices. These are further shown as causal networks for risk misallocation in Figure 8.3 to 8.8. In view of the problem, the next section describes an ideal process. The target is that all the currently poorly performing activities be carried out in a way that eliminates or minimises risk misallocation (contract practice and risk management)

9.1.1 Ideal Model Description

The model prescribed is a process model aimed at communicating and illustrating analytical risk allocation processes and available decisions. The aim is to be able to facilitate the allocation of risk that affects projects. As shown in the cause and effect diagram Figure 8.2 earlier in this chapter, the risks are contractual and non-contractual in nature. These are commonly known as project risks. Project risks are a sum of contractual risk and construction risks (Kangari, 1988). Using this background, the ideal model should be an integration of the contract life cycle and risk allocation cycle. This is so as to capture risks that are allocated out of contract and those allocated within. Trinkunience and Trinkunas, (2014) developed a cyclical modelling system for contracts comprising the following steps: 1. Request (selecting from existing contracting models); 2, Authoring (New improved contract model structure selection); 3, Negotiation (inserting additional structural contract elements); 4. Approvals (selecting or creating appropriate contract elements; 5, Execution (New contract based on new model); 6, Obligations (contract execution analysis); 7, Compliance (Contract result analysis) and 8, renewals (weak and strong side evaluation). Shown below in Figure 9.1:

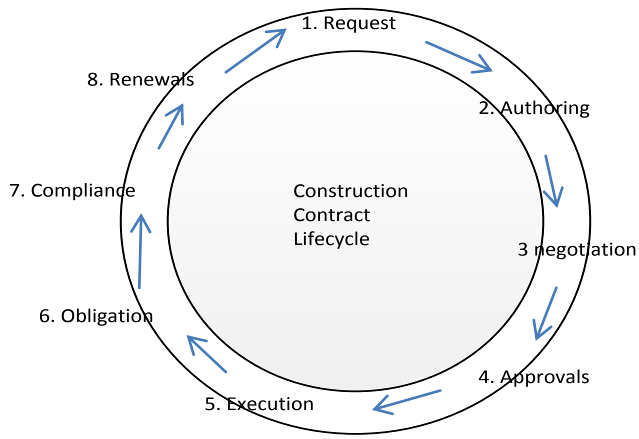


Figure 9.1 Contract Life cycle source Trinkunience & Trinkunas, (2014)

The ISO 31000 has the following process stages in its iterative risk management process: risk identification, qualitative risk analysis, quantitative risk analysis, risk response. Risk monitoring and control occurs at all stages as shown Figure 9.2:

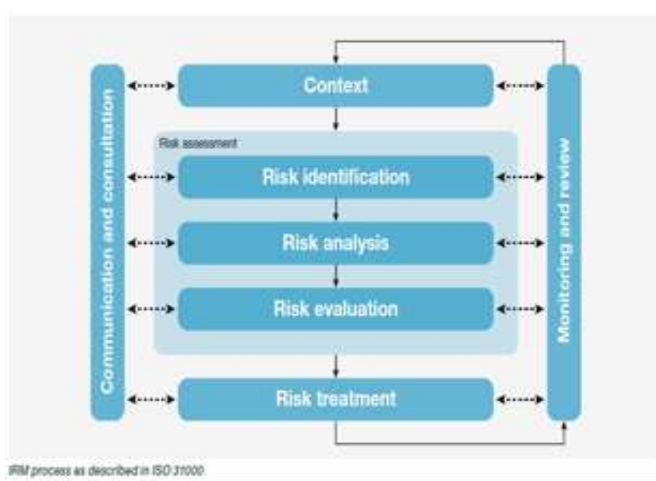


Figure 9.2 Risk Management/allocation Process

The integration of these two models will enable the capture of contractual risks and non-contractual risks in a real life project. The integration has procurement decision and tendering as additional steps in the process to realistically depict the project life cycle, resulting in a 17 step process as shown Figure 9.3.

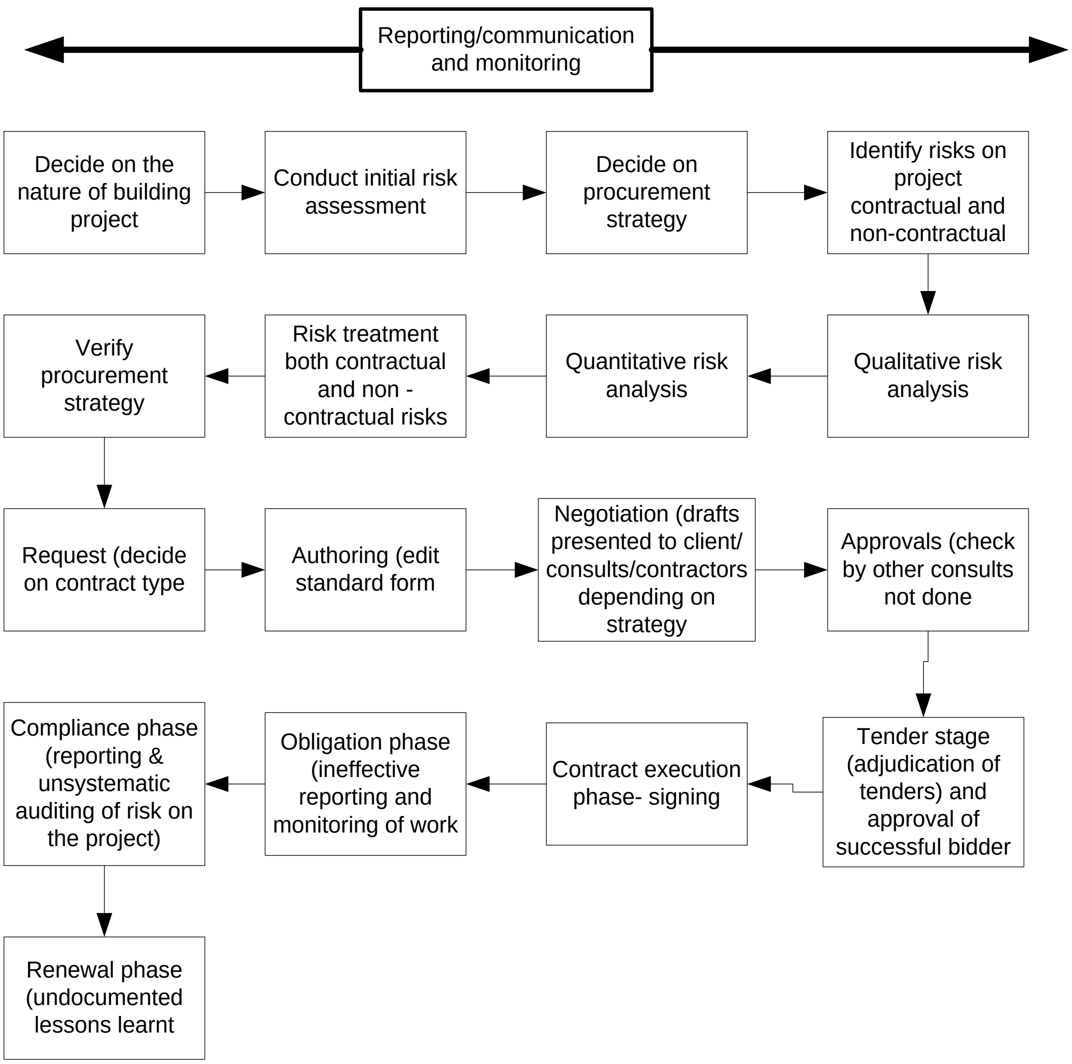


Figure 9.3 Shows process integration of the two models with additional considerations

In designing the process, it is important to take into account the construction process. The process protocol elements considered are shown in Table 9.1.

Table 9.1 Fitting the proposed model into existing project delivery frameworks

Proposed Framework	Generic Construction process (Kagioglou, et al., 2000)	PM BOK (2008) and ISO 21500 (2012)	RIBA (2013)	PMI (2004)
Decide on nature of Building project	1	1	1,2a	1
Initial risk assessment	1	1	1,2a	1
Decide on procurement method	1	1	2a	1
Risk Identification	2	2	2b	2
Qualitative risk analysis	2	2	2b	2
Quantitative risk analysis	2	2	2b	2
Decide on risk treatment	2	2	2b	2
Verify procurement (contract strategy)				
Decide on contract form	2	2	2b	2
Authoring	2	2	2c	2
Negotiation	2	2	2c	2
Approval	2	2	3	2
Tender stage	2	3	3	2
Contract execution	3	3	4	3
Obligation	3	4	4	3
Compliance phase	3	4	4	3
Renewal	4	5	5/6	4

Key to table:

Kagioglou, Cooper, Aouad, & Sexton- Generic Process protocol (1-Pre-project stage, 2-Pre-construction stage, 3- Construction stage*, 4 Post-construction/completion stage)*

PMBOK and ISO 21500 (2012) (1- Initiate, 2-Plan, 3-Execute, 4-Controlling, 5-Closing)

RIBA (0- strategic definition, 1-preparation & brief, 2a Concept design,2b- Developed design, 2c - Initial Technical design, 3 Final technical design, 4- Construction, 5- Handover, 6 Use

PMI (1-project initiation, 2-project planning, 3- project execution, 4- project closeout

Having established the suitability of the proposed processes within existing project life cycle, The RIBA plan of work (being the model followed in the Zambian building sector) will now be used to place the process within the project life cycle as shown in Figure 9.4.

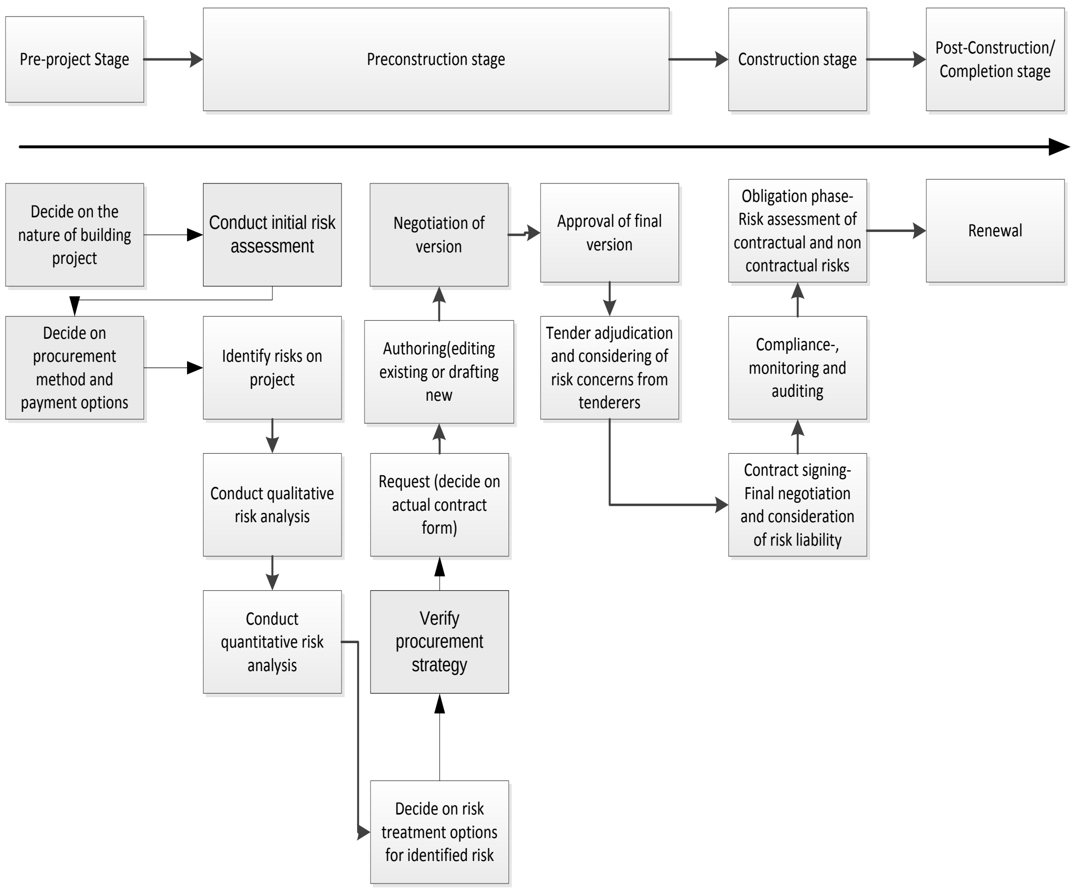


Figure 9.4 Proposed processes within the project lifecycle

Having established the position of each process in the project life cycle, the existing risk process is shown below as a baseline to show points of departure with the proposed process.

9.2 Establish process baseline

The current practice is shown in the Figure 9.5 below. This was established during the interview stage.

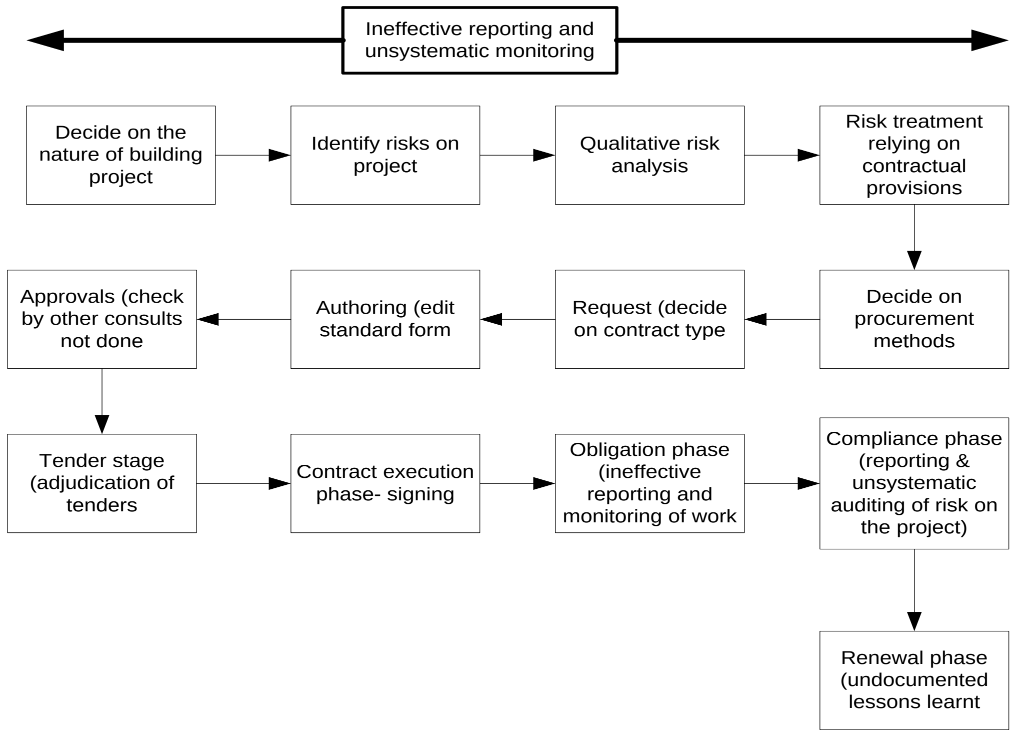


Figure 9.5. Current risk allocation

In view of ideal practice the steps used in the current risk allocation process in the Zambian building sector it may be noted that the sequencing of activities is different. Secondly, it is also worth noting that activities carried- out in the steps also differ slightly. Lastly, quantitative risk analysis is not done proactively but reactively hence it is not shown in the process model. Negotiation of versions of contract documents is the following linear process: clients' needs are given to designers and quantity surveyors produce the final tender documents which go for approval mostly in the private sector (comprising client and designers) while in the public sector after the quantity surveyors produce bill of quantities these are forwarded to procurement department who seek approval of documents normally without the consultation of designers (architects, engineers and quantity surveyors). The consequences of the current practice are documented in Table 9.2.

Table 9.2 Deficiencies and consequences of current Process for risk allocation

I.D	Step	Deficiencies	Consequences
1	Nature of the Building project	Not scoped in terms of risk impact of low, high, medium	Inadequate appreciation of risk profile of project and necessary measures are not put in place
2	Initial risk assessment	The initial risk assessment is rarely done	There is inadequate appreciation on risk identification, analysis and response
3	Decide on procurement option	Normally tradition is used but design and build also used	Heavy modification of contract documents instead of choosing or drafting appropriate type (inappropriate allocation of some risks)
4	Risk Identification	Risks are identified but consequential risks are not	In adequate risk identification (incomprehensive allocation)
5	Qualitative Risk analysis	Rarely done and consequences of risk not considered	Consequential risk not identified (incomprehensive allocation)
6	Quantitative Risk analysis	Not done at all	Most likely risks with high impact are not identified. (resource misallocation, use of wrong response method)
7	Risk Treatment	Mechanisms are rarely put in place for non-contractual risks and contracts are used for response measures not project requirements	Incomprehensive allocation, using measure not suited for project requirements leading to misallocation of resources
8	Verification of procurement method	Normally traditional procurement is used but design and build also used and a change hardly occurs from the initial procurement strategy selected	Heavy modification of contract documents instead of choosing or drafting appropriate type (inappropriate allocation of some risks)
9	Decide on Contract form selection	Private sector can choose from a wide range while public sector cannot	Inappropriate contract selection leading to instances of risk misallocation
10	Authoring-Contract Form selection and modifications	Existing forms are modified even when not suited for procurement method and modifications mainly to shift liability to the contractor are done	Incomprehensive and inappropriate risk allocation result
11	Negotiating of Versions	Stage approach is taken (design then Bill of quantities) and versions are not negotiated	The various consultants (design/cost) end up seeing the full document at tender stage without having input in the final tender approval

Table 9.2 Deficiencies and consequences of current Process for risk allocation continued

I.D	Step	Deficiencies	Consequences
12	Approvals- Final contract Documentation	Not all stage holders check on final product. e.g. Engineers, QS and clients/end users in public sector and Engineers in private sector	Some risks are inappropriately allocated, due to incomplete or conflicting details
13	Tender stage	-raising concerns by contractor on documents availed -tender evaluation and approval of preferred tender	Adjudication guidelines applied and lost bid chosen or most favourable contractor in a negotiated process
14	contract execution	- contractors hardly allowed to negotiate for contract conditions especially in public sector	Unfavourable allocation maintained, opportunity for identification of potential problems is missed
15	Obligation phase (risks assessment, monitoring and reporting	Risks assessment is not actively done contracts are relied upon Risk monitoring is unsystematic	Non-contractual risks are not monitored and sometimes not reported on Poor monitoring for compliance with contract requirements, supervision labour resources (misallocation of resources and incomprehensive allocation of risks)
16	Compliance (reporting and auditing	Clients do not fully comply with contractual requirements. Feedback is delayed. Audits are done reactively.	Risks become more severe due to late feedback (in appropriate allocation of risks and unfavourable allocation)
17	Renewal	This is undocumented so not all players can benefit	Various risk misallocation forms can be taken to new projects

Table 9.8 shows the current deficiencies with current practice in the building sector as regards risk allocation. It is the baseline from which changes will be proposed. The flow chart in Figure 9.6 depicts current practice.

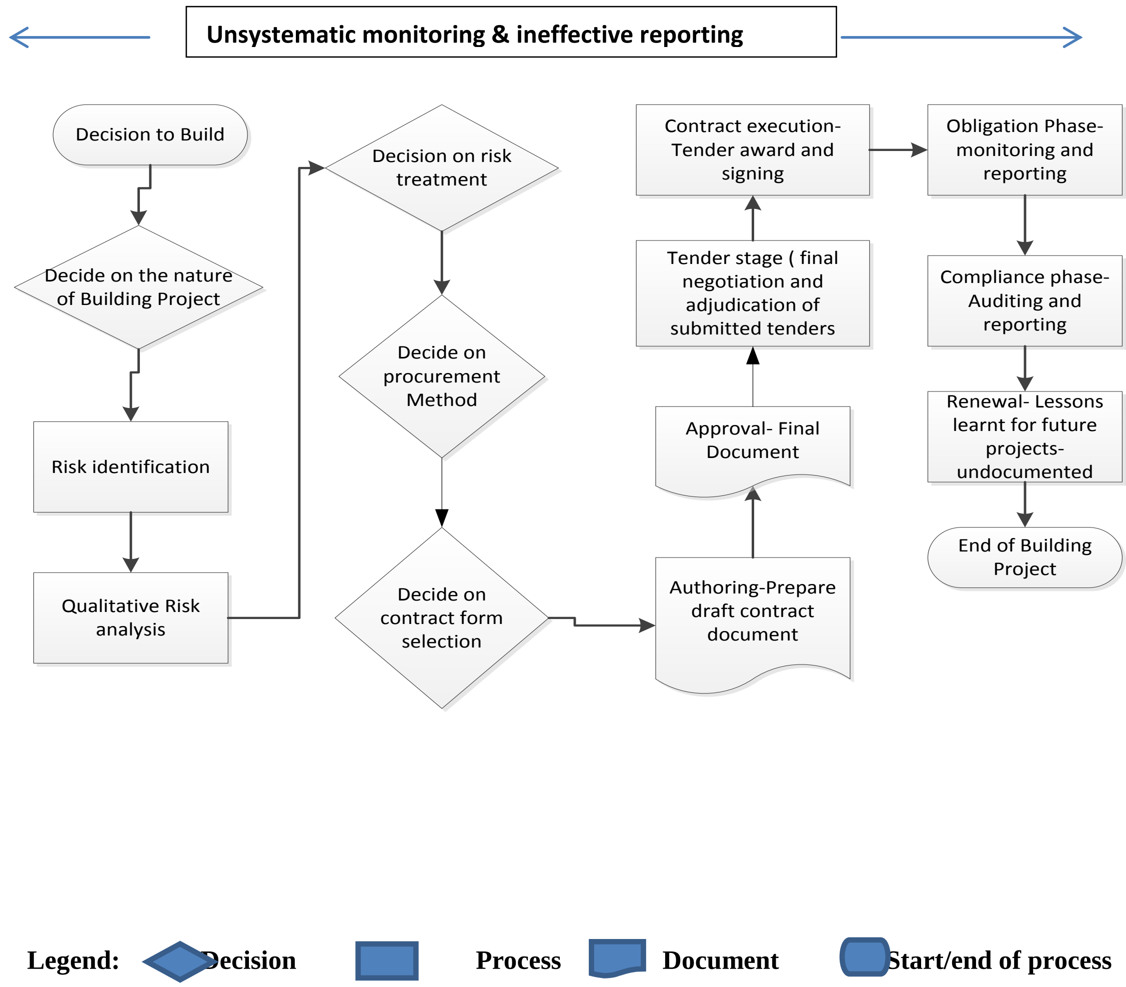


Figure 9.6 Process Flowchart for current Risk allocation

Current practice has been modelled and the deficiencies and consequences shown at each stage this is now presented as a framework for current practice in the Figure 9.7 below.

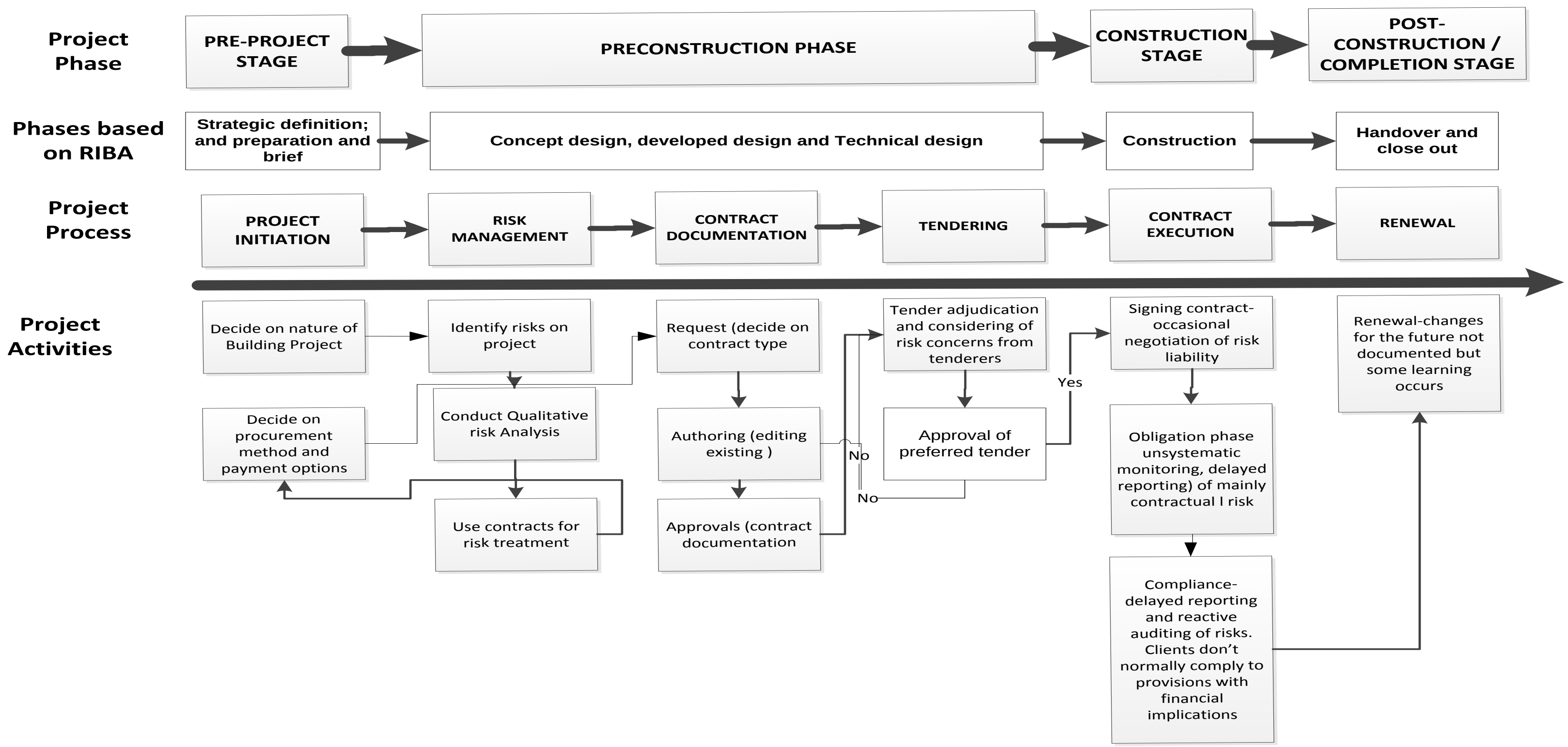


Figure 9.7 Framework for current practice

9.3 Develop Changes

Having established problems in the current process, the proposed processes are now documented with their necessary decision considerations and resources at each point. These are presented based on existent literature and empirical findings.

Proposed Mechanism development

Literature review and information from the empirical phase were used to develop a model and framework to be used to improve risk allocation in the Zambian construction Industry. This was from a background that risk management differs across countries, industries and sectors (Mullai, 2006). The model development uses a process model showing decision-making steps involved in a cognitive process in which each step follows in a logical order from the one before (Alsalman & Sillars, 2013). Therefore, it is a logic model. A process model provides a structured and sequenced approach to decision-making (Alsalman & Sillars, 2013). The main aim of the process model is to identify actions that would lead to appropriate risk allocation. After identifying inadequacies in the empirical phase, the framework shows logical decision making from the project inception to project close-out, mainly focusing on risk allocation (identified risks, risk analysis, response measures using suitable clause types and reimbursement method), and the process maps factors in contracting parties' responsibilities. Given that methods for responding to risk and the nature of risk evolve, based on technology and products offered by the financial sector in terms of insurance and bonds etc., the framework is flexible to infuse such changes to stay as current as possible. The proposed mechanism has 17 active steps. The various decisions that have to be made at each stage are now given step by step.

9.3.1 Decisions to be made within the Steps

1. Nature of the Building project

Various types of buildings exist such as commercial, industrial and residential (Ramus et al., 2006), administration and civic, hospital, recreational, education, other (Love, et al., 2010). Typical building types in the ZCI are houses, office space, hotels, lodges, and police stations, prisons, airport building, farm infrastructure, filling station warehouse, and factory. Once a building type has been chosen, determining the magnitude of the building is important in risk allocation decisions. Kardes et al., (2013) provide some parameters that can be used for determining project building type. The empirical phase of this study provided evidence that some dimensions are misplaced e.g. some projects are classified as simple when in fact the nature of the construction is fairly complex. Figure 9.8 shows steps that could be followed in scoping the type of building to engage in.

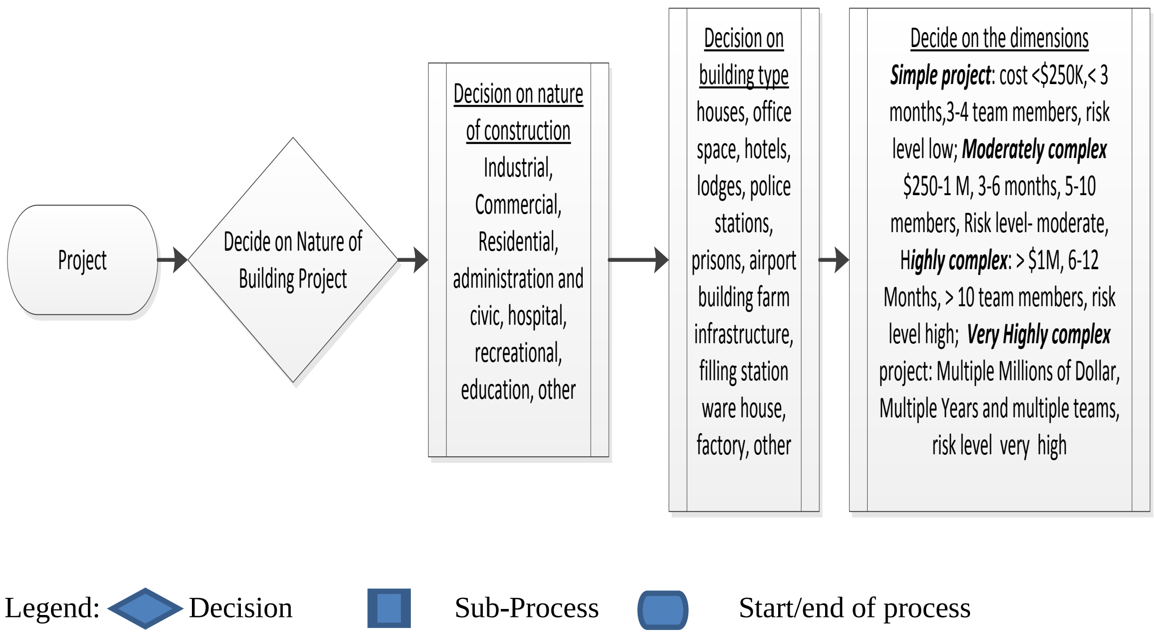


Figure 9.8. Establishing the context of the project

2. Conduct initial risk assessment

Risk assessment includes risk identification, assessment and response. Detailed processes of considerations for the aforementioned steps are shown below under the appropriate headings. The form helps to cover all the items needed to conduct an initial risk assessment (Table 9.3) to determine the viability of the project in its initial stages. Some of risks identified are Land acquisition, site information, site investigation, Obtaining planning permission, Financing the project, Changes in laws and regulations, Political risks, Changes in work scope , bureaucracy on design and others.

Table 9.3 initial risk assessment

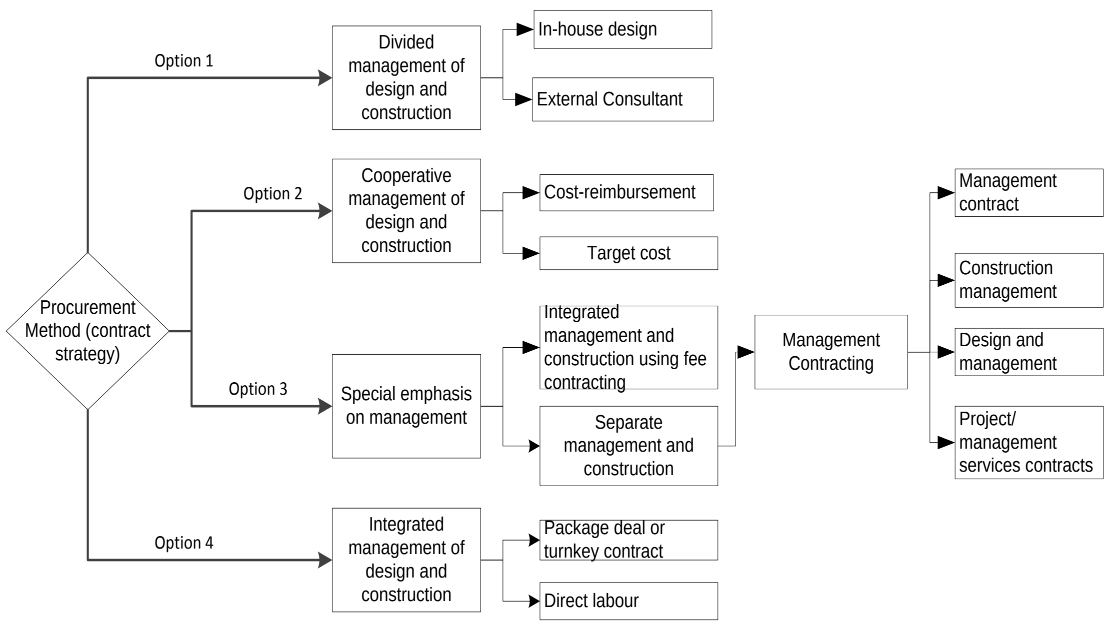
<table>
<tr><td>Client</td><td colspan="8"></td></tr>
<tr><td>Project name</td><td colspan="8"></td></tr>
<tr><td>Consultants</td><td colspan="8"></td></tr>
<tr><td>Contractor</td><td colspan="8"></td></tr>
<tr><td>Procurement method</td><td colspan="8"></td></tr>
<tr><td>Nature of Project (Tick)</td><td>Commercial</td><td></td><td>Residential</td><td></td><td>Industrial</td><td></td><td>Other</td><td></td></tr>
<tr><td>Risk Identification</td><td>Qualitative rating of risk (low, or high</td><td>Likelihood of impact</td><td>Expected impact (1-5)</td><td>Risk Rating (0-25)</td><td>Recommended response mechanism (s)</td><td>Recommended control mechanism</td><td colspan="2">Consequence of risk</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2"></td></tr>
</table>

Likelihood of risk occurrence values range from 0-5 where 0=Not applicable to project (0% chance), 1 = Very low chance (<10% chance), 2 = Low chance (10–35% chance), 3 = Medium chance (35–65% chance), 4 = High chance (65–90% chance), 5 = Very high chance (>90% chance) of occurrence. Ideally, no item with a 0 rating should be analysed therefore the form should only contain risks with a 1-5 rating (Hanna et al., 2013). While for the Relative impact the CII international project risk assessment research scoring system of 0-5 where 0 = Not applicable to project, 1 = Negligible and routine procedures sufficient to deal with the consequence, 2 = Minor and would threaten an element of the function, 3 = Moderate and would necessitate significant adjustment to the overall function, 4 = Significant and would threaten goals and objectives, 5 = Extreme and would stop achievement of functional goals and objectives

Once the decision to build has been made, an initial risk assessment has to be done to ensure that the risks associated with the initial stages have been considered. Decision to continue with the project has got to be based on the premise that the risk exposure is acceptable. Additionally, for high risks continuation is based on the prospect that careful development of the project will result in risk sharing, elimination, transfer, reduction, or avoidance (Smith, et al., 2014).

3 Decide on procurement method

Procurement for risk could be a risk response measure. The decision on the procurement method or contract strategy helps to determine what type of expertise are needed in terms of consultants and possibly the engagement of a contractor earlier on in the project. Empirical evidence from the research has shown that the ZCI public sector normally prefers the traditional procurement. Additionally, the document analysis provided evidence that the decision should be made early so as to identify and allocate risks appropriately. This view was affirmed by Emuze & Smallwood, (2013) who proposed that appropriate allocation of risk should be prioritised when choosing the procurement strategy. Notwithstanding, the focus of procurement systems is risk allocation and contract management (Chong & Preece, 2014). Figure 9.9 shows the various decisions that can be made, adapted from Smith et al., (2014).



Legend: Decision Sub-process

Figure 9.9 procurement Options

4 Risk Identification

Risk identification is the first step in the risk management process. Decisions to be made at this stage are the categories of risks and actual risks to the consultants, client, contractors and other players and methods of risk identification methods. The literature has been used to identify risk factors as shown in Figure 9.10 (See Barlish, Marco, & Thaheem, 2013; Odimabo

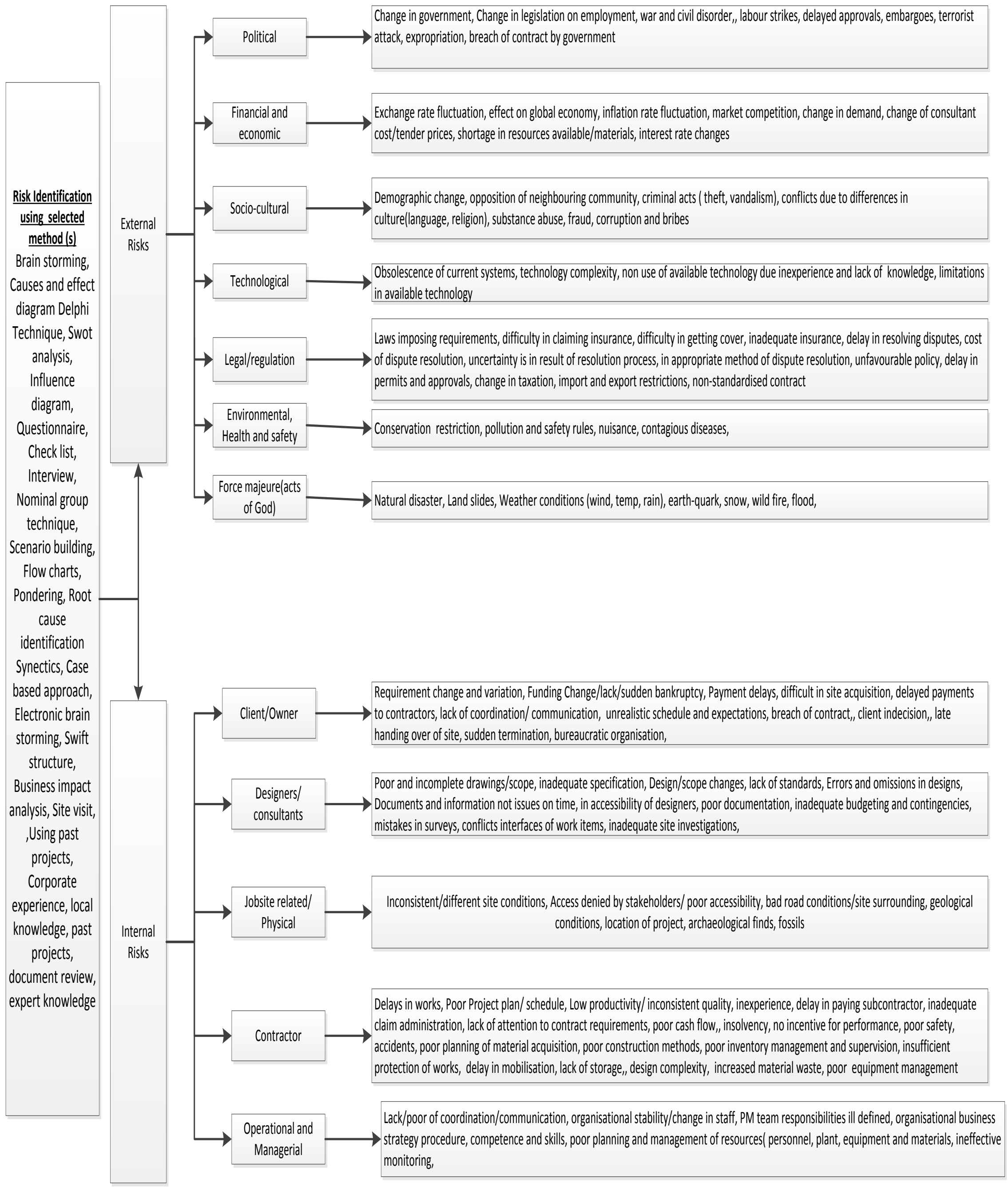


Figure 9.10 Risk factors in Building Projects

& Oduoza, 2013). All team members should have an input as risks a correlated (Appendix 10N) and perceptions differ as shown in Appendices 10I to 10K). Risk identification process should result in the completion of a risk identification form using the information provided in the risk identification (Table 9.3). The risk identification form provides a systematic basis for identifying risk while the figure shows the various types of risks internal or external classified as political economic or source client, contractor, designer etc. such as are common in building projects. Since perception of risks defer all consultants should be given an opportunity to forward possible risks.

Table 9.34 Risk identification Form

Client						
Project name						
Consultants						
Contractor						
Proposed Procurement method						
Nature of Project (Tick)	Commercial	Residential	Industrial	Educational	Health	Other
Risk Profile (Tick)	Low	Moderate	High	Very High	unsure	
Risk factor	Risk description				Risk classification	
Late payment	Risk resulting from clients delayed payment due to funding etc.				Financial	

5. Qualitative Risk analysis

Risk analysis can be conducted qualitatively and quantitatively while the study found that only qualitative analysis is done in practice in the ZCI. Qualitative risk analysis can use ranking options, comparing options and descriptive analysis through the use of qualitative tools namely: brain storming, fish bone diagram, checklist, risk breakdown matrix, interview, risk data quality assessment, risk matrix, interview and intuition.

Table 9.5 Qualitative Risk assessment form

Client						
Project name						
Consultants						
Contractor						
Proposed Procurement method						
Nature of Project (Tick)	Commercial	Residential	Industrial	Educational	Health	Other
Risk Profile (Tick)	Low	Moderate	High	Very High	Unsure	
Risk factor	Causes		Impacts		Risk classification	
1 poor quality	Poor workmanship, substandard materials		Quality		Technical	

The qualitative risk assessment sheet shown in Table 9.5 provides a systematic approach to conducting a qualitative risk assessment. Where a risk impacts (e.g. cost or time) could be used as a guide for conducting the quantitative risk assessment. The cost overrun or schedule overrun in the quantitative risk analysis could be predicted.

6. Quantitative Risk analysis

Quantitative approaches are divided into probability analysis, sensitivity analysis, and simulation techniques. Quantitative risk analysis methods include; event tree analysis, risk mapping, probability and impact matrix, expert judgement, fuzzy logic and AHP, probability distribution, sensitivity analysis, Monte Carlo simulation, kinetic tree analysis, risk portfolio, expected monetary value, adjusted discount rate, risk premium, judgement risk analysis process, advanced programmatic risk analysis and management, PERT, utility function in engineering performance assessment, failure modes and effect analysis, estimating using risks analysis, data driven analysis of corporate risk using historical cost control data, Estimating project activity duration using networks analysis (critical path analysis), schedule risk system, computer aided simulation for project appraisal review, fault tree analysis, game theory, Bayesian network technique. A suitable method depending on the nature of the risk can be used to complete the risk assessment in Table 9.5 below which has been adapted from the work of Hanna, Thomas and Swanson, (2013) can be used. This assessment sheet was tested and found suitable for carrying out a quantitative risk assessment. Choice of methods should be in tandem with the parameter being measured e.g. critical path analysis for time-related risk analysis.

Table 9.6. Quantitative risk assessment form

<table>
<tr><td>Client</td><td colspan="7"></td></tr>
<tr><td>Project name</td><td colspan="7"></td></tr>
<tr><td>Consultants</td><td colspan="7"></td></tr>
<tr><td>Contractor</td><td colspan="7"></td></tr>
<tr><td>Proposed Procurement method</td><td colspan="7"></td></tr>
<tr><td rowspan="2">Nature of Project (Tick)</td><td colspan="2">Commercial</td><td>Residential</td><td>Industrial</td><td>Educational</td><td>Health</td><td>Other</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">List of risks</td><td rowspan="2">Risk applies to project</td><td colspan="2">Contract risk</td><td rowspan="2">Like hood of risk (1-5)</td><td rowspan="2">Relative impact</td><td rowspan="2">Risk rating (0-25)</td><td rowspan="2">Expected value of the risks</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td></td><td></td><td></td><td></td></tr>
</table>

Likelihood of risk occurrence values range from 0-5 where 0=Not applicable to project (0% chance); 1 = Very low chance (<10% chance); 2 = Low chance (10–35% chance); 3 = Medium chance (35–65% chance); 4 = High chance (65–90% chance); 5 = Very high chance (>90% chance) of occurrence. Ideally, no item with a 0 rating should be analysed therefore the form should only contain risks with a 1-5 rating (Hanna et al., 2013). For the Relative impact the CII international project risk assessment research scoring system of 0-5 applies where 0 = Not applicable to project; 1 = Negligible and routine procedures sufficient to deal with the consequence; 2 = Minor and would threaten an element of the function; 3 = Moderate and would necessitate significant adjustment to the overall function; 4 = Significant and would threaten goals and objectives; 5 = Extreme and would stop achievement of functional goals and objectives. The risk rating is a product of likelihood of occurrence and relative impact. The decision rule then becomes that any risk rating 5 and above should be taken seriously as it could mean that the risk is highly likely or the impact could be extreme. The risk rating should then denote an expected value using an appropriate quantification method and the risks can be considered for allocation using the risk allocation consideration sheet shown below. Special attention needs to be given to non-contractual risks as mechanisms outside of the contract need to be formulated

7.Risk Treatment

Once risk analysis has been carried out and a list of risks likely to affect the project has been compiled the following sheet (Table 9.7) should be completed using the risk response process provided (Figure 9.11), starting with the risk with the highest possibility of occurrence and highest impact. The consequences of risks are not considered by consultants (questionnaire and interview results) when allocating risks as shown by the empirical results. As a result consequential risks are seldom mitigated when risks eventuate. Suitable contract clauses for risks should be well thought out especially if certain types of clauses have proved problematic in the past. This should be done at this stage to be able to appreciate the magnitude of a risk. Based on the empirical data the following considerations should be made for the following response mechanisms.

I. Bonds and guarantees sources- opt for insurance were possible to improve contractor's cash flow.

II. Methods of construction- suggest methods and allow for variation where contractor can possibly offer a better and viable option.

III. Subcontracting: should be calculated on project-by-project basis. Consider calculating the sum of all specialized work before arriving at the percentage estimate for sub-contracting

IV. Insert a realist time estimate for payment related issues

V. Clauses that deal with feedback could be have time bars for action.

VI. A contingency sum should be used with fairly accurate provisional sums and prime cost sums. If provisional sums and prime cost sums cannot be calculated accurately, they should be given to specialist designers and subcontractors**.**

Table 9.7. Risk Allocation Consideration form

Client							
Project name							
Consultants							
Contractor							
Proposed Procurement method							
Nature of Project (Tick)		Commer cial	Residential	Industrial	Educational	Health	Other
Risk Profile (Tick)		Low	Moderate	High	Very High	unsure	
Risk	Clause type	Risk Rating (0-25)	Expected value of risk (K,000)	Recommended action	Recommended risk allocation	Consequenc e of risk	Other response measures
1 Late payme nt	Penalty	25	3,000	Modify contract conditions	Contractor	Interest on late payment, site abandonmen t, slowing down work on site	Use Contingency sum, delay project to when funds are available

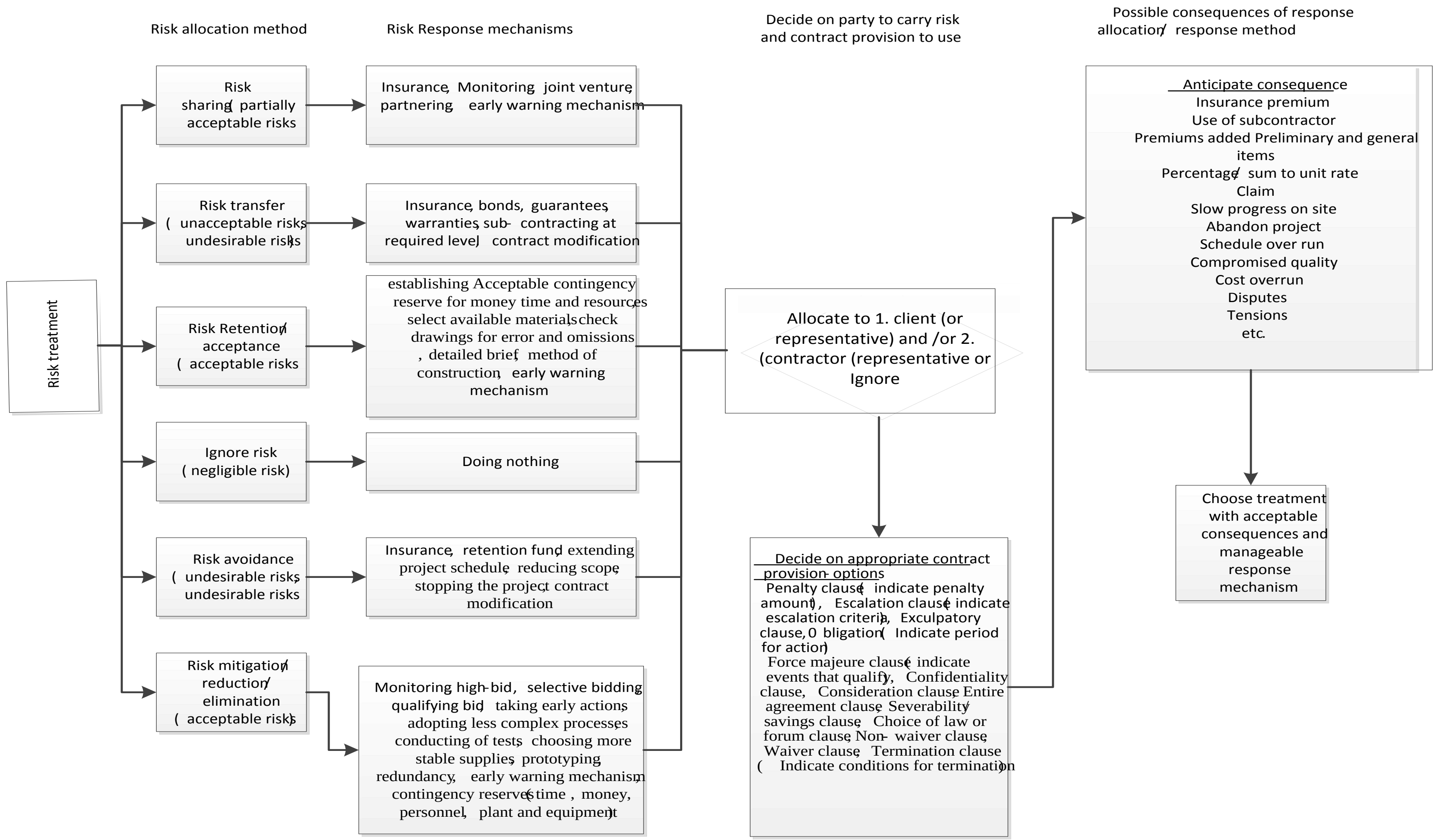


Figure 9.11 Risk Response decision process

8. Verification of proposed procurement

Before the selection of the contract form the procurement method has to be verified (Figure 9.12). To ensure that the risk allocation decided upon is in line with procurement strategy chosen and the capabilities of the project initiator. If it is found to differ then detailed risk assessment has to be repeated by first choosing the appropriate procurement method.

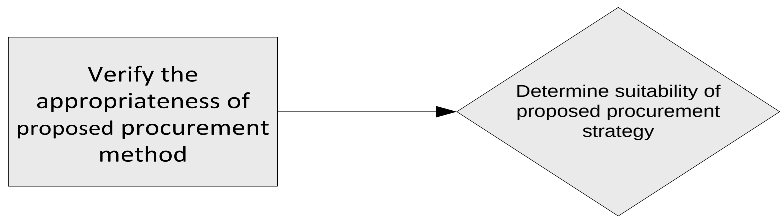


Figure 9.12 Procurement verification

9. Decide on Contract Form

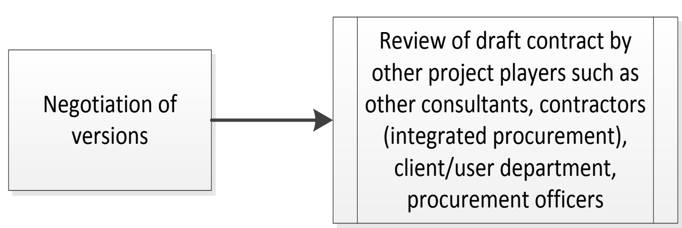
Construction projects need appropriate contracts for efficient execution. Zagloul & Hartman (2003) argue that in any given contract the owner's goal can be best achieved by selecting the contract type that will effectively motivate the contractor to perform. Furthermore, it has been estimated that better contracting practices, can result in a 5% savings in the project's total cost from study in 1986 and inappropriate risk allocation results in at least 3% contingency or risk premium in bids results from a study in 2006 (Groton & Smith, 2010). From the empirical phase it was established that public and private sector clients have different considerations these are depicted below. Further to this, the public sector has a designated suite of contracts while the private sector is freer to choose to depend on the client's decision. The selection of contract should be in line with desired contract type and procurement method to avoid massive modifications. Other project team members should have an input in contract section as their selection factors differ (Appendix 10B- 10D) and are moderately positively correlated (Table 7.24) as shown from the empirical phase. Once this has been done the authoring process can be initiated. See Figure 9.14 for the decision process. Once a standard form is chosen the drafting process can then be initiated.

10. Authoring- Contract Form Preparation and/or modifications

Trinkunience and Trinkunas, (2014) point out that the construction industry has vast nature of contracts and in most cases it is impossible to use the exact same contract consecutively. Moreover, in a scenario where a suitable standard form does not exist a bespoke contract may have to be used. Uff, (2009), Picakavance, (2005); and Hackett, et al., (2007) provide provisions of the items that need to be included in the contract as shown below. Care has to be taken to ensure that the contract is fair, clear and comprehensive in allocating risk (Charoemngan & Yeh, 1999; Hughes & Greenwood, 1996). Taking into consideration that contractors are typically unable to influence the contract conditions or clauses (Charoemngan & Yeh, 1999) unless the procurement mode is non-traditional. As a result of this, negotiation among the stakeholders resulting in the document is necessary. This view is affirmed by Wibowo and Mohamed, (2010) who propose that project risks should be negotiated. At this point, all accompanying documents should be provided see Figure 9.15 for the authoring process.

11. Negotiating of Version(s)

At this point the draft version is presented for review by appropriate wings or personnel of the project organization (Trinkunience & Trinkunas, 2014) as shown in Figure 9.13. The client needs to agree to the design, projected budget and prospective contractors while designers need to be in approval of designs and specifications as presented. Once these give their feedback the final version is produced and undergoes an approval process by those in charge normally the quantity surveyor, designers and procurement personnel in most cases.



Legend: Process Sub-Process

Figure 9.13 Negotiation of version(s)

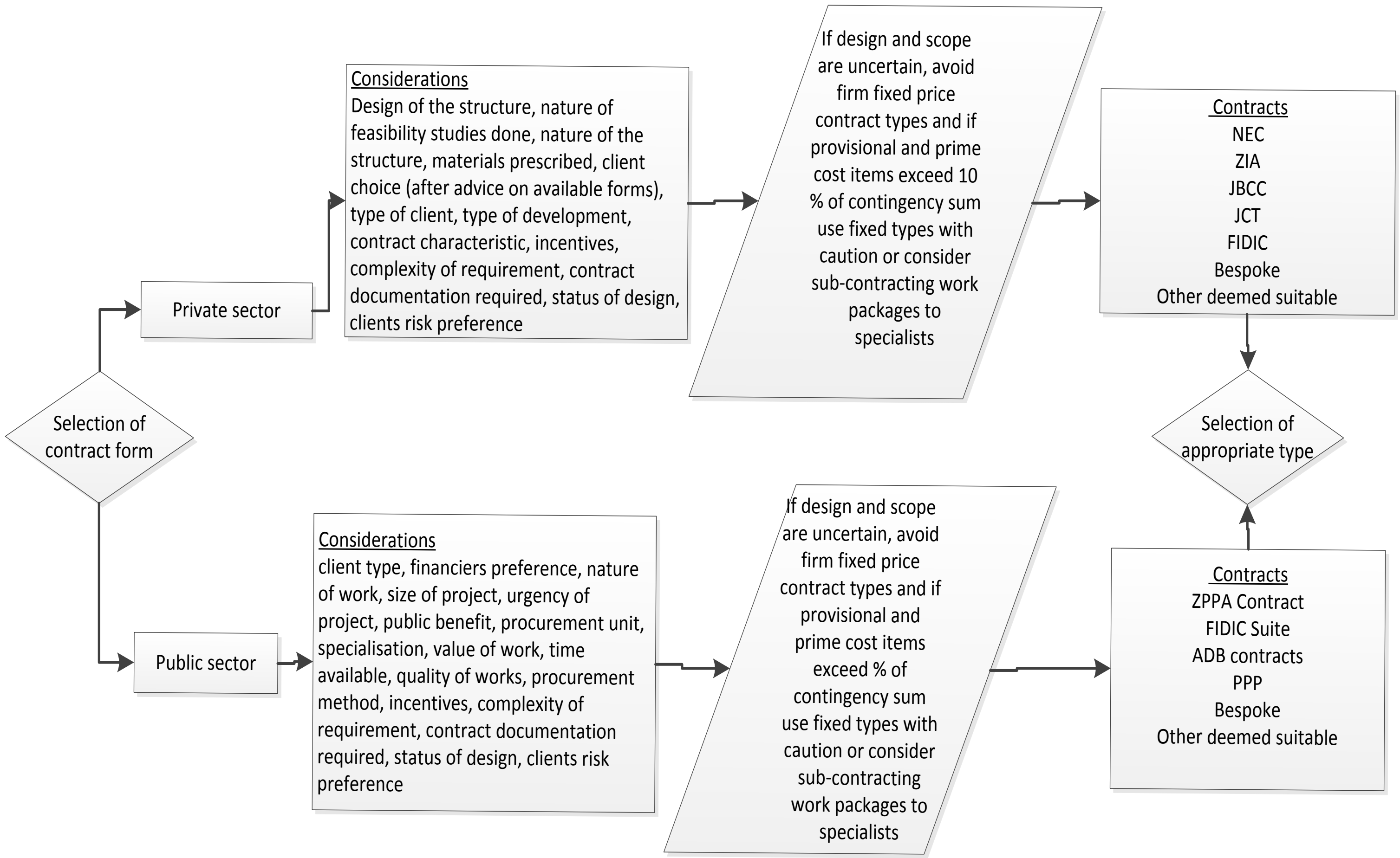


Figure 9.14 Selection of contract form

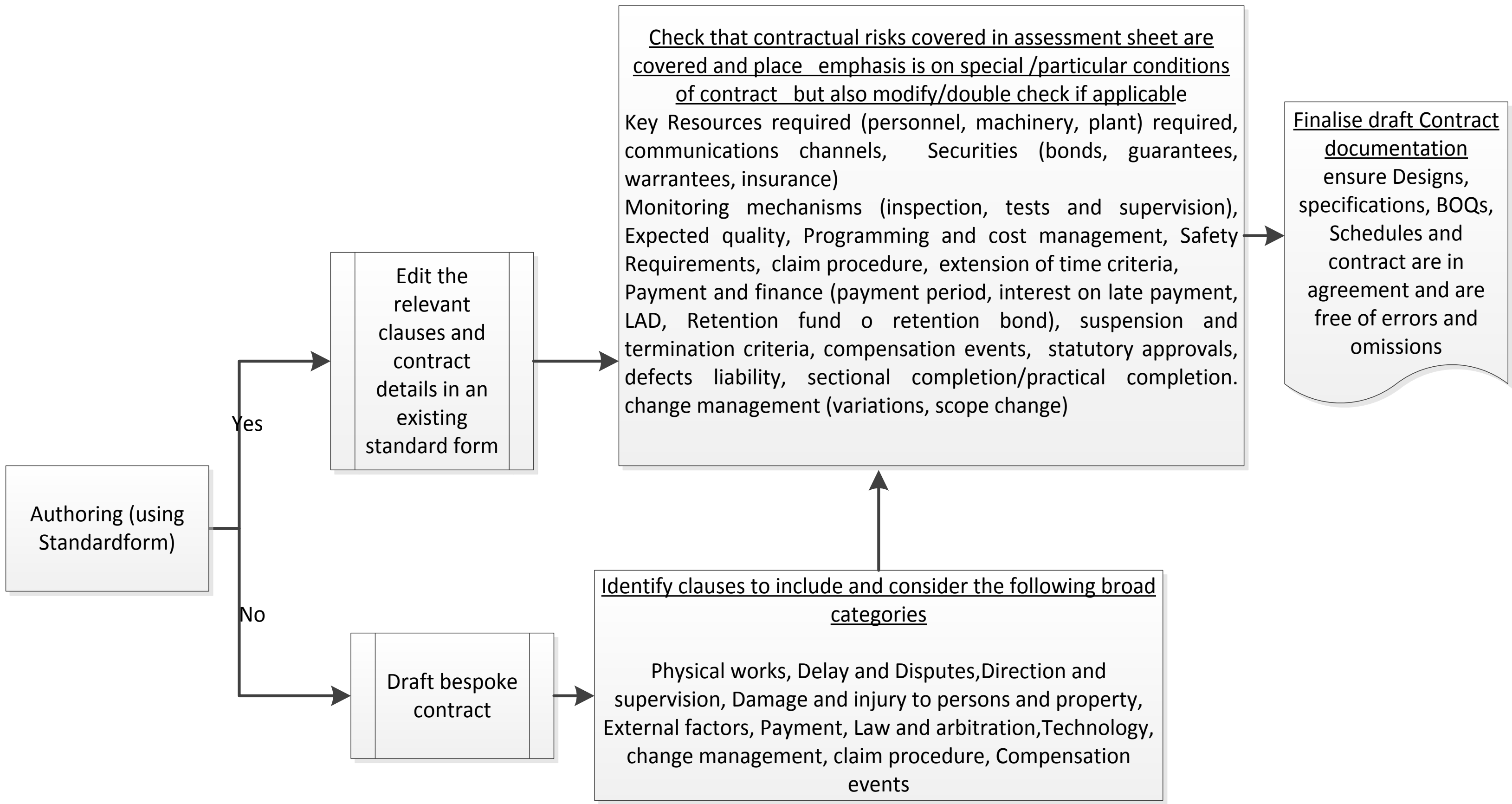


Figure 9.15 Authoring process

12. Approvals- Final contract Documentation

Authorized personnel, project owner and stakeholder can now check the document and the final product then be presented ready for tender or execution in an integrated system of procurement. The empirical phase provided evidence that in the public sector this stage is done by legal and procurement units resulting in fundamental omissions such as the financial provisions each insurance limits and defects liability, hence the need to include all relevant stakeholders at this stage as shown in Figure 9.16.

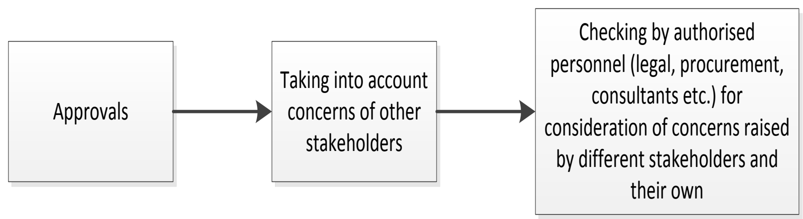
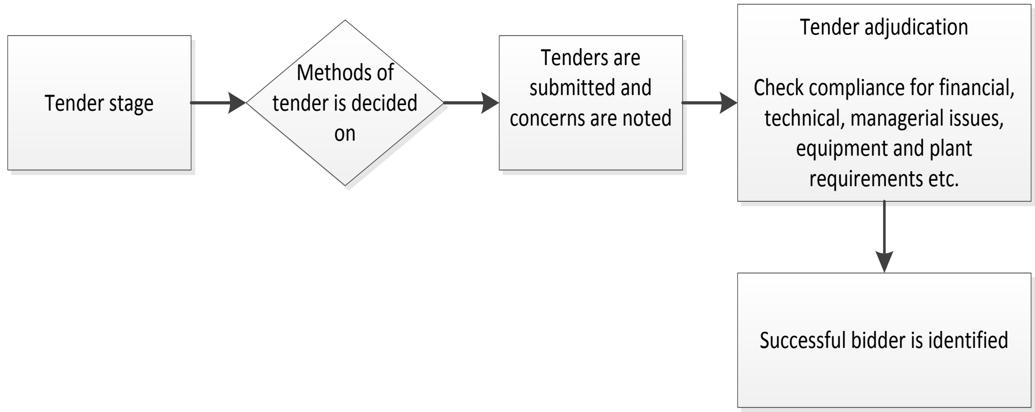


Figure 9.16 Approval of Final Documentation

13. Tender stage

At this stage a tender method as to whether open or closed is decided upon. It is important to consider issues raised by tenderers to ensure that the documentation is favourable. The empirical phase provided evidence that especially for public projects, negotiation is only possible at tender stage so should be included here. This is supported by Dzliadosz et al., (2015) who concluded that public tenders typically exclude the possibility of negotiations and consequently restrict contractual liability for unforeseen events. Once tenders are returned adjudication can then be conducted using parameters shown as highlighted by (Hackett, et al., 2007) and a successful bidder is chosen. A tender stage process may be conducted as shown in Figure 9.17.

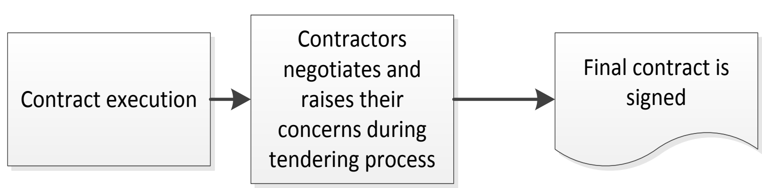


Legend: Decision Process

Figure 9.17 Tender stage

14. Contract execution

Contract execution starts when the contract is signed. Here risk related issues can be addressed and brought to the attention of the successful bidder. In addition, a platform should be given to the contractor to address their concerns so as to accomplish balanced risk allocation. In addition, further or supplementary response mechanisms could be put in place to increase success rate of the project especially for non-contractual risk. The risk management plan for the project could be agreed and formulated at this stage. The contract stage is as shown in Figure 9.18.



Legend: Process Document

Figure 9.18 Contract execution

15. Obligation phase (risks assessment, monitoring and reporting)

Here the processes of risk assessment (risk identification and analysis) , monitoring and reporting (communicating) are continued to ensure that risks that are arise from both uncertain and certain events are re-allocated and appropriate response measures are put in place (Figure9.19). Areas of emphasis are shown in the figure below. Continued risk assessment is vital as the PMI, PMBOK, ISO31000 and other standards shows the risk management phase and impliedly the risk allocation phase as an iterative process carried out throughout the contract. Care must be taken to ensure that non contractual risks have response mechanisms in place. Therefore, at the start of the project mechanisms for non-contractual risks should be instituted. Mooney and Mooney (2013) pointed out that whatever risks or obligations a party agreed to at the contract formation stage, they must comply with or risk breaching the contract. This should be the outcome of the legal agreement provided the parties intended to create legal relations and the contract was entered into freely. This reinforces the need to have a contract favourable to both parties. Implying that the client is not complying with contractual provisions should be avoided to ensure proper risk allocation is attained.

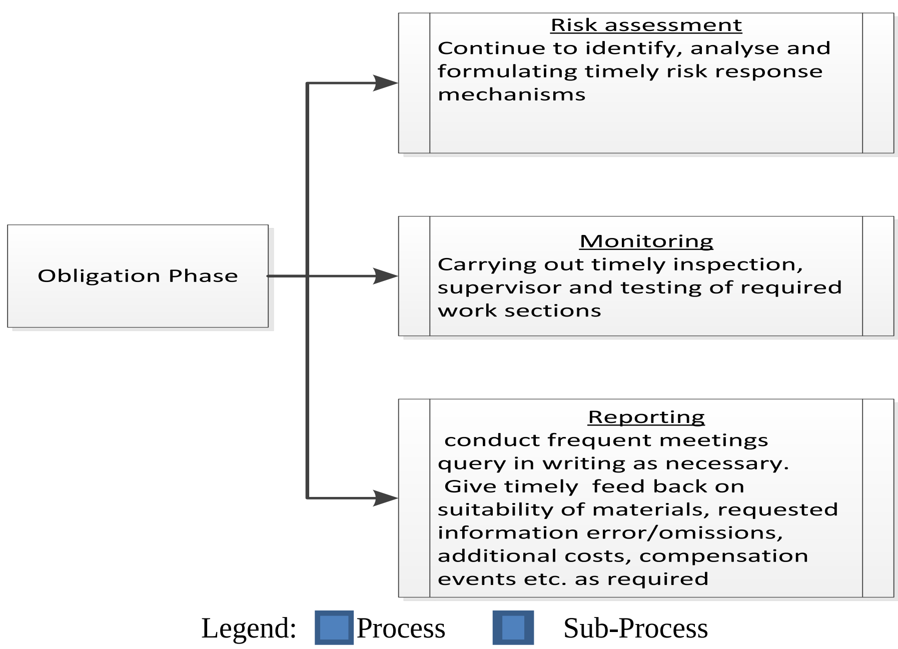


Figure 9.19 Obligation Phase

16. Compliance (Auditing)

This is mainly checking that measures put in place are adhered to (Figure 9.20). The empirical phase provided evidence that on occasion clients do not adhere to contract conditions. Due to this expectation by contractors' pricing of works results in high bids and eventually high contract sums. Non-compliance by the client to contract conditions such as honouring contractual claims results in the client paying for risks that did not eventuate, leading to resource misallocation. All parties should be compliant to contractual provisions to enhance success on a project (Gudience, et al., 2013).

Figure 9.20 Compliance stage

17. Renewal (lessons learnt)

An important aspect of risk allocation practice is knowledge management (Serpella et al., 2014; Hosseini et al., 2016). However, evidence from the Zambian building sector is that lessons learnt are not documented and by the time a similar project is embarked on these lessons may not be applied in totality. Moreover, managing data, information and knowledge generally are important for risk allocation and management (Cagliano, et al., 2015). Also, Obaide (2008) argued that after completing a project, team members are spread all over the company and project documentation is stored in some folders without the essentials being retained for later use. Therefore using a knowledge management approach (Tserng, et al., 2009; Hosseini, et al., 2016) the renewal stage is important for improving future practice. Areas of particular importance for improved risk management are shown in the Figure 9.21.

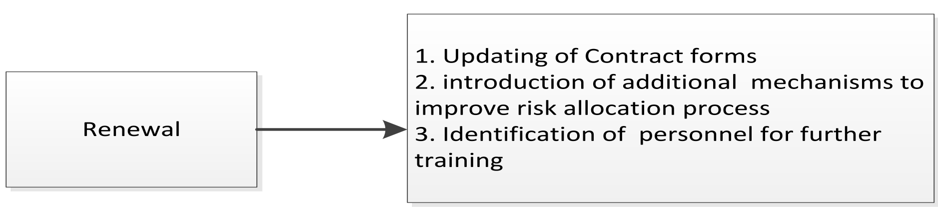


Figure 9.21 Renewal

9.4 Implement

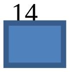
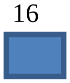
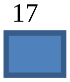
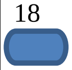
This stage basically documents the proposed process by way of risk map, flow chart and framework. The proposed changes are implemented in these new process models.

9.4.1 The Risk allocation Process Map

The process map in Table 9.8 shows the major steps in the risk allocation process described above. These have been decomposed to various sub-steps to clearly identify the decisions to be made at each step. Some of the knowledge bases identified by Kangari (1998) for risk management and therefore risk allocation are construction knowledge, legal, financial management and construction know-how. Additional data bases identified as resources or requirements are cost data, weather data, productivity data and economic.

Table 9.8 Process Map for risk allocation

I.D & Shape	Who	Step	Resource/requirement
0	Client/User department	Start of project	Client/user department
1	Client/User department	Nature of the Building project	Client- financial resource, construction knowledge
2	Client, Design consultants	Initial risk assessment	Knowledge on initial procurement risks, financial resources, response mechanisms
3	Client, Design consultants	Decide on procurement method	Construction knowledge and management knowledge
4	Design consultants (could include contractor in an integrated system)	Risk identification	Feasibility studies, site conditions data, design, cost data, economic data, weather data, productivity data
5	Design consultants (could include contractor in an integrated system)	Qualitative risk analysis	Identifies risks, market trends, knowledge(construction, legal, management), knowledge of qualitative methods
6	Design consultants (could include contractor in an integrated system)	Quantitative risk analysis	Identifies risks, market trends, knowledge of quantitative methods
7	Design consultants (could include contractor in an integrated system)	Risk treatment	Knowledge of available response measures, allocation methods, consequences of allocation measure
8	Design consultants and client (no need if contractor is already engaged)	Verify that proposed procurement strategy is still viable	Knowledge in procurement methods and risk allocation
9	Client/User department/(include contractor in an integrated system)	Decide on contract form selection	Knowledge on contracts available for use and there characteristics

I.D & Shape	Who	Step	Resource/requirement
10 	Client/consultant/(include contractor in an integrated system)	Authoring- contract form selection and modifications	Familiarity with contract/drafting, designs, specifications BOQs, special conditions, modification skills
11 	Design consultants/(include contractor in an integrated system)	Negotiating of versions	Skill and knowledge
12 	Design consultants, (include contractor in an integrated system)	Approvals- final contract documentation	Power and contract analysis skills
13 	Design consultants/ Client/ contractor	Tender stage 1 concern negotiations by contractors and evaluation of tender	Knowledge, authority, skill, information, check compliance for financial, technical, managerial issues, equipment and plant requirements etc.
14 	Design consultants/ Client	contract execution	Amicable agreement on risk liability
15 	Design consultants and Client/ Contract	Obligation phase (risks assessment, monitoring and reporting	Skill, knowledge
16 	Contractor /client/consultants	Compliance (reporting and auditing	Monitoring and compliance to contract provisions
17 	Contractor and consultants client	Renewal (lessons learnt	Compiling lessons learnt
18 	Contractor and consultants client	End of project	Contractor ,consultants and client

The process flow chart in Figure 9.22 shows the sequencing of the proposed risk allocation mechanism. It shows the additional steps of quantitative risk analysis and negation. The various decisions to be made at each step have already been documented from steps 1-18.

The Building Construction Risk allocation Process Model

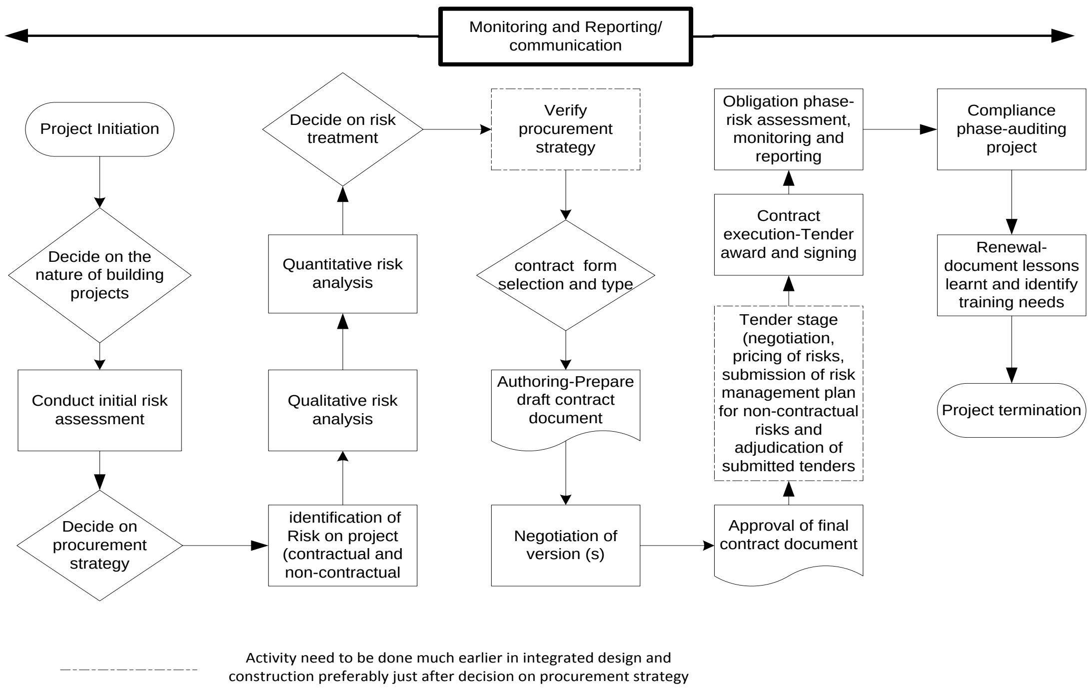


Figure 9.22 Building Construction Risk allocations Process Model

Figure 9.23 is the presentation of the process flow chart in a framework format showing the major process in the framework as project initiation, risk management, contract documentation tendering, contract execution and renewal. A framework is basically a set of components that when put together provide a structure for designing, implementing, monitoring, reviewing and continuously improving risk allocation throughout the project (definition adapted from Chapman, 2014).

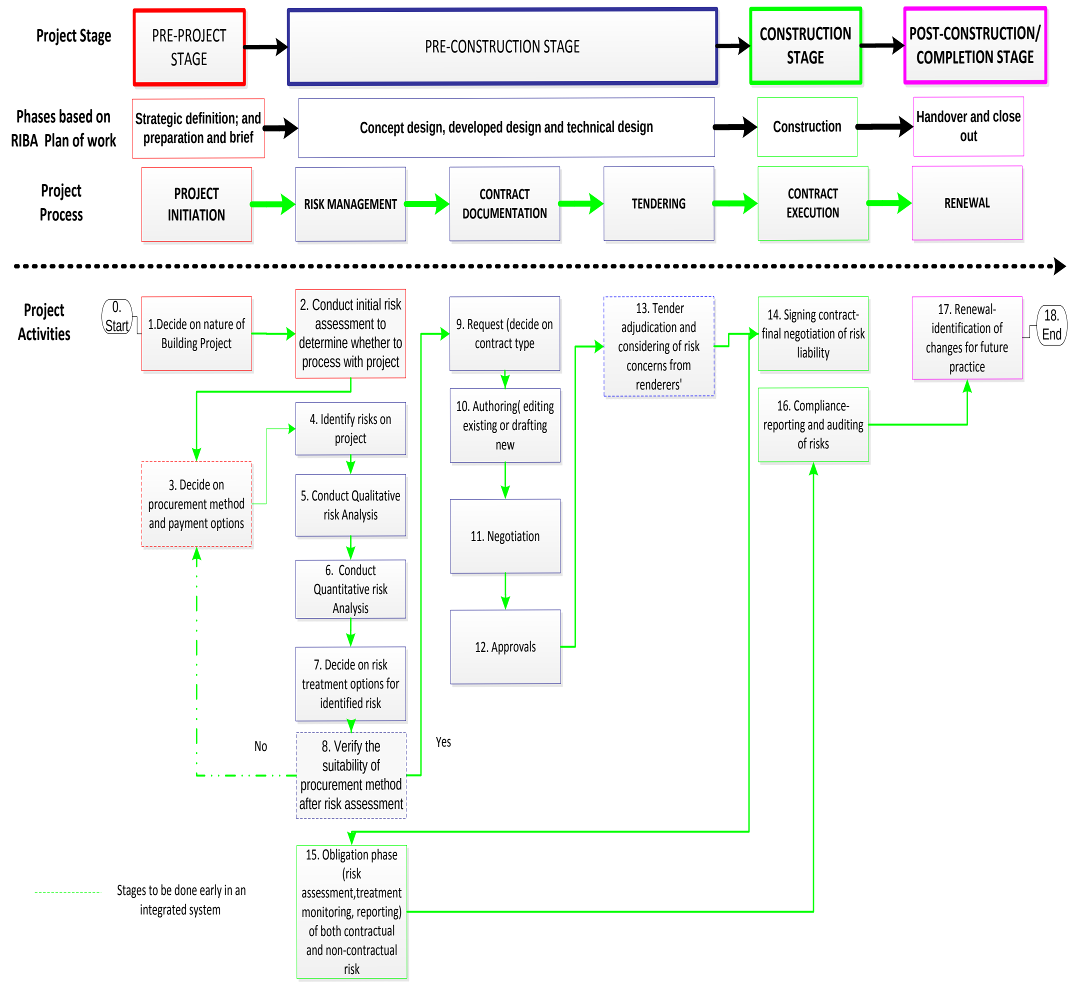


Figure 9.23. Risk Allocation Framework

9.4.2 Causes of Risk Misallocation addressed in the Process Model and Framework

The risk allocation framework can be used during the pre-contract and contract phases to cater for contractual and non-contract risk. In view of the causes for risk misallocation highlighted in the cause and effect diagram earlier in this chapter; the following are some of the causes that may be mitigated using the mechanism developed.

1. *Risk identification*: the process model provides for systematic and formalised risk identification showing available methods and possible risks. It is therefore envisioned that the process for identification will enable sufficient identification of risk and their consequences.

2. *Risk Analysis*: a formalised and systematic process is offered. This will proposedly provide for adequate analysis using appropriate methods.
3. *Risk allocation criteria and risk response mechanisms*: Current practices majorly use transfer and acceptance as risk allocation methods. The mechanism developed provides some suggestions on suitable mechanisms and their application.
4. *Risk Practice:* Unbalanced interest and power could be circumvented by considering the consequences for risk. However, poor risk perception is cultural; training and experience based; it hinges on personal belief values (Akintoye and Macleod, 1997; Azevedo et al., 2014; Wang & Yuan, 2011) and memory (Sjoberg, et al., 2005) hence cannot be totally be mitigated through the use of the framework. Nevertheless, lack of skill and knowledge is to an extent mitigated as the process and various decisions provided are able to minimize to an extent the risk of lack of skill and knowledge in risk allocation. It can be argued that this tool will enable the refining of knowledge by users (Chicken & Posner, 1998). Moreover, the education levels of professionals, contractors and clients and the knowledge gained in the industry through various projects suggests that they have the capacity to gain knowledge and skill.
5. *Contract Practice:* A selection process is documented to avert poor contract selection, inappropriate modifications, omissions, and errors, and to adopt suitable risk responses within forms and use appropriate contract types and clauses.

9.5 Measure Results

The results of using the framework require doing so and waiting for the results (Kendrick, 2010). However, measurement, in this case, was done by validation through a Delphi expert panel and questionnaire with professionals in the ZCI. Prior research has also used this method to measure expected results (See Alsalman & Sillars, 2013; Yafai et al, 2014). Validation through a case study approach could have been ideal however, finding a case where this could have been applied was a challenge.

9..5.1 Validation/Verification of the Framework and Process Model

The framework was validated concurrently through the use of a Delphi expert panel and questionnaire to professionals in the Zambian construction industry. The professionals in the study were purposively sampled heads of units or senior members of private or government departments. The Delphi technique was conducted using a questionnaire survey (Bourgeois, et al, 2014) directed to experts who were knowledgeable on risk management in the construction industry. Analysis of the questionnaire shown in Appendix 7G was done through descriptive statistics and tests such as coefficient of variation to test agreement on an issue by experts and professionals in the ZCI.

Discussion

9.5.2 Questionnaire to professionals in the Zambian construction industry

Respondent Profile

The respondents were either heads of units or senior members in private or public organisations either involved in construction or had consulted on various building projects. The common building types being residential buildings, office blocks, shopping malls, schools, clinics and hospitals while others included fire stations, hotels, service stations, and banks.

The years in experience of the respondents ranged from 6 to 22 years with an average of 15 years and mode of 20 years. All the respondents were professionals registered with their various professional bodies (Engineering institute of Zambia -EIZ); Surveyors Institute of Zambia –SIZ (also registered with the quantity surveyors registration board); Zambia Institute of Architects-ZIA and Royal Institute of Chartered Surveyors (RICs) as shown in Table 9. 9, which also gives the professional affiliation and qualifications possessed by the respondents.

Table 9.9 Profile of professionals involved in the Framework verification process

No.	Qualification	Professional Membership	Experience in Years
PT01	MSc. Civil	EIZ, SIZ	8
PT02	BSc. Architecture	ZIA	12
PT03	BSc. QS	EIZ, SIZ	17
PT04	PhD. CM	ZIA	12
PT05	MSc. Eng.	EIZ	20
PT06	MSc. Construction	EIZ, SIZ	16
PT07	BSc. Eng. Civil	EIZ	13
PT08	MSc. construction	EIZ	20
PT09	BSc. Building	EIZ, SIZ	8
PT10	MSc PM	EIZ, SIZ	12
PT11	BSc Civil	EIZ	15
PT12	MSc Construction Management	EIZ, SIZ	15
PT13	BSc. Building	EIZ, SIZ	10
PT14	BSc. (hons) QS	RICs, SIZ	7
PT15	BSc. Architecture	ZIA	20
PT16	BSc. Architecture	ZIA	21
PT17	BSc. QS	RICs, SIZ	20
PT18	MSc. Architecture	ZIA	22
PT19	BSc QS	SIZ	16
PT20	BSc. Civil	EIZ	6
PT21	BSc. QS	SIZ	14
PT22	BSc. Civil & Environmental Eng.	EIZ	8

Sequencing of the Framework items

The finding of whether the sequencing of processes and activities in the framework was adequate was done through an open ended question. The majority (19/22) of the respondents took the view that the sequencing of activities and processes in the framework was acceptable while 3/22 indicated it to be fair and suggested additional activities to be introduced mainly concerned with the tender stage. Below are some of the comments.

"The framework covers the needy areas in risk allocation"PT11

"Proper sequencing of steps on risk allocation in the framework helps to adequately deal with the issue of risk allocation" PT18

"The sequencing is satisfactory. It is sufficient enough to capture potential risks in the execution of the project to completion". PT21

The professionals nevertheless proposed that while the sequencing was appropriate in terms of activities they felt that it was important to present an activity under the stage of the project phase (construction or operation phase) rather than to maintain the project process (such as tendering or risk management) where it was to be carried out. Therefore initial risk assessment was to be under the pre-project phase (PT2 and PT3) rather than under the risk management process and the obligation activity to be under the construction phase (PT10, PT12).

Adequacy of illustrations and forms developed

Table 9.10 Adequacy of illustrations and forms developed

Adequacy of forms and illustrations	Min	Max	Mode	Mean	S.D	C.V
The initial risk assessment form is adequately formulated	2	4	3	3.14	0.61	0.20
The risks for building works adequately identified	2	4	4	3.45	0.65	0.19
The form for risk identification is adequately	1	4	3	2.91	0.80	0.27
The qualitative assessment sheet is adequately formulated	2	4	3	2.91	0.58	0.20
The quantitative assessment sheet is adequately formulated	2	4	3	2.95	0.69	0.23
The risk allocation sheet is adequately formulated	2	4	3	3.18	0.64	0.20
The treatment criteria adequately illustrated	2	4	3	3.18	0.70	0.22
The contract selection process adequately is illustrated	3	4	3	3.23	0.44	0.14
The contract authoring process is adequately illustrated	2	4	3	3.27	0.61	0.19

The forms were generally found to be adequate as all means were above 3 which was in agreement with the adequacy of forms (Table 9.10). Some participants raised some issues such as who was to undertake the given steps and preferences in terms of terminology. These are the majority who either indicated a 1 or 2. Notwithstanding, the issues raised are dealt with elsewhere. Some of issue of the notable were those concerning:

1. In the risk analysis, treatment and identification form the use of the term risk profile to be replaced with project profile. (PT9 and PT12)
2. Use of the term *tender evaluation* as opposed to the use of *tender adjudication* (PT17)

Adequacy of Decisions and activities

Table 9.11 Adequacy of Decisions and activities

No.	Adequacy of decisions/actives on the following items	Min	Mode	Max	Mean	S.D	C.V
1	Decide on nature of building project	3	3	4	3.27	0.46	0.14
2	Initial risk assessment	3	3	4	3.32	0.48	0.14
3	Decide of procurement method and payment options	3	3	4	3.36	0.49	0.15
4	Identify risks of project (contractual and non-contractual	2	3	4	3.27	0.55	0.17
5	Conduct qualitative risk analysis	2	3	4	3.14	0.56	0.18
6	Conduct quantitative risk analysis	2	3	4	3.18	0.59	0.18
7	Decide on treatment options for identified risks	2	3	4	3.09	0.53	0.17
8	Verification of procurement strategy	2	3	4	3.23	0.61	0.19
9	Request (decide on contract form and check if initial procurement mode is still viable	2	3	4	3.23	0.69	0.21
10	Authoring (edit existing form or draft new contract)	2	3	4	3.18	0.50	0.16
11	Negotiation (among design team)	2	3	4	3.05	0.49	0.16

Table 9.11 Adequacy of Decisions and activities (continued)

12	Approval (of final document by relevant person(s)	2	3	4	3.32	0.57	0.17
13	Tendering (adjudication and considering of risk concerns from tenders)	2	3	4	3.38	0.59	0.17
14	Signing contract (final negotiation of risk liability)	2	3	4	3.27	0.55	0.17
15	Obligation phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)	2	3	4	3.23	0.53	0.16
16	Compliance (reporting and auditing of risks)	2	3	4	3.18	0.50	0.16
17	Renewal (identification of l lessons learnt and changes for future practice and considerations for model update)	2	3	4	3.23	0.53	0.16

The measure of agreement used was the mean (should be value of 3) and coefficient of variation (should be between 0 and 0.5) which all showed agreement on the adequacy of decisions/ tasks within an activity (Table 9.11). Despite the levels of agreements reached; suggestions were made for improvement of the frameworks decisions and tasks were proposed as shown in Table 9.12. These were considered in the preparation of the final process model.

Table 9.12 Improvement suggestions made by ZCI professionals on framework

Step	Activity	Suggestions Made
2	Initial risk assessment	Include environmental risks (PT11), include site investigation (PT5), include EIA (PT12)
4	Identify risks of project (contractual and non-contractual	Slit risks for each phase of the project (PT8)
5	Conduct qualitative risk analysis	Consider the use of the risk matrix (PT11), Include grading for individual risks low, high, medium (PT12)
8	Verification of procurement strategy	What parameters should be used to verify procurement strategy (PT9) , consider available information, available internal resources, skill and knowledge, available time for verification criteria (PT12)
11	Negotiation (among design team)	Clarify who needs to be involved (PT2) only people with authority to negotiate (PT3)
13	Tendering (adjudication and considering of risk concerns from tenders)	Consider communicating identified risks to tenderers (PT13), consider various loops for tender being unresponsive
14	Signing contract (final negotiation of risk liability)	Consider issues raised during tender stage (PT3)
17	Renewal phase	Add post contract analysis (PT5)

Adequacy of Resources and requirements

Proposed resources and requirements for the activities in the process model for the framework were found to be adequate as the mean was above three for all items as shown in Table 9.13.

Table 9.13 Adequacy of resources and requirements

No.	Adequacy of resources and requirements	Min	Max	Mode	Mean	S.D	C.V
1	Decide on nature of building project	1	4	3	3.09	0.61	0.20
2	Initial risk assessment	2	4	3	3.36	0.58	0.17
3	Decide of procurement method and payment options	3	4	3	3.27	0.46	0.14
4	Identify risks of project (contractual and non-contractual	2	4	3	3.18	0.59	0.18
5	Conduct qualitative risk analysis	2	4	3	3.18	0.50	0.16
6	Conduct quantitative risk analysis	2	4	3	3.14	0.48	0.15
7	Decide on treatment options for identified risks	2	4	3	3.18	0.50	0.16
8	Verification of procurement strategy	3	4	3	3.18	0.39	0.12
9	Request (decide on contract form and check if initial procurement mode is still viable	2	4	3	3.14	0.47	0.15
10	Authoring (edit existing form or draft new contract)	2	4	3	3.14	0.48	0.15
11	Negotiation (among design team)	2	4	3	3.18	0.59	0.18
12	Approval (of final document by relevant person(s)	3	4	3	3.36	0.49	0.15
13	Tendering (adjudication and considering of risk concerns from tenders)	2	4	3	3.27	0.55	0.17
14	Signing contract (final negotiation of risk liability)	3	4	3	3.32	0.48	0.14
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)	2	4	3	3.18	0.50	0.16
16	Compliance (reporting and auditing of risks)	2	4	3	3.27	0.55	0.17
17	Renewal (identification of learns lessons learnt and changes for future practice and considerations for model update)	2	4	3	3.27	0.55	0.17

Despite a consensus being reached on analysis the professionals in the Zambian building sector had some suggestions towards the improvement of the framework as shown in Table 9.14

Table 9.14 Improvements for resources and requirements in the framework

Step	Adequacy of decisions/actives on the following items	Suggested improvements
2	Initial risk assessment	Engage 12
3	Decide of procurement method & payment options	Consider the procurement unit for public works (PT9), procurement specialists (PT12)
5	Conduct qualitative risk analysis	Engage specialists as per project requirements (PT5)
7	Decide on treatment options for identified risks	Engage specialists as per project requirements (PT5)
11	Negotiation (among design team)	Add actual human resource, Specify who needs to be involved (PT2)
13	Tendering (adjudication and considering of risk concerns from tenders)	Add financial resources (PT)
14	Signing contract (final negotiation of risk liability)	Key authorities to be involved (PT3)

9.5.3 Delphi Expert Panel

Respondent Profile

Experts were identified from different sources like academicians, academics involved in industry practice and pure practising professionals. All with not less than five years' experience in construction risk management. These were identified from public journals, text books and professional networking sites such as LinkedIn. A total of 42 potential experts were identified. There after an email invitation was sent to the potential participants with a consent form which included the parameters of an as indicated in Appendix 11d of the consent form. The consent form was used to determine the suitability of an expert for the research and validate respondents as those who did not meet at least four of the criteria in section 6.5.3.4 were able to see that they did not meet the criteria. The invitation was accepted by 14 participants who all met the qualified to be experts. This presented a response rate of 33.3 **%.**

Though this may not be statistically significant the aim of the Delphi expert panel is to provide quality or credibility of the findings (Landeta, 2006; Rowe & Wright, 1999). Notwithstanding, other studies have found that the number of panellist does not have a significant impact on the accuracy or the effectiveness of the Delphi expert panel outcomes (Powell, 2002; Landeta, 2006; Rowe & Wright, 1999).

Table 9.15. Expert panel respondent profile

Code	Profession/Background	Country
EXP1	Project Manager	UK
EXP2	Practicing Academic PM	Australia
EXP3	Practicing Academic Civil Engineer	South Africa
EXP4	Practicing Engineer	Canada
EXP5	Practicing Academic Architect	Zambia
EXP6	Practicing Academic QS	India
EXP7	Academic Engineer	New Zealand
EXP8	Academic QS	South Africa
EXP9	Architect	UK

The respondents were from various parts of the world as can be seen from the table above and were from a rich variety of backgrounds. The characteristics of panellists are shown in the Table 9.15. The quality of experts could be said to be high as all had presented at a conference, had minimum qualification of BSc. (Table 9.16) and all had over five years' experience in the construction industry.

Table 9.16 Characteristics of the panel

	Characteristics	Yes (%)	No (%)
1	Possess at least five years in experience in construction industry	100	0
2	Possess a minimum of BSc. or first degree	100	0
3	Has Professional registration	89	11
4	Faculty member at an accredited institution of higher learning	78	22
5	I have been a primary or secondary writer of at least 3 peer-reviewed journal articles	89	11
6	I have presented at a conference	100	0
7	I have written or edited a book or book chapter on risk management	33	66
8	I have been a member or chair of nationally recognised committee	89	11

9.5.3.1 Round 1 Analysis

In Round 1 the experts were to address the following

1. Comment on the items and sequencing of the items in the framework
2. Agree or disagree on how the various forms had been formulated
3. Agree or disagree as to the adequacy decision/task for every activity.
4. Agree or disagree as to the adequacy of requirements or resources for using the framework.

Of the 14 experts who had agreed to take part in the study only 9 submitted their responses representing a response rate of 64%. The data was analysed to provide feedback to the panellists. The results of the analysis were presented in form of modes, means, and standard deviation and co-efficient of variation as shown in Appendix 11A to 11 C.

Sequencing of the Framework items

The majority (7/9) were of the view that the sequencing of activities was appropriate and 22% felt that procurement (step 3) should be placed after risk allocation (Table 9.17). The comments below were made on sequencing.

Table 9.17 Sequence of the framework (expert panel)

Code	**Comments on Sequencing - framework**
EXPT01	The generic risk allocation framework outlines how construction practitioners can operate and oversee risk-based project activities through a well sequenced risk management process. Essentially, practitioners have to align the framework with organizational culture.
EXPT02	The sequencing is appropriate
EXPT03	Good presentation of the needs. One issue that is not spelt out, but which should be included is integration of the contractor's risk assessment with that of client/consultant (probably at the construction phase, but ideally as soon as possible).
EXPT04	There is nothing fundamentally flawed with your framework (suggestions were made for activities within)
EXPT05	Risk management should run throughout the project process. Under project activities the arrow head should be shown for "No" from 2 to 0 (it does from initiation to completion, operation phase is outside the scope of the study)
EXPT06	The sequencing is well structured consider. What happens if the tender process does not end-up with a successful bidder
EXPT07	Since the procurement system selected for any project is in large part dependent on the need of the client, designers, and contractors to allocate risk, the logic of deciding on a procurement system then given the sequence you show, identifying key risks is flawed in the extreme. Since the key risks could well come and be predicted on the procurement system selected, you have a situation in which the subsequent observations on risk are predicted on former decisions. In effect the only way that this could work rigorously would be to re-run the process repeatedly taking into account each of the available procurement systems.
EXPT08	I am confused about where you have placed project activity 3-Procurement and payment options. Surely this activity only occurs after activities 4-7 and agreement of design of the facility to be constructed. Should rather be linked to activity 2.
EXPT09	The sequencing is acceptable however what happens when tenders are not responsive or when you can’t select any

It is worth noting that on the first round a consensus was reached on all items as the coefficient of variation was found to be below 0.5 for all questions see Appendix 12A to 12C. The decision rule used for the study was that:-

-If $0 \leq CV \leq 0.5$, good degree of consensus is achieved and no need for additional round

- If $0.5 \leq CV \leq 0.8$, unsatisfactory degree of consensus.

- If $CV \geq 0.8$, poor degree of consensus and another round is needed.

While a good degree of consensus had been reached and no additional rounds were needed, the comments made by the experts needed further clarification and commenting by them for consideration in the final version of the framework hence a second round was done.

9.5.3.2 Round II Analysis

The panellists were given the feedback from round 1 in the form of modes, means, standard deviations and coefficient of variation. They were then asked to comment on the improvements raised from round 1. Only eight out of the nine panel members completed the second round questionnaire, representing a response rate of 89 %. The responses are shown in Appendix 12A-12C.

<u>Summary of round II Analysis</u>

Sequencing:

The sequencing should have procurement after the decision to cater for clients who are not knowledgeable or skilled in construction. For clients who have knowledge and skill there is a default decision to do so in-house. Additional loops at tender stage and obligation stage in case some issues on the process need to be rectified.

Steps

- Nature of building should be replaced by type of building
- Initial risk assessment should consider environmental risks (Environmental impact Assessment should be used)
- Risk identification form to use project risk profile instead of risk profile. Additional risks were suggested related to complexity risks, client knowledge, the project team and specifications.
- Verification of procurement to have some parameters for verification
- Negotiation stage to include issues to negotiate e.g. scope, budget, responsibilities
- Approval stage to have some indicative list of documents to be approved
- Tender stage to have four processes: 1 tender posting and questions 2. Clarification and negotiation 3. Risk based tender evaluation and 4. the selection proponent (approval of tender)
- Renewal stage: to be named lessons learnt

Resources and requirements

- Obligation stage to have a risk management plan (the framework is intended to work towards a plan)
- Renewal stage: to be named "lessons learnt" and should include a knowledge management format/protocol.

9.6. Final -Steps in the Framework

1.Type of the Building project

This step was previously labelled nature of building project. The proposal from the expert panel was to change to type of building project. Secondly, on the dimensions the dimension of complexity was removed as the focus is on the risk profile of the project. Furthermore, only broad classifications for building types will be used as the broad categorisation of types has numerous sub-categories (Figure 9.24).

Establishing the context of the project

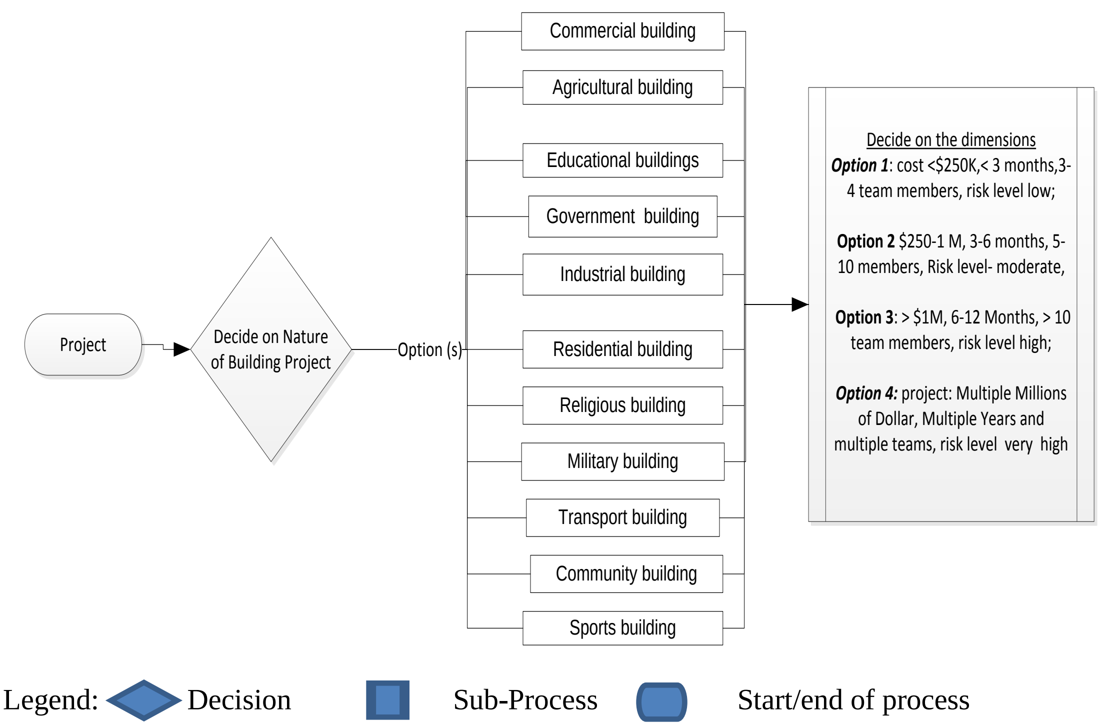


Figure 9.24 Establish project type

2.Decide on procurement method

This stage raised some concern from some professionals and experts. Professionals working for professional organisations proposed that this procurement be thought of immediately after the decision to build so that the team engaged on a project could carry out the initial risk assessment for clients who had no in-house team. Some (2) experts felt it was too early for this consideration but the majority of the experts (7) felt it was in order, especially to consider all types of clients. Therefore the dimensions of procurement strategy as highlighted by Watermeyer (2012) were considered in terms of the ones that should be applied at this stage and those left for consideration at the procurement verification stage. At this stage of contracting (nature of the relationship between client and contractor integrated or separated), and tendering (competitive or negotiated or combination of both), pricing could be considered depending on what the client can afford based on the proposed/expected duration of the project and perhaps some degree of work packaging could be considered (nature of work to be undertaken). Decision on procurement method is depicted in Figure 9.25.

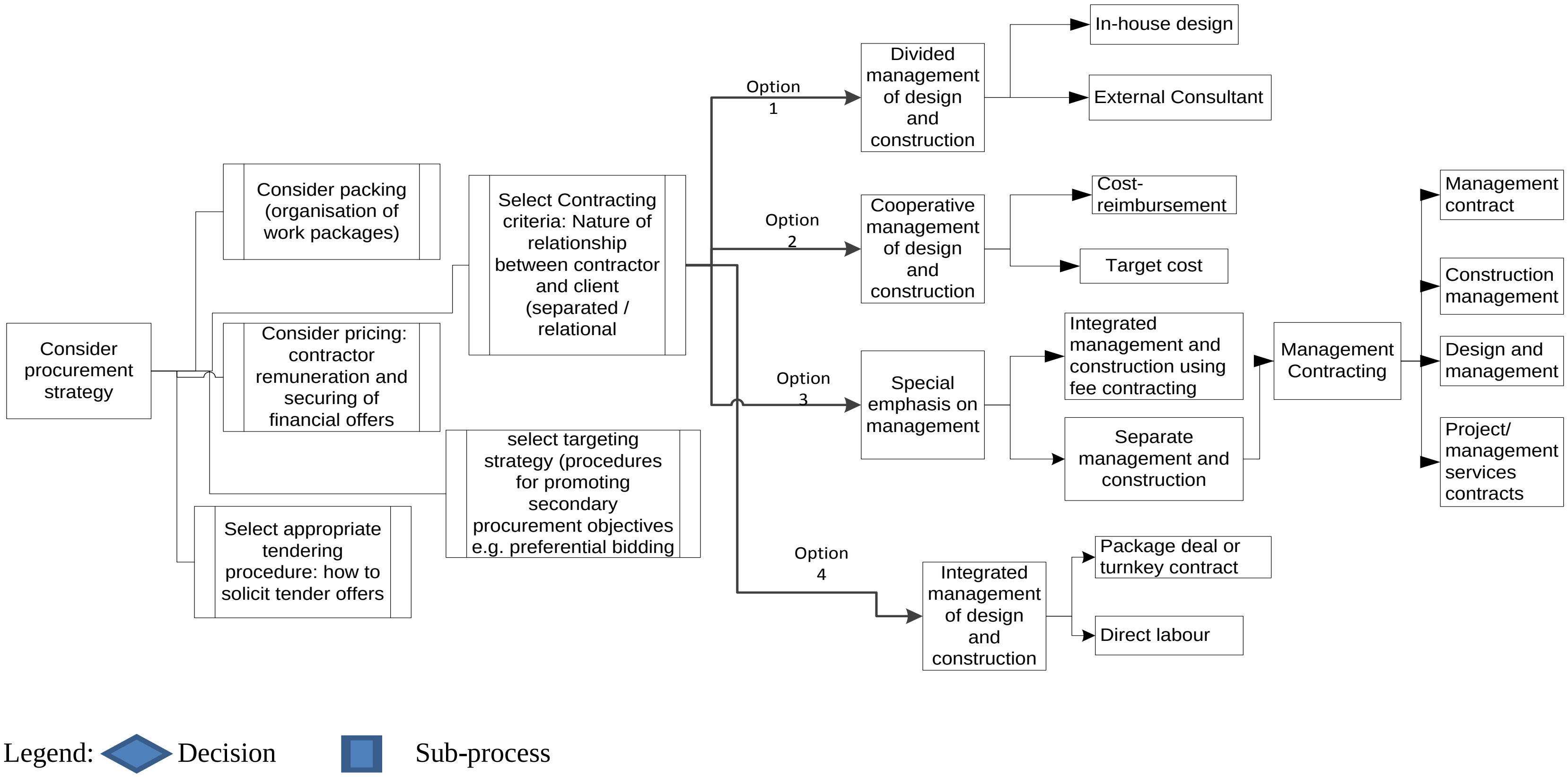


Figure 9.25 Procurement strategies (final)

3. Conduct initial risk assessment

The main idea for this stage is to decide whether the project should proceed or not therefore the parameters in the form (Table 9.18) should all be feasible to be able to proceed.

Table 9.18 Final- Initial risk assessment Final

Client								
Project name								
Consultants								
Contractor								
Nature of Project (Tick)	**Commercial**		**Residential**		**Industrial**		**Other**	

Risk Identification	**Qualitative rating of risk (L/M/H) Likelihood/ impact**	**Likelihood of impact (1-5)**	**Expected impact (1-5)**	**Risk Rating (0-25)**	**Recommended response mechanism (s)**	**Requirement in place (Yes/No)**	**Recommended control mechanism**	**Consequence of risk**
Land acquisition								
Environmental Risks -EIA)								
Site Investigation								
Obtaining planning permission								
Financing the project								
Expected changes in laws and regulations								
Possible Political risks								
Possible changes in work scope								
Bureaucracy on design								
Others etc.								

Likelihood of risk occurrence values range from 0-5 where 0=Not applicable to project (0% chance), 1 = Very low chance (<10% chance), 2 = Low chance (10–35% chance), 3 = Medium chance (35–65% chance), 4 = High chance (65–90% chance), 5 = Very high chance (>90% chance) of Occurrence. Ideally, no item with a 0 rating should be analysed therefore the form should only contain risks with a 1-5 rating (Hanna, et al., 2013). While for the Relative impact the CII international project risk assessment research scoring system of 0-5 where 0 = Not applicable to project, 1 = Negligible and routine procedures sufficient to deal with the consequence, 2 = Minor and would threaten an element of the function, 3 = Moderate and would necessitate significant adjustment to the overall function, 4 = Significant and would threaten goals and objectives, 5 = Extreme and would stop achievement of functional goals and objectives

4. Risk Identification

The risk identification form had a recommendation by both the professionals in the ZCI and Delphi expert panel to change the name from risk profile to project risk profile. Additionally, a comprehensive check was done to ensure that all risks were written as risk events in the Figure 9.26. Further to this a suggestion to split the risks by phase was not seconded by most experts. Therefore a column added on the form (Table 9.19) where the phase(s) in which the risk occurs was deemed to be in order.

Table 9.19 Risk identification Form

Client					
Project name					
Consultants					
Contractor					
Proposed Procurement method					
Nature of Project (Tick)	**Commercial**	**Residential**	**Industrial**	**Other**	
Project Risk Profile Tick)	**Low**	**Moderate**	**High**	**Very High**	**unsure**
Risk factor	**Risk description**	**Risk classification**	**Stage in project**		
Late payment	Risk resulting from clients delayed payment due to funding etc.	Financial	Construction phase		

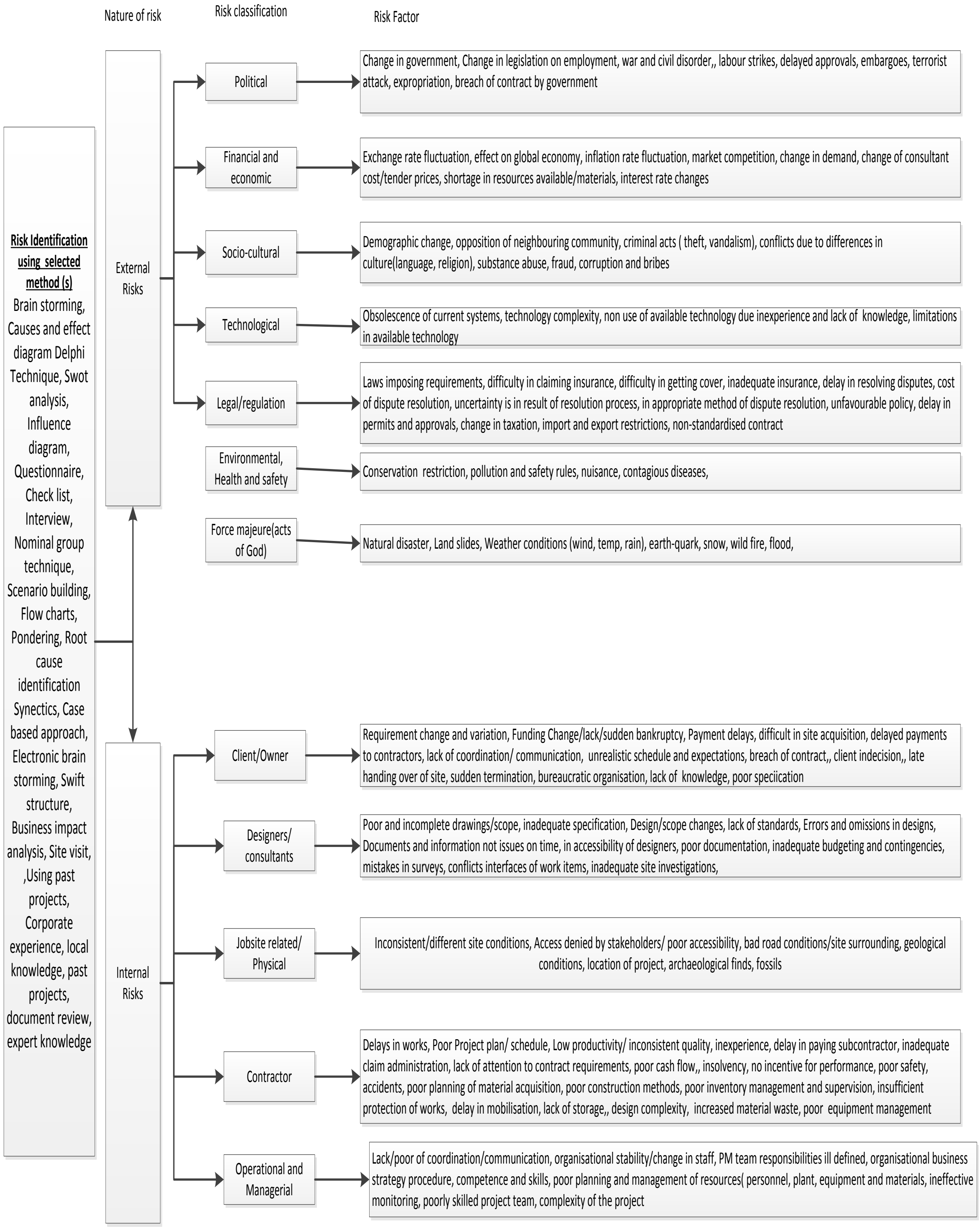


Figure 9.26 Risk factors in Building Projects

5.Qualitative Risk analysis

A proposal was made to use a matrix shown below for determining the impact and likelihood of risk to complete Table 9.20.

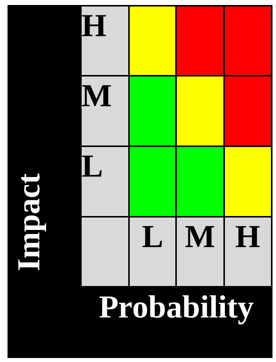


Table 9.20 Final -Qualitative assessment form

Client								
Project name								
Consultants								
Contractor								
Proposed Procurement method								
Nature of Project (Tick)	**Commercial**		**Residential**		**Industrial**		**Other**	
Risk Profile (Tick)	**Low**	**Moderate**	**High**	**Very High**	**unsure**			
Risk factor	**Causes**	**Impacts**	**Risk classification**	**Expected Impact (L/M/H**	**Expected likelihood (L/M/H**			
1 poor quality	Poor workmanship, substandard materials	Quality	Technical					

6.Quantitative Risk analysis

Table 9.21 shows the final quantitative risk analysis form.

Table 9.21 Final-Quantitative risk assessment sheet form

<table>
<tr><td>Client</td><td colspan="7"></td></tr>
<tr><td>Project name</td><td colspan="7"></td></tr>
<tr><td>Consultants</td><td colspan="7"></td></tr>
<tr><td>Contractor</td><td colspan="7"></td></tr>
<tr><td>Proposed Procurement method</td><td colspan="7"></td></tr>
<tr><td>Nature of Project (Tick)</td><td colspan="3">Commercial</td><td>Industrial</td><td colspan="2">Residential</td><td>Other</td></tr>
<tr><td rowspan="2">Risk Factor</td><td rowspan="2">Risk applies to project</td><td colspan="2">Contract risk</td><td rowspan="2">Like hood of risk (1-5) (L)</td><td rowspan="2">Relative impact (RI)</td><td rowspan="2">Risk rating (0-25)
L x RI</td><td rowspan="2">Expected value of the risks</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td></td><td></td><td></td><td></td></tr>
</table>

Likelihood of risk occurrence values range from 0-5 where 0=Not applicable to project (0% chance), 1 = Very low chance (<10% chance), 2 = Low chance (10–35% chance), 3 = Medium chance (35–65% chance), 4 = High chance (65–90% chance), 5 = Very high chance (>90% chance) of Occurrence. Ideally, no item with a 0 rating should be analysed therefore the form should only contain risks with a 1-5 rating (Hanna, et al., 2013). While for the Relative impact the CII international project risk assessment research scoring system of 0-5 where 0 = Not applicable to project ,1 = Negligible and routine procedures sufficient to deal with the consequence , 2 = Minor and would threaten an element of the function , 3 = Moderate and would necessitate significant adjustment to the overall function , 4 = Significant and would threaten goals and objectives, 5 = Extreme and would stop achievement of functional goals and objectives . The risk Rating is a product of Likelihood of occurrence and relative impact. The decision rule then becomes that any risk rating 5 and above should be taken seriously as it could mean that the risk is highly likely or the impact could be extreme. These should then assign expected value using an appropriate quantification method and consider risks for allocation using the risk allocation consideration sheet.

7.Risk Treatment

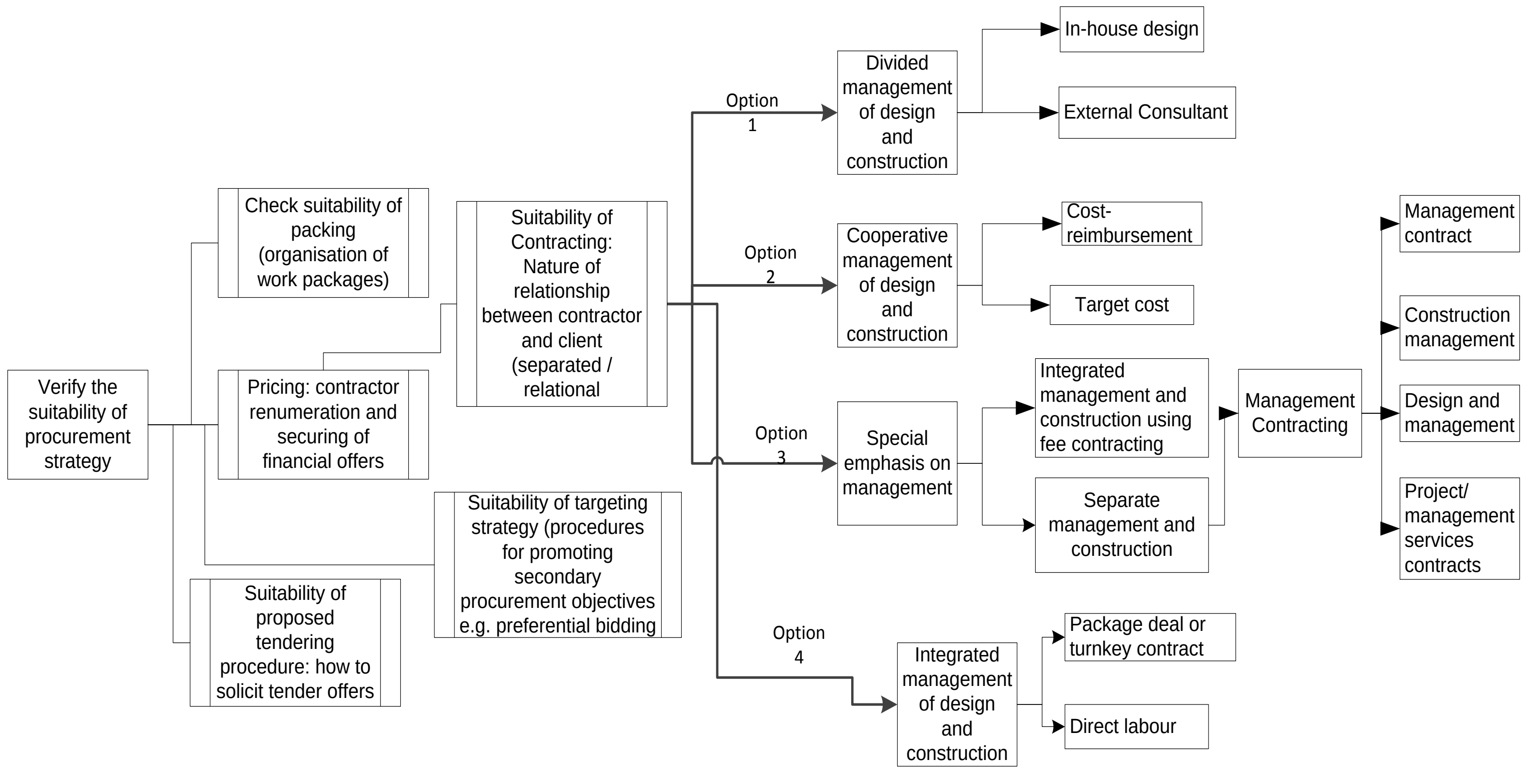
There were no suggestions made for the process diagram for this stage therefore it remained as designed (see Figure 9.11). Below is the form for risk allocation consideration whose only change is project risk profile from risk profile (Table 9.22).

Table 9.22 Final-Risk Allocation Consideration sheet form

Client							
Project name							
Consultants							
Contractor							
Proposed Procurement method							
Nature of Project (Tick)		Commercial	Residential	Industrial	Educational	Health	Other
Project Risk Profile (Tick)		Low	Moderate	High	Very High	unsure	
Risk	Clause type	Risk Rating (0-25)	Expected value of risk (K,000)	Recommended action	Recommended risk allocation	Consequence of risk	Other response measures
1 Late payment	Penalty	25	3,000	Modify contract conditions	Contractor	Interest on late payment, site abandonment, slowing down work on site	Use Contingency sum, delay project to when funds are available

8. Verification of proposed procurement

Parameters for verification were suggested in the verification phase. The parameters procurement parameters put forward by Watermeyer (2012) were considered. Therefore the final model was as shown in Figure 9.27.



Legend: Process

Figure 9.27 Final Verification of procurement

9. Decide on Contract Form

There were no suggestions made for this stage therefore it remained as designed refer to (Figure 9.14)

10. Authoring- Contract Form Preparation and/or modifications

There were no suggestions made for this stage therefore it remained as designed (See Figure 9.15).

11. Negotiating of Version(s)

Experts' concern was what was to be negotiated at this stage. Deficiencies in the design identified in the interviews were addressed by having the negotiation include design, contract conditions, bills of quantities, any other schedules, specification, estimate and the materials in the works. Changes are shown in Figure 9.28.

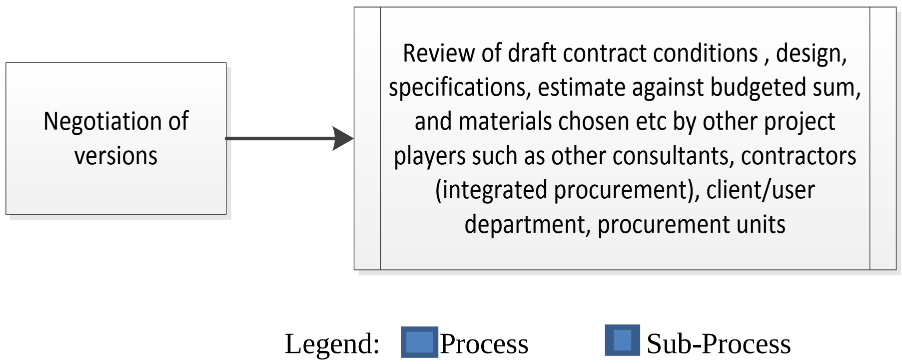


Figure 9.28 Final-Negotiation of version(s)

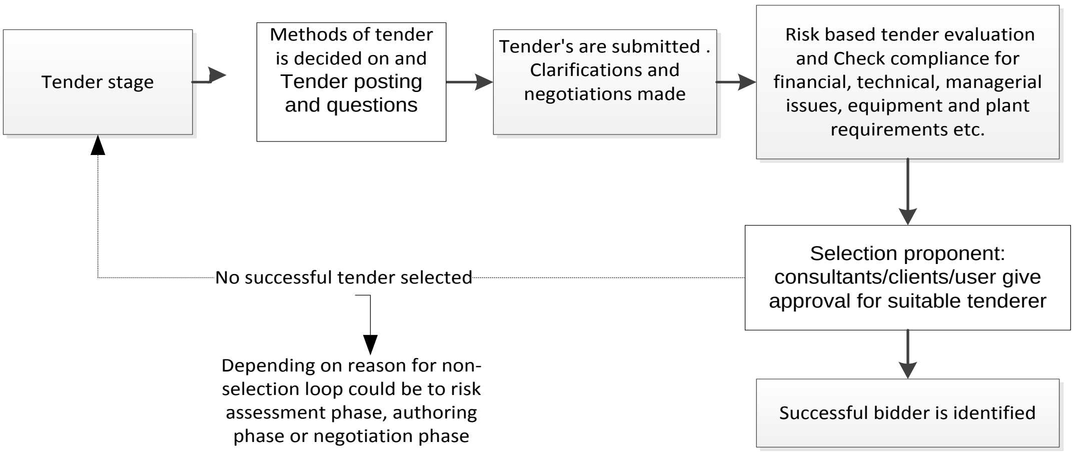
12. Approvals- Final contract documentation

The main issue raised by experts was what was to be approved at this stage. The approvals should include design, contract conditions, bills of quantities, any other schedules, specification, estimate and the materials in the works as these were some of the issues raised during the interviews as deficiencies in the current process (Figure 9.29).

Figure 9.29 Final-Approval of Final Documentation

13. Tender stage

Suggestions of improving this stage were made by experts as in Figure 9.30.

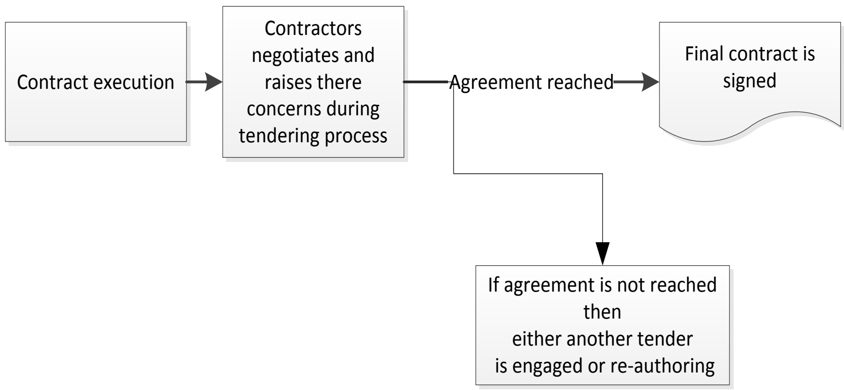


Legend: Decision Process

Figure 9.30 Final -Tender stage

14. Contract execution

There were no suggestions made for this stage. However, the interview data presented a scenario where a contractor refused to sign a contract after bidding and the options for this as presented after further interview with a procurement unit personnel added re-tendering, negotiation with another contractor who was one of the bidders or re-authoring as shown in Figure 9.31.

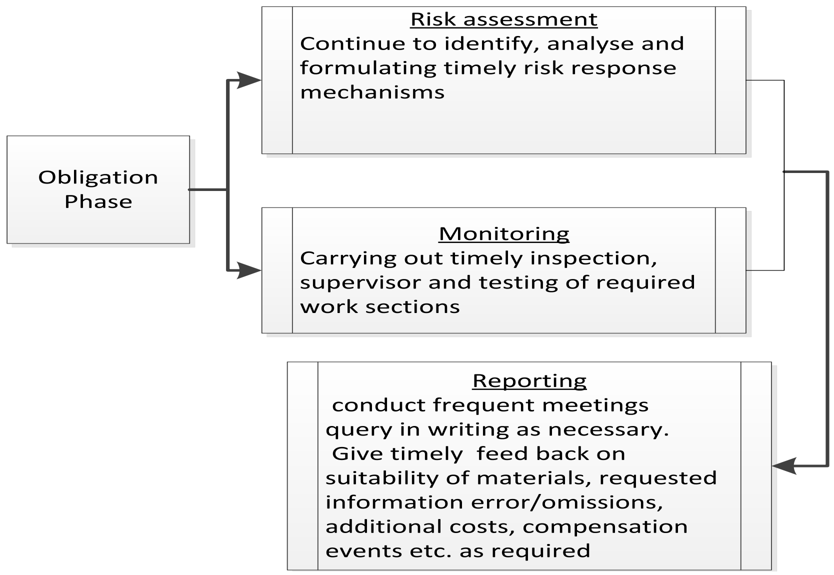


Legend: Process Document

Figure 9.31 Final-Contract execution

15. Obligation phase (risks assessment, monitoring and reporting)

There were no suggestions made for this stage (Figure 9.32) however it was found to be important to formulate a protocol for monitoring risks during the obligation phase as shown in Table 9.23.



Legend: Process Sub-Process

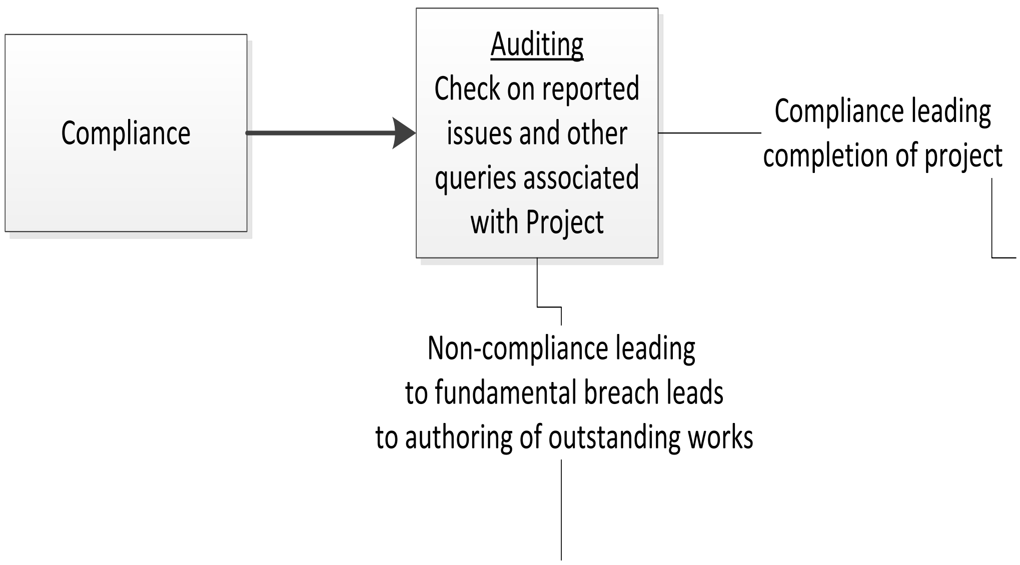
Figure 9.32 Final-Obligation Phase

Table 9.23 Risk monitoring form

Project Tile								
Date			**Stage of project**				**Prepa red by**	
Risk	**Risk rating**	**Risk measure**	**Frequency of occurrence**	**Treatment strategy**	**Action (qualitative/**	**Control**	**Current Evaluation**	**Persons receiving evaluation**
Late payment	Low/ low	Accept / ignore		Financial management	Weekly cash flow/bu dget	QS	Late payment to contractor	Client , contractor, QS, contract administrato r/PM

16. Compliance (Auditing)

There were no suggestions made for this stage however a compliance documentation form was deemed helpful for the process as shown in Table 9.24.



Legend: Process

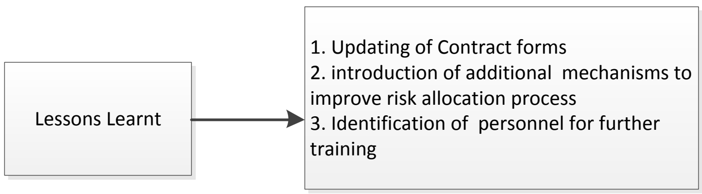
Figure 9.33 Compliance stage

Table 9.24 Compliance documentation form

Project Title						
Taken by			**Stage of project**			
Risk	**Risk leading to Fundamental breach (Y/N)**	**Date recorded**	**Corrective action**	**Frequency of occurrence**	**Preventive/ action**	**Persons responsible**

17. Lessons learnt (Renewal or post- contract analysis)

This stage was initially labelled 'Renewal'. It was suggested that the name be changed to 'lessons learnt' with an accompany lessons learnt/ knowledge management protocol. The proposed protocol is shown in Table 9.25.



Legend: Process

Figure 9.34 Lessons learnt/ Renewal

Table 9.25 Lessons learnt documentation

Project Name					
Project commencement date		**Project completion date**		**Date of documenting lessons learnt**	
Risk Profile of project		**Person documenting the lessons learnt**			
Problem/Success	**Knowledge learnt**	**Impact of Problem/Success**	**Knowledge retention/transfer**	**Action to be taken on future projects based on knowledge learnt**	
Poor quality plumbing materials	Products without standardised rating should be avoided	Rework of plumbing works	Send Mr Kabwe for training in different standards for plumbing	Specifications should specify the quality standard of materials to be used	

18.End of the project

This marks the end of the risk allocation cycle on a project.

Table 9.26 Final Process Map for risk allocation

I.D & Shape	**Who**	**Step**	**Resource/requirement**
		Strategic Definition	
0	Client/User department	Start of project	Individual Client/user and or department
1	Client/User department	Type of the building project	Client- financial resource, construction knowledge. Project type should be clearly identified
2	Client, Design consultants, specialist(s) if needed	Initial risk assessment	Knowledge on procurement risks, financial resources, response mechanisms, pricing, packaging, tender (negotiated/ competitive).
3	Client, Design consultants	Decide on procurement method	Construction & management knowledge, procurement department to be involved if part of organization structure, planning permission, environmental impact assessment, feasibility, site data, designers
		Design stage (concept, developed and technical design)	
4	Design consultants (could include contractor in an integrated system)	Risk identification	Feasibility studies, site conditions data, design, cost data, economic data, weather data, and productivity data. Identify internal and external risks to the context.
5	Design consultants (could include contractor in an integrated system) specialist(s) if needed	Qualitative risk analysis	Identifies risks, market trends, knowledge (construction, legal, and management), and knowledge of qualitative analysis methods. Identify risk causes, impacts, classification of risks and likelihood.
6	Design consultants (could include contractor in an integrated system), specialist if needed	Quantitative risk analysis	Identifies risks, market trends, knowledge of quantitative analysis methods, identifies risks covered in contract, devise response for non-contractual risks, make allocations for non-contractual risks based on desired consequences.
7	Design consultants (could include contractor in an integrated system) , specialist(s) if needed	Risk treatment	Knowledge of available response measures, allocation methods, consequences of allocation measure. Efficiency of the proposed mechanisms for allocation - consider type of clause, treatment method or party risk is allocated to. Calculate appropriate sub-contracting & contingency levels
8	Design consultants and client (no need if contractor is already engaged)	Verify that proposed procurement strategy is still viable	Knowledge in procurement methods and risk allocation, parameters to be agreed on should be packaging, contracting, pricing, tendering and targeting. Additional considerations should include available 1. Information, 2. Internal resources, 3. Skill and knowledge, 4. Time.

9	Client/User department/(include contractor in an integrated system)	Decide on contract form selection	Knowledge on Contracts available for use and their characteristics. Match risk identified to appropriate contract form. Check adequacy of specification, completeness and adequacy of design
10	Client/consultant/(include contractor in an integrated system)	Authoring- Contract Form selection and modifications	Familiarity with contract/drafting, Designs, specifications BOQs, special conditions, modification skills and authority
11	Design consultants/(include contractor in an integrated system)	Negotiating of Versions for documents	Skill and knowledge in negotiation. Consider drawings, specifications and BOQ, contract conditions, schedules, estimates and materials included in the works.
12	Design consultants, (include contractor in an integrated system)	Approvals- Final contract Documentation	Power to make modification to contract and contract analysis skills. Approvals for contract documents include design, etc.
13	Design consultants/ client/ contractor	Tender stage 1. Tender posting & questions 2. Risk based tender evaluation 3. concern negotiations by contractors and 4 Selection proponent	Financial resources, authority, skill, information. Conduct risk based assessment. Check compliance for financial, technical, managerial issues, equipment and plant requirements, H&S, etc.
Construction			
14	Design consultants/ client	Contract execution	Amicable agreement on risk liability and key authorities to sign the documents and be present for all negotiation
15	Design consultants and client/ contract	Obligation phase (risks assessment, monitoring and reporting	Skill, knowledge, formulation of risk management plan. Obligation to risk formulated, continued risk assessment, monitoring and reporting. timely information flow and early warning of risk events
16	Contractor /client/consultants	Compliance (reporting and auditing	Schedule management, monitoring & compliance to contract provisions. Auditing to be done to ensure plans are being implemented.
Handover and close out Phase			
17	Contractor and consultants client	lessons learnt	Compiling lessons learnt, identify personnel for further training or recruitment, identify areas in the contract documentation needing amendments and identify additional mechanisms and pitfalls.
18	Contractor and consultants client	End of project	Contractor ,consultants and client

Final Generic Risk Allocation Framework

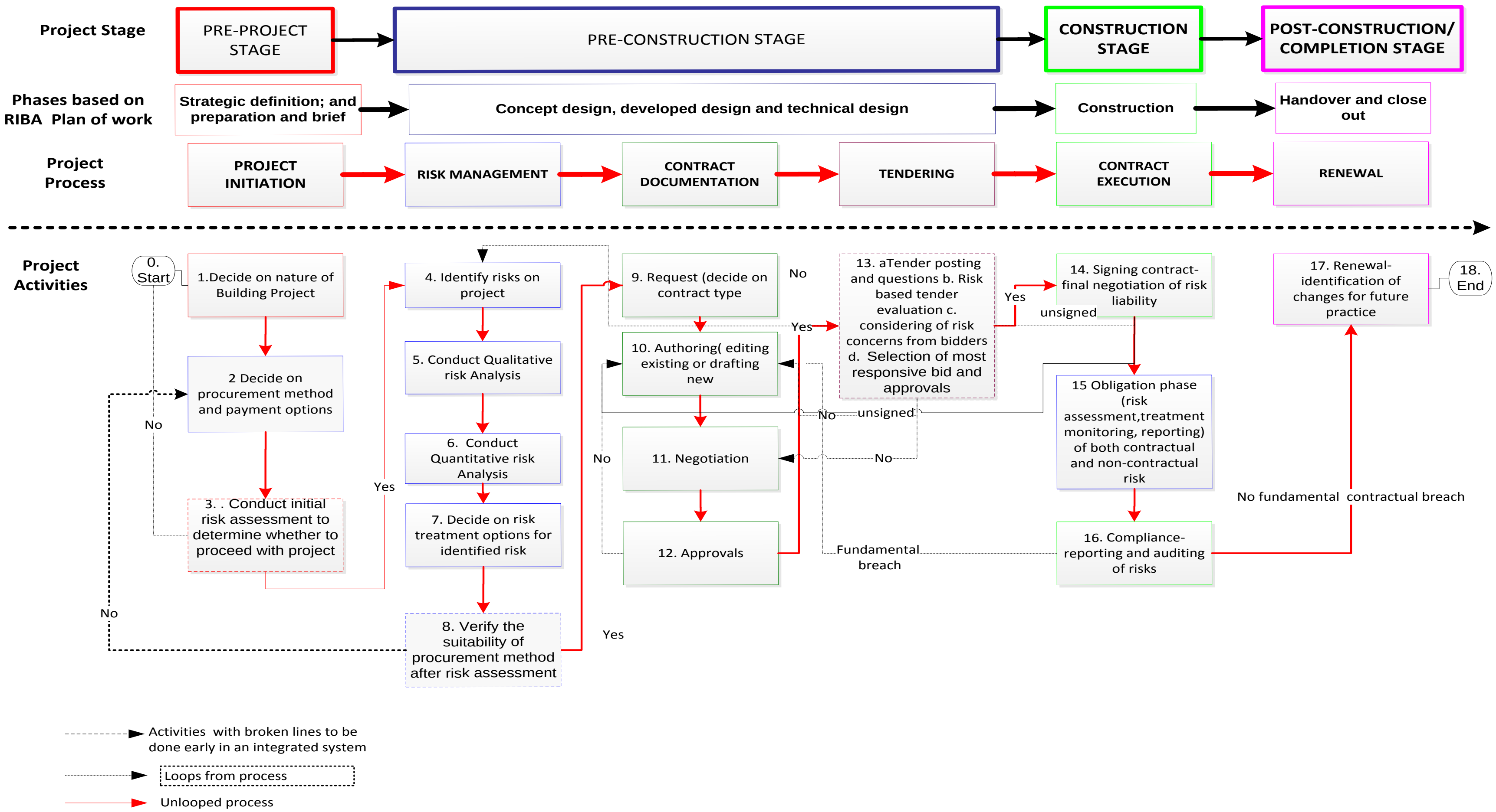


Figure 9.35 Final Risk allocation Framework

9.7 Synopsis of the risk allocation framework

The risk allocation model developed is for use by the client or contractor who is engaged in the pre-contract stage for medium to large building projects. The framework can be used to manage and allocate risk in the pre-construction phase and the construction phase preferably for new projects. As can be seen from the framework (Figure 9.35) the majority of the tasks are to be conducted during the pre-construction phase (step 4-13). Nevertheless, the pre-project stage is where the project originates.

The pre-construction phase has three main steps: the decision on the project, how it would be procured and the expected initial risk considerations. Decisions to be made on the project would include finances available, nature of building project and when the project is needed. For procurement: pricing mechanism, how the project would be packaged and awarded are to be considered. Risk considerations at this stage are considered in a more general manner. Risks to be considered are land availability or acquisition, environmental and political situation, planning and permits, scope and financial outlook of client. This would then lead to the pre-construction stage if decision is to proceed with the project.

In the pre-construction stage the project concept design would begin to be developed. When the design is developed significantly the risks can then be identified, analysed and response measures determined. During risk identification, consequential risks would have to be identified. Furthermore, the risks should be mapped to the project stage when the mitigation should take place. In the risk analysis stage consequences of risks should also be considered apart from the likelihood and expected impact. Consequences can then be mitigated in the event of a risk occurring in the construction phase. When the allocation is done, mechanisms for addressing a risk should clearly be identified and checked for conformity in the contract form to be selected. At this point the procurement method would then need to be revisited to ensure that the right professionals are engaged and the important risks that can be alleviated through procurement can benefit from the step.

Once the correct procurement method has been verified the decision on a contract type can then be made with the considerations of project characteristics in mind such as type of work under taken, type of development/work, status of design, size of project, method of price determination and complexity of requirements etc. Once the contract is decided upon additional project specific information can be included. This is best facilitated by approvals from those in authority and negotiation with other project members on issues such as budget, conditions of contract and specifications in the project. A risk based tender evaluation can then be conducted. This would entail checking compliance for technical, financial, managerial, methods of work and available equipment/plant. If there are no bottlenecks in this stage then a successful bidder can be chosen marking the start of the construction stage. In an integrated system this stage would done much earlier. At contract signing both parties can point out their concerns and discuss and decide on risk mitigation measures.

During the construction stage risk assessment should continue. This coupled with monitoring and reporting should ensure that arising risks are alleviated proactively. In the compliance phase auditing and reporting of risks should continue to ensure that risks are effectively managed. In reporting, early warning and information flow between parties should be prioritised.

To ensure that past risks are more effectively and proactively dealt with, in the renewal stage there should be some form of knowledge capture. The knowledge capture should be aimed at identify personnel for further training or recruitment, identify areas in the contract documentation needing amendments and identify additional mechanisms and pitfalls to prevent recurring risk.

9.8. Benefits of using the Framework

- The framework can be used by project owners and contractors in a separated or integrated mode of procurement.
- The framework provides a systematic approach for managing risk on a project from inception to project handover and saves a risk management plan.
- It provides an opportunity to contracting parties to learn and document experiences from past projects so as to increase capacity both at organisational level and individual capacity
- Complete adherence to the framework could provide a win-win situation as risk allocation could be more balanced.
- Various models and framework in the existent literature are mathematical in nature hence the ease of application is rarely achieved. The framework and steps provided provide an easy format to follow.

9.9 Limitations of the framework

- The framework does not provide for risk allocation in the operation and project disposal phase
- Organisations should provide an enabling organisation structure or organisation culture to make the framework relevant.
- Framework has a lot of detail and may cause user fatigue but over time due to familiarity this could be overcome.
- For the framework to remain current and relevant, it has to be updated by the user(s) who have to continue training and learning in risk management.

9.10 Chapter Summary

This chapter has offered a discussion on how the process model was developed and validated. Current practice was mapped out with the existing shortcomings. The process model is developed with any possible short coming identified from the empirical phase. The model is to be used on new medium to large sized projects in the ZCI by client or contractor engaged in the early stages of a project. The chapter concludes by giving the benefits of the model and its limitations. The next chapter concludes the study.

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CHAPTER 10 - CONCLUSIONS AND RECOMMENDATIONS

10. Introduction

This chapter is a summary of the findings, conclusions and recommendations of the study. It highlights the Implications for theory, methodology and Practice. This is followed by the contributions made to knowledge by the study. The chapter discusses the limitations and validity of the study. Lastly, areas for further research are identified.

10.1 Findings

The overall aim of this study was to discover why risk misallocation is recurrently contributing to project failure in the Zambian construction industry with a view to developing a mechanism for risk allocation. This was done by firstly investigating contract selection strategies (Section 8.2 in Chapter 8) and risk allocation approaches in the contract selection process; assessing the practices, processes, and resources used to allocate risk (Section 8.3 in Chapter 8) and uncovering how risks that are viewed as pertinent are allocated in the contract documents used in the ZCI (Section 8.4 in Chapter 8). The study combined risk management theory and contract theory concepts to develop a risk allocation mechanism as shown in Figure 9.35 in Chapter 9. The mechanism was validated through a Delphi procedure using questionnaire survey administered to experts and questionnaire administered to purposively selected professionals in the Zambian construction industry (Section 9.6.5 in Chapter 9). The mechanism was developed based on some aspects of existing models and the empirical findings from the 4-phased research in order to formulate a systematic process model that could help to at least alleviate risk misallocation in the building sector. The proposed systematic process model is expected to act as a mitigation measure for professionals and practitioners in risk allocation, from project inception phase right through to the project handover phase as shown in Figure 9.35 in Chapter 9.

The research objectives and questions set for the study were achieved. To recapitulate, the following were the research objectives of the study.

- To investigate how the selection of contract forms used in the ZCI influence risk allocation

- To assess the risk allocation practices used by contracting parties in the ZCI

- To establish how risks perceived to be pertinent by contracting parties are allocated in the contract forms used in the ZCI
- To devise and validate a process model for aiding risk allocation in the ZCI

The introductory chapter highlighted some forms of misallocation such as incomprehensive risk allocation and one-sided allocation in the ZCI (Section 1.1.1 Chapter 1 and Section 2.6 in Chapter 2). The empirical phase also provided evidence of resource misallocation and use of inappropriate methods of allocation (Table 7.5 and section 7.2.2 Chapter 7). All types of misallocation account to some extent for quality shortfalls, cost and time overruns, claims and project abandonment. To begin with, risks that are normally misallocated are related to information, compensation events related risks (delay in the provision of information and design issues section 7.1.4 and 7.2.1), economic (unstable exchange rates, escalation in material prices see section 7.2.1 of chapter 7), and site conditions related risks (inadequate site investigation section 7.9 in Chapter 9). The client normally shifts liability to the contractor with the aim of reducing transaction costs (see Sections 7.1.4/7.1.6 and in Chapter 7 and section 8.3.4.10 in Chapter 8). This is done through waiver clauses, modifications of conditions of contract, and non-compliance to contractual provisions. Other misallocations are achieved through ill application of response mechanisms such as subcontracting level and preference for sources of guarantee/bonds. Resources misallocation results from delay in information provision, approvals or insufficient information (inadequate specification, unclear designs, errors and omissions in designs etc., poor planning of resources, frequent changes in scope) as shown in Table 7.14 and Sections 7.1.5, 7.2.1 and 7.3.3 of Chapter 7.

The first objective was aimed at investigating contract selection and its influence on risk allocation. The ZCI has demonstrated problems related to contract unsuitability. The factors considered for contract selection do not to a large extent take into consideration the issue of risk (Sections 7.1.1 and 7.4.8 in Chapter 7). In addition, current practice by the public sector of using contract values as a contract selection criterion may be viewed as inadequate (Section 7.1.1). The selection of contracts is improperly done and this is partly because the contract portfolio is inadequate to meet industry needs e.g. for integrated procurement. This results in massive contract modification which in turn sometimes results in unfavourable risk allocation (See Section 7.7 Project 3).

On the second objective, practices used for risk allocation by contracting parties have particular shortcomings. The resources valuable for risk decision-making namely data, information (See Table 7.3, and 7.14 in Chapter 7) and feedback (Section 7.6.2 and 7.3.5 in Chapter 7) are not given in a timely manner to those involved and when they are, they are not comprehensive enough when design related (Section 7.6.2 and 8.3.1 in Chapter 7 and 8). Knowledge and skill are pre-eminently in risk identification (Sections 7.5.1 and 7.2.7 in chapter 7) while risk analysis (sections 7.5.2 and 7.2.7 in chapter 7) is rarely done and when it is, it is qualitative in nature when the majority of the consequences of prevalent risks are either cost or time related, implying a quantitative approach (Appendix 8A-8H). Furthermore, many firms do not have established process for risk management (Section 7.3.8 in Chapter 7)

Response measures are in dire need of attention and notably; supervision and monitoring are not adequately done (Table 7.39, Sections 7.12 and 8.4.3 in Chapters 7 and 8 respectively), the sub-contracting mechanism needs to be revisited especially on large projects (Section 8.4.3.4 in Chapter 8), preference for sources of bonds and guarantees should be reconsidered (section 8.4.3.2 in Chapter 8 and 7.2.10 in Chapter 7). Perceptions about risk are majorly negative (section 7.2.4) and differ significantly for some risk factors (section 7.7.5); creativity and agency are practiced in as far as they are not constrained by contract and other contractual or legislation stipulations (section 8.3.4.5 in Chapter 8). Interest and power are mainly exercised by the client to protect their interests without considering the full impact of the consequences resulting from contractor's reaction (See 8.3.4.2). The client's interest and power lead them to modify contracts in a way detrimental to the contractor and in the final analysis these modifications result in unbalanced risk allocation (Section 7.1.5 in Chapter 7 and 8.3.3.5 in Chapter 8). Negative incentives in the form of penalties abound but the same cannot be said for positive incentives such as bonuses (Section 7.11 in Chapter 7). Both players in the construction industry are motivated by financial gain, gaining experience and knowledge (Table 7.17 in Chapter 7). Practices such as contract modification result in unjustifiable risk transfer by the client to the contractor of financial related risks (Section 7.1.3). Generally, the industry is characterised by un-formalised and unsystematic risk management practices (See 7.3.8 Chapter 7).

In addressing the third objective; it is noted that the methods used to allocate pertinent risks are overwhelmingly transfer and acceptance (Table 7.37 in Chapter 7) using obligatory clauses and on occasion waiver clauses (Table 7.38 in Chapter 7). These do not motivate for risk liability and are undesirable modes of allocation because risks end up being borne by the transferring party who is normally the client, when claims are submitted by the contractor or when the contractor abandons the site. Since the contracts used are lump-sum, some risks attract fixed penalty mostly for the delay which however is difficult to implement due to the client's own non-compliance which is generally identified as late payments (Table 7.6 and Appendix 10G Chapter 7). Escalation clauses are rarely instituted by clients, on risks that could be managed by such clauses and when risks materialise they are either ignored or absorbed by the contractor in order to secure projects in the future (section 7.1.5 in Chapter 7)

The fourth objective was actualised by the development of a framework, process map, and process model (within the framework) as documented in Chapter 9. The model has the following steps namely; 1. Project initiation, 2. Procurement decision, 3. Initial risk assessment. 4. Risk identification, 5. Qualitative risk analysis, 6. Quantitative risk analysis, 7. Risk treatment, 8. Verification of procurement method, 9. Contract type selection, 10. Authoring, 11. Negotiation, 12. Approvals, 13. Tendering, 14. Tender adjudication and selection, 15.Obligation phase, 16. Compliance, 17. Lessons learnt and 18. End of project. The allocation model integrates risk management process, contract practice and project life cycle to make it useful in both the pre-contract phase and contract phase. Further to this the process model provides a platform for documenting lessons learnt. These can be used post-contract. The model accords an opportunity to capture risky events as sources, occurrences, and consequences. It is envisioned that the mechanism will help alleviate risk misallocation in the building sector. The tool can be used by clients and contractors on medium to large scale projects and utility can be suited to the procurement mode used. To recapitulate, the research questions of the study were as follows:-

Main research question

Why is risk misallocation recurrently contributing to project failure in the Zambian construction industry and what mechanism can be devised to aid risk allocation?

Sub-questions

1. What factors influence the choices of contract forms on building projects to influence risk allocation?
2. What are the risk allocation practices used by contracting parties in the ZCI?
3. How are risks perceived as pertinent by contracting parties allocated in the contractual provisions in the ZCI?
4. What mechanism can be devised and validated to aid risk allocation in the ZCI?

The first question was addressed using literature in Chapter 4 and empirical data obtained from the semi-structured interview and questionnaire survey in Chapter 7. Question 2 was answered through the use of existent literature in Chapter 2/3 and empirical data from semi-structured interviews, questionnaire and documents survey in Chapter 7. The third question was answered through the use of quantitative data from the questionnaire survey (to determine pertinent risks) and the qualitative data from the document analysis of eight building contracts based on four different standard forms in the empirical phase (to determine the allocation of pertinent risks) in Chapter 7. The last question was addressed by developing a systematic process risk allocation framework and process model which was validated/verified (Chapter 9) using a Delphi panel through a questionnaire and a questionnaire administered to purposively selected professionals in the Zambian construction industry.

10.2 Conclusions

1 The contract selection does not reflect risk aspects such as status of design, procurement methods and price determination. Moreover, in the public sector contract selection is based on contract price rather than the nature of the works. There is evidence that the contract portfolio is limited as even integrated projects are conducted using contracts meant for traditional procurement.

2 The professionals within the industry have more skill in risk identification and communication rather than risk analysis and monitoring. This impairs their risk management capabilities. Additionally, risk management practices are un-formalised and unsystematic.

3 There is common practice of not having active risk mitigation measure for accepted risks and there is a tendency to unjustifiably transfer risk to the contractor by the public sector client with little avenue for negotiation. Many risks are allocated based on responsibility without corresponding time bars for performance with exception of FIDIC red book (1999). Clauses used in contracts are open to interpretation especially for contracts used on public projects aside from those used for large projects as they as based on the FIDIC red book.

4 The majority of the firms in the industry do not have risk management mechanisms. There is an over dependence on the contract which does not offer solutions to all risks especially non-contractual risks. This implied that a mechanism needs to be developed. A risk allocation framework was thus developed and verified.

10.3 Recommendations

1.The selection criteria for contracts should reflect risk aspects such as procurement method and price determination in a more hierarchical manner. In the public sector, contract selection should demonstrate relevance to the nature of the works rather than being determined by contract value. The contract portfolio for the public sector should also be increased to include contracts for integrated procurement systems. This would in turn make the use of other contract types ultimately inevitable.

2.The professionals within the industry should embark on skills improvement drives aimed at improving their risk analysis and risk monitoring acumen to make risk navigation and communication with peers more effective. Additionally, national institutions such as colleges, universities and the National Council for construction should play an active role to upskill all the relevant stakeholders in risk management.

3. The proposed new paradigm for the allocation of risk in an industry where responsibility distribution is driven by situational dynamics, demands that flexible contractual stipulations have to be inculcated as new normalcy. The clients and contractors should suggest allocation measures that are underpinned by dynamic strategies for monitoring and controlling risks. Therefore when risks are accepted during the risk allocation process, the acceptance should be active and not passive. This means that response measures should be put in for all accepted risks so that there are proactive measures for monitoring and mitigating risks. Furthermore clauses should be practically actionable thus response periods should be specified along with corresponding non-compliance measures.

3.The firms should have a systematic and formalised method of managing risk that dovetails their peculiar organisational structure. The model developed in this study could be adopted and lessons learnt documented as a basis for evolving the framework. The documentation process could also help identify areas of skill improvement of those involved on building projects.

10.4 Implications of the study

Various implications are highlighted for theory, methodology and practice as outlined below:

10.4.1 Implications for Theory

Giddens management theory and Structuration theory were used for this study and their use as theoretical lenses provided the following insights which count as a new interpretation to an existing problem.

Structuration theory: was also successfully operationalized as a lens with the parameters of work and effort; materiality, agency and creativity; interest and power; and knowledge. Materiality (perception) and knowledge were found to be key factors in the success of risk allocation as they influence all other parameters. Nevertheless, risk knowledge was seen to be confined to risk identification, qualitative risk analysis and communication. Subsequently, since monitoring was found to be inadequate; this raises issues as to the usefulness of risk identification and communication in the construction phase. Creativity and agency in alleviating risk allocation issues were found to be practiced to the extent that power, interest, and regulations (contracts and Legislation) allowed. ST has provided evidence that the client influences the project organisation more than any other actor. Table 10.1 summarise deficiencies in risk allocation based on the structuration theory perspective.

Table 10.1 Illumination using ST as a lens

Concept	Issues
Knowledge	Knowledge is limited in quantitative risk analysis and risk monitoring.
Work and effort	Agents put in work and efforts for as long as structure (contracts) does allow. However, deficiencies resulting from the contract provisions are the most constraining. Lack of risk management frameworks or procedure in organisations constrains risk allocation
Materiality-(perception)	Majority of consultants, contractors and clients perceive risk as negative. The opportunities presented by risk are therefore hardly seen. Source of risks is mainly external resulting in unmitigated internal risks
Agency and Creativity	Creativity of agents is clearly constrained by structure more so structure instituted by contract conditions
Interest and Power	The clients seem to be interested in reducing transaction costs and use their power to modify contracts while contractors in their own interest cover themselves and use their power to abandon projects when their very existence is threatened

The research has shown that other theories can be used to understand risk allocation these include; expectancy theory and learning curve theory and Gilbert's management theory. Therefore, this shows that risk allocation is a concept that needs to be viewed from multiple theoretical perspectives so as to understand it and to enable appropriate allocation of risk.

Table 10.2 Illumination using GMT as a lens

	Information	**Instrumentation**	**Motivation**
Environmental Support	-Inadequate design data is used for tendering and occasion construction -Information asymmetry exists and is mostly tacit -Feedback is normally adequate though delayed	-Work Environment support: most firms have no formal and systematic method of risk allocation and management -Resources: normally inadequate in terms of finance and personnel in public sector -Tools: experience and intuition most valuable tool -time given to carry-out projects seem to be adequate -Monitoring and supervision are inadequate -On occasion levels of subcontracting are inadequate	-Consequences of risk allocation criteria and risks rarely evaluated -Incentives : rarely given to contractors -Rewards: rarely given for good performance but limited non-monetary incentives are made available, - limited career-development opportunities on risk management issues -less experienced are motivated by knowledge gained, the experienced are motivated by financial and satisfaction of client -overall work environment for contractors does not seem to be positive
Person's Repertory of Behaviours	Skills and knowledge lack in quantitative risk analysis and monitoring -few employers offer systematically designed training that matches the requirements of exemplary performance	-Individual capacity: most respondents were qualified -over time professionals adapt to project needs with increase in experience	-Unclear whether selection matches capacity/project needs for professionals in public sector given the project outcomes though professionals in most cases seem to have capacity

Gilbert's management theory: was successfully operationalized for use in the risk allocation. It was found that players in the building sector sometimes do not have the right information, resources, and motivation; incentives do not reward damaging behaviour though clients seem to be benefiting from such bad behaviour e.g. non-adherence to contractual provisions. It could, therefore, be concluded that everything is not in place for mitigating risk misallocation. In addition contracts are not effectively motivated by rewards but by consequences such as penalties. Table 10.2 summarise deficiencies in risk allocation using Gilbert's management theory.

10.4.2 Implications for methodology

Peckiene et al. (2013) in their analysis of methods of research on risk allocation from 1990-2012; Irimia-Dieguez et al. (2013) from 2000- March 2013 and Rodriques-da-Silva and Crispim (2014) from 1998-2013 provide evidence that most studies done in this area are quantitative mainly using questionnaire surveys. This has continued to be the case as affirmed by the analysis done by the researcher of studies done between March 2013 and March 2015 in Chapter 6 section 6.3.1. Prior studies have given meaningful results on the subject but do not help us to fully understand risk allocation. Moreover it is argued that survey research as a methodology undermines validity and usefulness of findings (Wood & Ellis, 2001). This research has shown that the subject of risk allocation has to be understood from both a qualitative and quantitative perspective if risk misallocation is to be alleviated. Qualitative methods employed have provided in depth understanding on issues pertaining to risk allocation while quantitative studies help us to understand aspects such as prevalence, attitudes and perceptions. Therefore, more studies should be conducted using a mixed method approach.

10.4.3 Implications for Practice

The study has highlighted various implications for practice as follows:

10.4.3.1. To policy makers

- Subcontracting: the 20% threshold for subcontracting should be reconsidered on a project to project basis to ensure attainment of the most practical level of sub-subtracting more so on large projects as it seems contractors do not like joint ventures.
- Bonds and other securities: Clients should desist from insisting on requesting for bonds and guarantees from banks without justification. Securities should also be acceptable from other financial institutions such as insurance companies

- Contract portfolio should be increased to reflect current needs and practice of the industry. Currently especially for public works the standard forms available are for traditional procurement but in reality, various procurement options are being utilised such as design and build.

10.4.3.2 To public and private sector- building Sector

- Contract form and conditions: there is need to have a diverse contract portfolio for separated and integrated procurement routes. These should have conditions that enable the favourable participation of both parties.
- Adherence to contract: The clients non-adherence to contract provisions result in contractors over pricing bids and unbalanced risk allocation because contractors are forced to bear ricks which they should not e.g. paying more on borrowed funds. Therefore both parties should comply with contract provisions.
- Feedback: Feedback on requested clarification, information and performance should be timely to reduce delays. Currently no time bars exist in the contract provisions. These should be included to remove this grey area.
- Monitoring of risk once the project has started should be adequate and systematic so as to realise the benefits.
- Risk analysis training is needed if the risk allocation process is provide a basis for managing financial risks with high impact and consequences
- The building sector needs a process model to help alleviate risk misallocation. This is documented Chapter 9. And can be adapted to specific firm requirements.
- Perceptions need to be improved by more education and training of those in the construction industry who are or will become involved in risk management.
- Attainment of maturity in risk management; practices and techniques used in risk management need to become more sophisticated, formalised and systematically applied.
- The majority of deficiencies stem from design. Therefore, concise specifications and drawings should be developed.

10.5 Research contributions

Various contributions have been made in this thesis namely: original empirical research, an original synthesis, Offering a new interpretation, different contexts, new Technique in a new area, new evidence on an old issue, using different methodologies and unique areas in the discipline. These are discussed below:

The major contribution of this research to the body of knowledge and the practice of construction risk management is the development of process model for risk allocation based on the Royal Institute of Builders Plan of work shown in Figure 9.35 Chapter 9 published in a double blind paper co-authored by C. Tembo and Nthatisi Khatleli, entitled *Risk allocation mechanism for Building Projects based on RIBA plan of work*, Proceedings of the 9th Conference International Structural Engineering And Construction Society • ISEC-09, Valencia, Spain • Jul 24-Jul 29, 2017 themed" Resilient Structures and Sustainable Construction" ISEC PRESS, Jul 2017. The paper is indexed by scopus. The proposed model is to aid clients or contractors engaged in the initial stages of the project to minimise or avoid risk misallocations resulting in the form of resources misallocations, allocation to the inappropriate party or incomprehensive allocation of known risks. It is an aid in that it guides the process of risk allocation and management to alleviate risk misallocation.

The mechanism was formulated by answering a research question that few studies on risk misallocation answer as to why risk misallocation occurs recurrently. Many researchers have dealt with risk misallocation by investigating whom between the parties a risk should be allocated to. A contribution in this study is made as the study goes beyond the allocation problem to studying effectiveness of mechanisms, and adequacy of resources (information) allocated for identified risks. This therefore has added the aforementioned dimensions to the argument of risk misallocation. Furthermore section 8.5 provides some causal networks of how risk misallocation might occur. These could be used as a basis for predicting risk misallocation. These were arrived at qualitatively.

A conceptual model on risk allocation in the construction industry shown in section 5.1 of chapter 5 illuminates the various ways in which risk is allocated based on threats. This is published double blind Journal co-authored by Tembo-Silungwe C.K and Nthatisi Khatleli in 2017 entitled A conceptual Model for risk allocation in the Construction industry, *American Journal of Applied Sciences,* vol. 14, no.7, pp. 690-700 . This illustration provides a new synthesis of risk allocation. Current literature focuses on the methods namely: transfer, share, retain or avoid. The model has added important dimensions such as mechanisms used to mitigate risk, payment methods and types of clauses as considerations that go alongside risk allocation. The model also recognises that some risks hinge directly on responsibility.

To the existing literature, the factors negatively influencing project performance in the building sector as perceived by contracting parties have been uncovered (Table 7.32). These are categorised as low, medium and high risk factors. This is a contribution in that no such literature exists in the published literature on the Zambian building sector as a whole. Therefore, this knowledge gap has been filled. Further to this, the relationships between the risk factors are pointed out. Many of which are positive in nature implying an increase in one positively associated factor might foster an increase in one or several others as shown in Appendix 10N. Furthermore, risk factors that are possibly perceived statistically different by various consultants and contractors of varying years of experience are pointed out (See section 7.7.6, 7.7.7 and 7.7.8 in Chapter 7)

In addition, the majority of studies done are agency related this study has identified environmental/structural constraints (un- formalised and unsystematic risk management and consequently risk allocation Section 7.3.8 in Chapter 7 and response mechanisms) that need to be addressed for appropriate risk allocation. Further, the identification of knowledge gaps in skills lacking for appropriate risk management and practices (poor capabilities in quantitative risk analysis and risk monitoring Section 7.2 and 7.5 in Chapter 7) by professionals and clients provides a basis to improve risk management capabilities and practices of professionals. The areas in dire need of improvement are risk analysis and risk monitoring (Section 7.5.3 in chapter 7) and subcontracting on occasion (Section 7.2.10).

Yet another contribution is the use of structuration and Gilbert's management theory in a developing context. These contributions are published in double blind sources as follows 1.Structuration theory : Tembo-Silungwe C.K and Nthatisi Khatleli, Identification of enablers and constraints of risk allocation using structuration theory in the Construction Industry, *Journal of Construction Engineering and Management*, 144(5): and 2 Gilberts management theory A. C. Tembo and Nthatisi Khatleli, Causes of Risk Misallocation in the Zambian Construction Industry. Proceedings of WBC16 congress 2016, 29 May- 3 June 2016, Tampere, Finland ISBN 978-952-15-3745-5 (vol. v), pp. 604-614 and B. C. Tembo, and Nthatisi Khatleli , Exploring the Gilbert Behavioural Engineering Model (BEM) for enhancing risk allocation in the Zambian Building Sector, Proceedings of the International Conference on Infrastructure Development and Investment Strategies in Africa DII -2016, 31 August-2 September 2016 Livingstone, ISBN 978-0-86970-782-, pp. 237-247.

The majority of past research has been conducted in developed contexts were governance and market structures are impliedly developed. The use of the aforementioned theories in a developing context adds to the body of knowledge the difficulties that might arise. To mitigate perpetual bias other theories such as Expectancy Theory, Learning Curve Theory, Principal-Agency and Transaction Cost Economic Theory were limitedly deployed to broaden the landscape of explanations that could be used to explain the practice of risk allocation in the Zambian context. Additionally, structuration theory is commonly used in information technology research while Gilbert's management theory is commonly used in business management research. Their use in the construction risk management domain is yet another contribution to the development of the field. Moreover, the theories used provide new evidence for an existing problem by providing empirical data that bring a fresh interpretation to the subject of risk allocation as shown in Tables 10.1 and 10.2 of this Chapter.

Risk management is normally studied in isolation from contract practice and the project cycle. The model developed in this thesis makes a synthesis of how risk management, the project cycle and contract cycle can be integrated into one for use on building projects (Figure 9.35). Due to this peculiar nature it can be used for various modes of procurement and plans of work such as the project management institute (PMI) as shown in Table 9.1. It offers a unique categorisation and organisation. This was achieved by using different methodologies and drawing from various built environment disciplines such as Architecture, quantity surveying, civil engineering and Project management (in the verification process).

Methodologically, risk allocation studies are normally quantitative in nature. This study used a mixed method approach mixing qualitative and quantitative data. From inception of the study it was pointed out that models form the vast outcomes in past research. This study outcome also produced a model that is arrived out qualitatively and quantitatively in the hope that practitioners can easily adapt the model to practice unlike the many mathematical models that seem to provide little utility in industry practice. In its validation the model was validated by both practitioners in the ZCI and Experts in the field of risk management and contract management as outlined in Section 9.6.5 of Chapter 9.

There is now clarity that although risk liability may be unfavourably shifted to the wrong party, the biggest challenge in risk allocation is management responsibility. So the selection of available and applicable mechanisms and resources to manage and allocate risk is of utmost importance in the control of risk misallocation. It is clear that parties know what they are liable for but the management of their liability is what leads to risk misallocation. This is exacerbated by the mechanisms available if constraining.

10.6 Limitations and Validity of the Research

This study like any other research had various limitations. Firstly, the generalizability was bounded by the utilization of building sector projects only. The level of the ZCI development and sophistication raises a contextual issue in the applicability of the results elsewhere. The findings and the model can generally be applied to building works in Zambia. Application of the findings to other sectors such as road works or in other countries would have to be done with caution. The development of causal networks in Section 8.5 of Chapter 8 was derived from qualitative data analysis and from the cause and effect diagram in Figure 8.2 mainly through interpretive judgement. These therefore need to undergo some quantitative analysis to fully understand relationships, strengths and directions on the casual networks

The sample size for contractors, especially in group 1 and 2, could have been larger but most contractors sought after as potential respondents were not found at registered addresses. The presence of majority Chinese owned companies in group 1 also presented a language barrier; therefore affecting the representativeness of this contractor category, and the National council for construction list also had some contractors listed in the building category who were in fact suppliers of building materials. These factors reduced the sizes of the samples nevertheless; the practically attainable samples were identified and used.

Failure to collect certain kinds of information was a threat to internal validity (see Cone and Foster, 2006). Most contributors of documents to the document analysis provided documents that had not been signed for execution but that had been presented to bidders at tender stage. More information could have been captured on pricing for contingency in certain cases nevertheless; percentages for contingency sums were given in all cases. It was also found that not all participants provided responses to opened-ended questions in the survey. Notwithstanding, the responses provided data for use in the analysis and gave an accurate account of practice. In addition to this, the data was triangulated by using several sources of data such as interviews and document analysis. It is worth noting that not all issues could have been triangulated but the keys issues were. Some non-responsiveness was attributed to lack of knowledge or fear of providing either an inaccurate answer or information that respondents felt gave them a competitive advantage.

Nevertheless, the information provided for open-ended questionnaire responses could be termed as sufficient.

Fourthly, some missing data e.g. qualifications and years of experience affected the analysis accuracy but these missing items were minimal (less than 0.6% of the total answers) rendering the data collected sufficient and relatively accurate and did not raise issues of reliability.

Another limitation was the cross-sectional nature of the study. A longitudinal study could help understand risk practices better than relying on the memory of participants. This was a limitation observed in the interview and questionnaire stages of the study. However, the use of a cross-sectional study prevented threats to internal validity such as history (changes in an environment producing changes in variables) and maturation (changes in research participants not related to research intervention). For the questionnaire survey, a comprehensive list was provided to respondents to tick as opposed to relying on their memory. Randomised sampling of potential participants improved the internal and external validity of the study. Distortions resulting from instrumental bias were mitigated by using rating scales that had previously been used in similar research. The pilot questionnaire survey and preliminary interviews provided reliability for the questionnaire and interview protocol used. The reasonably high response rates also supported the reliability of results (Leedy & Ormrod, 2010; Bryman & Bell, 2015).

Throughout the research efforts were made to have social interaction such as conference presentations and seminars with peers where comments and perspectives were received and acted upon. This supported the validity of the study. Theoretical validity was achieved by theory triangulation (Rovai, et al., 2013) as various theories are considered in explaining various constructs in risk allocation such as transaction cost theory, principal agency theory, learning curve theory, Gilbert's Management theory, structuration theory and expectancy theory. It can also be argued that internal validity has been maintained; this is the degree to which a theory expressing underlying relationships is accurate. This was achieved by using multiple sources of data including interviews, documents, and questionnaire survey. Researcher bias resulting from interpretation was curtailed to a large extent by providing verbatim or actual written quotes to ensure that the accuracy of participants' beliefs, attitudes and intentions was maintained (Bryman & Bell, 2015). Finally the validity of the risk allocation framework developed is primarily related to the professions in the ZCI and expert panel members' values, concepts, ideas, experience, perceptions and quality of opinions.

10.7 Suggestion for future research

The existent literature does not provide a detailed practical account of how risk monitoring is done during pre-contract and construction stages. It is therefore suggested that future research should focus on how risk monitoring is to be done to realize effective risk monitoring and control. Furthermore, the document analysis and existent literature (Project Management Institute, 2004) revealed that various risks have various risk response measures. It would also be insightful to map out response mechanisms for particular risk factors.

Casual networks shown in section 8.5 were arrived at using qualitative analysis basically based on interpretive judgement. The networks could be interrogated further by techniques such as interpretive structural modelling, regression analysis or path analysis. In addition, a study to document the actual utility of the mechanism developed here using a case study would provide added support for risk allocation. Furthermore, automating the process developed here by developing a computer application would make the framework easier to use.

Additionally, a similar model could be developed for the operation and disposal phase of the project or to address issues of resilience and sustainability in construction. Finally, this research was on building projects therefore similar research could be done for other kinds of construction projects such as the transport infrastructure.

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APPENDICES

Appendix 1 Models in literature on risk allocation/management/assessment

Authors	Nature of Framework/Model	Method of data Collection	Focus	Limitation
Hastak & Shaked, (2000)	Assessment of risk on international projects	Case study	Calculation of International project risk levels	Accuracy dependent on the quality of risk analysis
Dey, (2001)	Decision support system for RM	Literature, AHP and decision trees	Design stage	Only applicable for approved projects after feasibility study
Wang Dulaim & Aguria (2004)	Qualitative RM model	Interviews, Survey	International projects in developing countries	-Applicable to international projects in a developing country
Dikmen & Birgnoul, (2006)	Risk and opportunity	Literature review, AHP	International construction projects	-unsuitable for the quantification of risk factors
Medda (2007)	Game theory	Literature	Transportation industry	-Transportation sector
Lam , Wang, Lee & Tsang *(*2007)	Fuzzy logic model of risk allocation decision	Literature and validation using a case	Construction contracts	-Risk allocation between owner and contractor in a traditional contracting
Mbachu and Nkado (2007)	Identification and risk level evaluation of project constraints	Interviews, Questionnaire Survey	Building projects	-Tailored for PM -framework application limited to the identified factors
Fan , Lin & Shew (2008)	Mathematical model	Literature	General construction	
Zhao and Duan (2008)	Integrated risk management	Literature review validated via a simulation	Construction projects	-can only be used on projects procured through an integrated approach -Model only focuses on risk transfer
Tserng, Yin, Dzeng, Wou, Tsai & Chen (2009)	Identification of project risks using mathematical model	Interviews Validation case study	Work flow of construction projects	-Risk identification only
Fu, Chunquin & Ln Bing (2009)	Agent construction modelling work flow among participants		Collaboration	-Model focused on transferable risks
Jin and Doloi (2009)	Risk allocation decision making process	Questionnaire Survey , Expert panel consultation	PFI	-decision making process in PFI projects

Zhao and Li (2010)	Risk Allocation Process	Cases	International construction	-Tailored for PM
Fischer, Leidel, Riemann & Alfen (2010)	Integrated RM system	Questionnaire Survey and expert interviews	PPPs	-ppp only
Xu, Chan & Yeung (2010)	Fuzzy set; Fuzzy synthetic evaluation equitable risk allocation between the government and the private sector	Face to face Interviews, Delphi Survey	PPPs	-PPPs
Jin (2010b)	Neuro-fuzzy technique	questionnaire	Privately financed public infrastructure	-addressed design risk -validation on school buildings
Jin & Zhang (2011)	Artificial neutral networks (fuzzy logic)	Questionnaire survey, Delphi questionnaire	PPPs	Transfer to be based on capability and attitude aspects which could be misrepresented depending on circumstances
Khazaeni, Khanzadi and Afsfar. *(*2012)	Fuzzy adaptive decision-making logic to balance risk allocation	Delphi Questionnaire	RM competency and cost	-only focused on risks to do with cost
Zhao and Li (2013)	Input, tools & techniques, output	Literature/ case studies	International projects	-Risk allocation in international projects
Chang C (2013)	Mathematical model capturing contract hazards in Principle –Agent Model		Construction contracts	-Applies in a scenario where incentives are available to a contractor for carry risk
Odimabo & Oduoza, (2013)	Risk assessment framework	Questionnaire survey, interviews , case study	Building projects in Developing countries	-For risk assessment in construction firms
Alsalman and Sillars (2013)	Modelling the effects and causes of risk allocation in the construction industry	Questionnaire Survey, Delphi expert panel	Construction	-Focus is on construction phase -Study included only commercial building projects
Hanna , Thomas & Swanson (2014)	Modelling internal and external risks in RM process in contracting parties	Web questionnaire and interviews	Cooperative approach	-Limited to Cooperative approach
Lehtiranta & Junnonen (2014)	Modelling duties of project participants at different stages of project	Case studies	Construction management	- Limited to construction management approach

Nasirzadeh, Khanzadi & Rezaie (2014)	Quantitative risk allocation using fuzzy logic	Validation: case study	Water transmission tunnel: complex structure	-projects usually not characterised with many risks
Zhang & Fan (2014)	Integer programming to model response strategies for cost, schedule and quality	cases	General construction	-only robust when cost, quality and schedule are not rigid (needs extra resources) -application by PM
Alireza Valipour, Farahbod Mohammadi, Nordin Yahaya, Hadi Sarvari and Norhazilan Md Noor (2014)	Barriers to risk allocation	Unstructured interview and questionnaire	PPP	-Did not identify enablers in risk allocation in PPP
Yafai et al (2014)	Risk assessment model	Questionnaire and interviews	Construction industry	The assessment is based on qualitative risk analysis
Dawood, (2015)	Client based risk management tool	Questionnaire and Interviews	Design stage	Utility for clients at design stage
Lee, Lee, Lee,Y, & Han, (2014)	Risk assessment system	Literature review	International construction project risk monitoring	Monitoring of projects only
Dawood, (2015)	Risk management methodology	Literature review and survey	Construction processes	Design stage only
Gładysz, Skorupka, Kuchta, and Duchaczek.(2015)	Project risk time management	Case study	Construction industry	Manages on the risk of time
Algahtanya, Alhammadi, and Kashiwagi (2017)	Risk Management Model	Case study based on mathematical modelling	Construction projects	Client decision making

Appendix 2A Poorly Delivered Projects (Survey –Researcher July 2014)

Item	Name of project	Original sum US$	Revised Sum US$	Original Duration (months)	Revised duration (months)
1	Construction of an office block for Energy Regulation Board (Lusaka)	5,670,000	6,285,819	24	38
2	Renovations to main terminal at Livingstone Airport	1,012,560	1,200,000	25	34
3	Construction of Beit Trust Children's Hospital in Lusaka	Not given	1,650,000	24	32
4	Construction of an office block for Ministry of Works and Supply	423,608	560,000	12	27
5	Construction of an office block for National Roads Fund Agency (Lusaka)	409,000	498,320	12	30
6	Expansion works at Katima-Mulilo Border Post for Zambia Revenue Authority and immigration (Sesheke)	2,631,578	4,560,560. 94	24	60
7	Construction of administration block, hostel and other support infrastructure at Mulungushi University	35,609,000	Not given	36	Not given but was still under construction 2 months from date of completion

Appendix 2B Examples of Poorly Delivered Projects and Project irregularities

<u>Examples of Poorly Delivered Projects and Project irregularities (Auditor General's Report 2015)</u>

<u>Ministry of Mines, Energy and Water Development</u>

Construction project for sample sheds for Geological Survey after abandonment in 2014 was awarded to Lumworks in January 2015. Although the contract provided for an advance payment of 20 percent of the contract price of K4,841,684 being K968,337 the Ministry made an advance payment of K1,107,447 resulting in an overpayment of K139,110.

<u>Ministry of Home affairs</u>

During the period from 2013 to 2015, the Ministry engaged seven (7) contractors with contract prices totalling K13,046,083 to carry out various infrastructure development activities on behalf of the Zambia Correctional Services against which amounts totalling K3,870,258 were paid representing 30 percent. A scrutiny of records and physical verification of various projects carried in June 2016 revealed that there were delays in the completion of projects as follows

- Construction of storage shed (16 months)
- Construction of multi-purpose hall at Bothwell Imakado staff training (96 weeks)
- Construction of weigh bridge house and associated works (53 weeks)

- Rehabilitation of 4 cells (54 months)
- Construction of 2 male cells and Ablution block Milima prison (46 weeks)

Ministry of Works and Supply- Abandoned Contracts

During the period from November to December 2015, the Ministry engaged three contractors namely Heros construction Limited (Construction of Police Office Block: 2no. Medium Cost Houses, Construction of Police Office Block, 2no. medium cost Houses, 8no. Low cost houses and associated external works.), T. Mushinkula Trading (Construction of administration office block and associated external works) and Best Finish Construction (Construction of Civic centre, 2no. High cost houses and associated external works) to construct various projects in Manyinga and Ikelenge districts of the North Western Province. The total contract prices for the works awarded to the contractors amounted to K43,454,524. As of January 2016, the contractors had been paid advance payments amounting to K8,186,625. However, the contracts were terminated due to non-performance and in this regard, the Provincial Buildings Engineer issued recovery certificates in amounts totalling K5,438,098.

Ministry of Health

The ministry had various projects during the report period most of which were district hospitals with contract sums ranging from K 56,980.20 to K20,873,265.05 (see page 136-156 for details). The document observations were aspects of poor workman ship in all projects and project delay in the following.

Project	**Period of delay**	**Project**	**Period of delay**
Construction of Vubwi district hospital	14 weeks	Construction of Gweembe district hospital	22 weeks
Construction of Maternity block (Vubwi)	31 weeks	Construction of Kazungula district hospital Phase 1	8 Weeks
Staff houses and Nsadzu mental rehab	39 weeks	Construction of Lukulu district hospital Phase 1	2Weeks
Construction of Lundazi district hospital	13 weeks	Construction district hospital (chilubi) Phase 1	11 Weeks
Construction of Namwala district hospital phase 3	24 weeks	Completion of Chilila Health post	35 weeks
Construction of Serenje district hospital	59 weeks	Construction of Mkushi district hospital Phase II	36 weeks
Construction of Kapiri Mphoshi district hospital Phase III	35	Construction of a health Post and staff House at Kashitu	35 Weeks
Ikelengi district hospital	27 weeks	Construction of staff house ,3no VIPs, completion of Health Post and Completion of staff house at Namakolongo Health Post	52

Ministry of Education

Construction of Administration Block - October First Enterprises

The Ministry of Education, Science, Vocational Training and Early Education signed a contract on an unknown date with “October First Enterprises Limited” for the construction of an Administration Block at the National Science Centre at a contract sum of K4, 989,629 with a completion period of twelve months. According to the conditions of the contract document, the start date was 7th May 2015, and the site hand over was 23rd May 2015. The project's intended date of completion of works was 6th May 2016. The Project Manager was the Head Infrastructure under the Ministry of Education. A physical inspection of records and building, revealed the following: 1. the tender evaluation reports for the contractor were not availed making it difficult to 2. ascertain how the selection process was done. This was contrary to ZPPA Regulations No. 18. 3 Although a sum of K1,930,874 out of the total contract sum of K4,989,629 representing 39 percent of the contract had been paid, works were at slab level as of September 2016.4. Contrary to ZPPA Regulation No. 20 (3b) and the General Conditions of the Contract under Section "B Number 26 to 28", regarding the extension of the intended completion date, there were no correspondence regarding any extension at the time of audit. Although it was apparent that the contractor had not performed according to the contract, it is not clear why the Ministry had not evoked Clause 46 of the contract and charged the contractor liquidated damages for the delays or terminated the contract. Further, inspections carried out on 14th September 2016 revealed that the contractor had abandoned the site.

Contract for the Construction of Wall Fence - Ya Investments Limited

The Ministry signed a contract on an unknown date with Ya Investments Limited for the construction of external works (Wall fence) at the National Science Centre at a contract sum of K1,243,262 with a completion period of three (3) months under the supervision of the Head Infrastructure under the Ministry of Education. The following were observed:

i. Failure to Provide Pre-award of Contract Documents

 Contrary to ZPPA Regulation No. 18 and 20 which requires the Ministry to keep all documents relating to the procurement proceedings, tender evaluation reports for the contractor was not availed for audit therefore making it difficult to ascertain how the selection process was done.

 The contract signed between the Ministry and Ya Investment Limited had missing information such as contract date, site handover date, date signed, date stamp, start and expected completion date contrary to ZPPA Regulation No. 20 (3a) and Contract provision No. 16.1

 Contrary to contract provision No. 15.1, 16.1 and 17.1 which requires the contractor to carry out the works in accordance with the programme submitted and based on specification and drawings showing the works to be done, the scope of works did not specify what was to be done as the contract only indicated "the execution of external works at the National Science Centre (NSC)". As of April no explanation had been given.

ii. Questionable Payment

On the 23rd of December, 2015, a sum of K178,840.22 representing 11.7% was made towards the interim certificate and a review of the monitoring reports, revealed that the contractor took possession of site on the 4th of May 2015. According to the scope of works, the external works included the construction of boundary wall fence.
However, a review of the correspondence obtained revealed that the contractor had made little progress far below what was expected and that there was scanty construction materials on site. Despite the Ministry observing such disparities, and issuing a final warning for the termination of the contract on the 23rd December 2015, a payment to the contract was made on the same day thereby making the payment questionable.
A physical inspection of the site in July 2016 revealed the following:

 Although the site clearing, excavations and earthworks, concreting the footing had been undertaken, block work was only done for three courses for a stretch of 640 meters long, the quality of block works was poorly executed.

 Works such as fixing of palisade fence panels, copping, sliding gate and disposing of surplus executed materials had not commenced and the contractor was not on site at the time of inspection conducted in February, 2016.

Office of the President

Construction of a Six (6) Storey Office Block for the Provincial Administration –Chinsali

On 17th September 2012, China Jiangxi Corporation was engaged to construct a 1 x 6 storey office block for Provincial Administration in Chinsali District at a total contract price of K48,682,288. The contract period was seventy eight (78) weeks commencing on 16th October 2012 and ending on 24th April 2015. Following the non-completion of the project within the contract period, the contractor was given a number of extensions bringing the completion date to 31st March 2016. On 14th June 2016, the contract was further extended to 11th November 2016. As of June 2016, the contractor had been paid a total amount of K33,468,792 According to the General Conditions of Contract, Clause 43 settlement of certified claims is supposed to be done within twenty eight (28) days from the date of issuance. However, a scrutiny of certified claims revealed delays in settlement of two (2) certificates in amounts totalling K1,662,729 of up to two hundred and ten (210) days.

Construction of a four (4) Storey Office Block for the Provincial Administration in Chinsali

On 24th July 2013, the Provincial Administration engaged Matty Construction Ltd to construct a four (4) storey office block for the Provincial Administration in Chinsali District at a contract price of K22,575,211. The completion period was twelve (12) months commencing on 27th August 2013 and ending on 27th August 2014. Following the non-completion of the project within the contract period, the contractor was given a number of extensions bringing the completion date to 30th August 2016. On 29th August 2016, the contract was further extended to 3oth November 2016. As of June 2016, the contractor had been paid a total amount of K16,563,290 as shown in the According to the General Conditions of Contract, Clause 43 settlement of certified claims is supposed to be done within twenty eight (28) days from the date of issuance. However, a scrutiny of certified claims revealed delays in settlement of two (2) certificates in amounts totalling K3,215,594 of up to one hundred and ninety eight (198) days.

Ministry of Agriculture

Office of the President

Poor Workmanship - Masaiti Youth Training Centre

On 1st October 2014, J Sapwe Enterprises Limited was awarded a contract to construct a Youth Training Centre in Masaiti at a contract sum of K371, 105. The scope of works included earth works, substructure and super-structure to roof level, roof covering, landscaping, and wiring, plumbing works and finishing of the buildings. The duration of the contract was sixteen (16) weeks. An amount of K332, 247 had been paid to the contractor leaving a balance of K38, 588. A physical inspection carried out in April 2016 revealed poor quality of work and defects such as corrosion of the roof, development of cracks on the floor and a leaking roof, while windows stays were missing.

Examples of Poorly Delivered Projects (Auditor General's Report 2014)

Ministry of Mines, Energy and Water Development

Construction of Sample Sheds

On 21st June 2013, the Ministry engaged Sarzam Contractors to construct Sample Sheds for Geological Survey and the remedying of any defects at a contract sum of K3, 999,317. The contract period was fifteen (15) months. As of December 2014, the contractor had been paid amounts totalling K2, 245,146 representing 56% of the contract sum. Inspection in September, 2015 revealed that the works had not been completed, twenty six (26) months after the contract date .It was also revealed that the contractor had abandoned the project. Further, although the contract under section 49.0 of the Special Conditions of the contract provided for charging the contractor at 0.5% per day liquidated damages of the uncompleted works for delayed completion, the Ministry did not invoke the clause. However, as of November 2015, works had not resumed.

Ministry of Home affairs

Construction of the Office block for National Registration and Passport in Senanga
On 7th March 2014, the Provincial Administration, Western Province entered into an agreement with Messrs Kisukami Construction for the construction of the National Registration and Passport Offices in Senanga at a contract sum of K1,024,309 VAT inclusive with a completion period of six (6) months starting 7th March and ending 30th September 2014. As of October 2015, the contractor had been paid amounts totalling K415, 548. A physical inspection carried out in October 2015 revealed that the building was at wall plate level and the contractor was not on site.
As of October 2015, the contractor was not on site and the works had not recommenced.

Construction of the Office block for National Registration and Passport in Solwezi
In January 2014, Messrs Lochi International Limited was engaged to construct the National Registration and Passport Offices in Solwezi at a contract sum of K2, 148,000 with a completion period of twenty six (26) weeks. The contractor took site possession on 3rd February 2014 and the expected completion date was 31st July 2014. As of October 2015, the contractor had been paid K504,755. A physical inspection carried out in October 2015 revealed that the structure was at lintel level and the contractor was not on site.

Rehabilitation of the Office Block for National Registration and Passport in Mporokoso
In December 2013, Messrs Kawanzane Enterprises was engaged to rehabilitate the National Registration and Passport offices in Mporokoso at a contract sum of K362, 607 VAT inclusive with a completion period of twelve (12) weeks from the date of site possession. As of October 2015, the contractor had been paid K72, 521. A physical inspection carried out in October 2015 revealed that no works had been done.

Ministry of local government

Pages 112-123 shows 19 projects and page 126 shows 3 projects that are all delayed from initial completion mainly concerned with fire stations. Others involving health posts, houses and school related infrastructure, Juvenile cell and roads (3 Eastern province see page 144-169).

Province and projects recorded	Western (27)	Luapula (10)	Copperbelt (13)	North-Western (18)	Eastern (12)	Muchinga (14)	Central (25)	Lusaka (10)	Southern (13)
Quality Issues	5	3		7		6	5	2	
Contractor paid for incomplete work				3	3	3	4		
Stalled work						3	7		
Abandoned site	1	2							
Delayed	14	6		7		3		5	9

Ministry of Health
The projects were mainly characterised by poor workmanship and delays as shown below (see page 214-230).

Province and projects recorded	Western (4)	Luapula (1)	Copperbelt (1)	Eastern (12)	Muchinga (3)	Central (11)	Lusaka (1)
Quality Issues	4	1	1			11	1
Delayed					2	6	1

Ministry of Transport, Works, Supply and Communication

The Ministry entered into contract with Messer's DWA Zambia Ltd of Chipata for the construction of A Fire House at Chipata Airport on 24th September 2013 at a contract sum of K1, 143,015 with a duration period of four months up to 31st January 2014. A scrutiny of payment vouchers revealed that amounts totalling K556, 683 had been paid towards the contract leaving a balance of K586, 332. A physical inspection of the project carried out in May 2015 revealed that the structure was at roof level and the contractor had since abandoned the site. An additional thirteen (13) contractors as at October 2015 who had been awarded thirteen (13) contracts to construct different projects in various districts in total contract sums of K86,160,578 had abandoned the projects after being paid advance payments in amounts totalling K19,917,184 **(**See Page 246). . It was also observed that no works had been executed after site possession. In addition, the bank guarantees on the advance payments made had expired.

Ministry of Education, Science, Vocational Training and Early Education

Poor Supervision of Infrastructure Projects

Although the Ministry has building officers at the Ministry Headquarters, Provincial Headquarters and in the Districts whose responsibility is to provide supervision on the projects being implemented, and the implementation of infrastructure projects was within the boundaries of the Provincial and District Officers, the officers were not privy to the documentation for the projects and were consequently unable to effectively supervise the projects in their jurisdictions.

Failure to Provide Contract Documents.

During the audit, a sample of thirty two (32) projects under implementation by the Ministry was selected for audit scrutiny. However, only twenty - eight (28) contracts were availed leaving a balance of four (4) whose total contract sums were K35, 321,497. As a result, the executed works at the four (4) sites could not be verified. (See page 268).

Delayed Completion of Projects

Twenty seven (27) selected projects revealed that twelve (12) contracts for the construction of various schools at a total contract sum of K369, 012,598 awarded during the periods August 2011 to September 2014 had not been completed within the contract periods (page 267-281 for details).

Ministry of Agriculture and Livestock

Physical inspections carried out during the period from March to September 2015 comprising construction of laboratories, offices, Houses and sheds revealed weaknesses in the management of projects in that there was poor workmanship, failure to complete the projects on time and none adherence to contract terms in respect of twenty four (24) projects on which expenditure of K5, 262,275 (see pg. 342-354 for details).

Office of the President

Rehabilitation of Zemba Zemba Dam

Lavio Construction Ltd was engaged for the rehabilitation of Zemba Zemba Dam in Chirundu in 2013 at a contract price of K508,786 and the works had not been completed and that the contractor was not on site. A audit in August 2015, revealed that despite the contractor having been paid amounts totalling K473,898 representing 93 percent of the contract sum, the works had not been completed and the contractor was not on site.

Grading and Reshaping of R296 Undi Off Road (T4 to Msoro 14 KM) and Rehabilitation of Kamphambe – Katiula Road (16kM)

100% of the road works had been done. However, embankments were poorly compacted.

Examples of Poorly Delivered Projects (Auditor General's Report 2013)

Cabinet office

1.Kenneth Kaunda international airport: Rehabs for value of K 1, 824,382.
Payment was inflated and not according to measured works. The advance payment given without advance payment guarantee
2.Fitting of carpets to offices on 3rd Floor cabinet office
Contractor paid in full K360,035 on 8 May 2013 prior to commencement of works. Additionally quantities inflated resulting in payment of K125,574 which was not recovered as of December 2014.

Other issues

1. Lack of monitoring reports despite payment being made for the service
2. Non-compliance to procurement guideline e.g. companies single sourced, procurement committees not constituted to award contracts

Zambia Police- Ministry of home affairs

Roan police station: Poor workmanship noted 1. Cracks in the walls, fascia board not fitted as per BOQ, 2. Doors, grill and burglar bars fitted poorly and leaking taps, fluorescent fittings not supplied, painting incomplete etc. Additionally there was no liability period in the contract hence the defects could not be rectified.

Ministry of home affairs

Rehabilitation of national registration and passport office Chingola
Variations in access of 25% though procurement authority needs to be obtained for this.

Contractor paid 96% of contract sum though the work had been abandoned with the construction being up to the lintel level only

Rehabilitation of National Registration Offices in Mufulira – Lot 6

On 5th December 2012, Messrs A and D Elmalachi Business Solutions Ltd was engaged to carry out rehabilitation works at the National Registration and Passport Office in Mufulira at the contract sum of K175,250 with a completion period of seven (7) weeks. On 9th August 2013, the contract was varied by K129,595 to include the construction of an ablution. block bringing the total contract sum to K304,845. As of 31st December 2013, the contractor had been paid amounts totalling K184,586. However, the following were observed:1. Although the variations were in excess of 25% of the contract, no procurement authority was obtained. The additional works were instead approved by the Project Manager. 2. A physical inspection carried out in April 2014 revealed that works had stalled and the contractor was not on site due to delays in settling stage certificates.

Rehabilitation of Solwezi Records Centre

On 26th February 2013, the Ministry engaged Instalec Engineering to rehabilitate Solwezi Records Centre at a contract price of K51,936,170 with a completion period of thirty (30) days. The scope of works included; construction of water closet, provision of plumbing fittings, provision of sanitary fittings and fitting of ceramic floor tiles. However, on 20th December 2012, prior to the signing of the contract, the Ministry paid the Contractor in full. The payment to the contractor prior to the signing of the contractor was irregular. Although in his response dated 29th September 2014, the Controlling Officer stated that administrative action had been taken against the contractor and that the contractor was on site, a visit to the site on 17th October 2014 revealed that the works had not been completed and the contractor was not on site.

Ministry of Local Government and Housing

Livingstone District Council - Rehabilitation of Fire Station
The Council was funded an amount of K800, 000 for the rehabilitation of a fire station. In this regard, Kakonto Construction Enterprises Limited was engaged to carry out the works at a contract sum of K1, 249,805. As of June 2014, the contractor had been paid amounts totalling K393, 822. A physical inspection conducted in August 2014 revealed that works on the fire station had not been completed and the contractor was not on site. In his response dated 12th August 2014, the Controlling Officer stated that the contractor abandoned the contract after being queried on some unsatisfactory works. The Council had since written to the Provincial Administration Office of Southern Province to assess the works for onward termination of the contract.

Luanshya Municipal Council - Wasteful expenditure - Construction of a Market at Walale
The Ministry disbursed an amount of K200,000 for the construction of a market for the council at Walale. A review of records revealed that the council awarded a contract to Kyakosa General Dealers for the construction of a market. Although an amount of K40, 000 was paid to Kyakosa General Dealers for the construction of a market, a physical inspection of the site revealed that no works were done as of July 2014. As of August 2014, no funds had been recovered from the Contractor rendering the expenditure wasteful.
Ministry of Health

During the period from March to August 2014, the Ministry of Health received a total amount of K170, 357,956 (US$29,397,662) from the Eurobond proceeds, for the rehabilitation of the University Teaching Hospital, Livingstone General Hospital, Ndola Central Hospital and Kitwe Central Hospital In this regard, the Ministry of Health entered into four (4) contracts despite engagement of contractors without Clearance from the Attorney General.

The University Teaching Hospital undertook a number of rehabilitation works during the period under review at the institution. A scrutiny of signed contracts revealed that five (5) contractors did not provide advance payment guarantees and performance bonds contrary to the requirements of the signed contracts. However, advance payments were still made to the contractors. Further observes are made of poor performing projects in the ministry page (See pages172-183).

Ministry of Finance

Delay in the Completion of CSO Office Block

The Auditor General's Report on the accounts for the Government of the Republic of Zambia for the year ended 31st December 2010, mention was made of the delay in the completion of the office block.

A review of the situation in October 2014 revealed that the building had not been completed. In additionally the contract price had been revised as of October 2014 contract sum was K42,413,003 from K36,584,341 as of 2013 resulting in an increase of K5,828,752. This was the fifth time that the price was being revised from the original price of K14, 743,125 in 2001. Out of the total contract price of K42,413,003 only K32,625,150 was paid as of October 2014 leaving a balance of K9,787,852 against the contract price.

Ministry of Education

Infrastructure Development - Abandoned Projects

In April 2011, the Ministry awarded two (2) contracts to two (2) contractors at a contract sum of K42,008,473 for the construction of two (2) high schools in Serenje and Mumbwa districts. As of July 2014, amounts totalling K24,622,497 had been paid to the contractors. However, contrary to the terms and conditions of the contracts, the works had not been completed and the contractors had abandoned the sites. Despite Savenda Management Services Limited abandoning the construction of Mailo Boarding School in Serenje, the Ministry awarded the same contractor another contract for the construction of Mkushi South Boarding High School at a contract sum of 44,030,740. Further to this ministry has in excess of 25 school projects country wide. Over 50% of these projects were reported to not have a contractor on site despite payments having been made. Poor workmanship, and delays have been reported on most projects (See pages 215-226)

Examples of poorly performed projects Auditor report 2009-2012 (Un-rebased currency)

Rehabilitation of Staff Houses - Kariba Border Post

On 6 November 2012, the Ministry of Defence engaged Met-Weld Fabrication Ltd for the rehabilitation of staff houses at a contract sum of K269, 525,600, with a completion period of twelve (12) weeks.

The following observations were made:

i. Although the contractor commenced works, no site possession certificate was issued to determine the actual date works commenced.

ii. Although Clause 7 (e) of the contract stipulates that 5% of the contract amount shall be retained for a period of six (6) months after date of last certificate of the works covering the defect liability period, the contractor was paid the full contract amount before completion of all works.

iii. Although the contractor had been paid in full, works valued at K61, 780,000 were still outstanding.

Rehabilitation and Construction at the National Sports Development Centre (NASDEC)

On 28 June 2012, the Ministry of Youth and Sport engaged Hua Chang Infrastructure for the construction of two (2) change rooms, one (1) tennis court, and fourteen (14) demountable steel terraces and rehabilitation of one (1) basketball court, three (3) tennis courts, one (1) volleyball court, three (3) netball courts and associated external works at NASDEC at a contract sum of K7,762,807,754. The contract was for a period of twenty eight (28) weeks, with a defect liability period of twelve (12) months. As of December 2013, the contractor had been paid amounts totalling K3, 088,891,646, leaving a balance of K4, 673,916,108. A physical inspection of the project carried out in December 2013, revealed that the constructed tennis court and the rehabilitated one basketball court, tennis courts, volleyball court and netball courts had developed deep cracks on the floors . Although there was a defect liability period of twelve (12) months up to 31 December 2013, the defects had not been attended to.

Rehabilitation of the International Hostel Blocks at Unza

On 25 October 2012, the Ministry of Youth and Sport awarded a contract to Messrs Mercury Lines Ltd for the rehabilitation of the six (6) international hostel blocks at the University of Zambia at a contract sum of K6, 167,551,220. The contract was for a period of five (5) weeks with a defect liability period of twelve (12) months. As of December 2013, the contractor had been paid amounts totalling K5, 304,711,379, leaving a balance of K862, 839,841.

- *Omitted Works*: A physical inspection carried out in September 2013 revealed that, although the completion certification was issued, works valued at K164, 087,000 had not been done.
- *Defective Works*: Electrical works valued at K17, 300,000 were poorly done, as the cables had started melting in most of the rooms. The courts' floors had cracks in them.

Construction of Milenge District Hospital – Phase 1: Stalled Project

On 8 September 2010, the Ministry of Health awarded a contract for the construction of Milenge District Hospital – Phase 1, to Mwasika Building Contractors Ltd of Lusaka at a contract sum of K4, 211,208,320, with a completion period of forty-eight (48) weeks ending September 2011. In this regard, in June 2011, an amount of K2, 575,647,904 was allocated for the project. . As of June 2013, a total amount of K1, 136,232,471 had been paid to the contractor, leaving a balance of K3, 074,975,849. The sewer ponds at Kalabo District Hospital were abandoned. As of June 2013, the works had stalled and the contractor had abandoned the site. Inquiries with management revealed that the contractor abandoned the site in December 2011. At the time of abandonment, the maternity block was at ring beam level, the service block at slab level, the theatre block at foundation level, and the rest of the works had not commenced.

Samfya District Hospital

On 24 March 2010, the Ministry awarded a contract for the construction of Samfya District Hospital – Phase 3 to Mango Tree Construction Company Ltd at a contract sum of K6,619,567,068. In this regard, the project and works were to be completed within a period of fifty two (52) weeks. The scope of works included construction of six (6) medium-cost and (4) high-cost staff houses, construction of one (1) women's and one (1) children's wards and

District	Project	Contractor	Contract Period	Contract Sum K	Amount Paid to Contractor at Time of Audit in Kwacha	Delay From Initial Date of Completion (Months)
Choma (Southern Province)	Choma General Hospital , Construction of Admin, OPD and X-Ray blocks, 3 wards, Kitchen,	Associated Electrical Sales	05.11.09 to 27.01.11	7,879,016,600	6,109,241,006	35
Gwembe (Southern Province)	Construction Munyumbwe High School	Huajiang Investment Ltd	01.04.08 to 19.07.10 130 Weeks	24,101,337,500	22,045,316,730	41
Monze (Southern Province)	Mission Hospital Semi-detached staff House- Construction of a semi-detached staff house	Mwanza Contractors	19.01.09 to 19.06.09 20 Weeks	398,499,340	431,667,839	54
Itezhi-Tezhi (Southern Province)	Medical Office Standard Laboratory -Construction of a standard laboratory	Nambala Contractors and Hardware Supplies-	02.12.05 to 02.04.06	120,000,000	220,000,000	92
Mpulungu (Northern Province)	Construction of Mpulungu District Hospital – Phase II, Construction of Administration block, female ward, OPD/Laboratory, children's ward, Mortuary, Incinerator and external works from foundation up to finishing	Earthrow Investment Ltd	09.12.10 to 30.11.11 56 weeks	6,257,400,797	5,509,310,471	25
Mporokoso (Northern Province)	Construction of Lunte Girls Technical High	Wah Cong Enterprises Ltd	14.02.11 to 05.11.12 90 weeks	28,102,712,000	12,529,558,739	13
Nakonde (Muchinga Province)	Construction of Nakonde District Hospital Phase – 2, Construction of administration block, OPD and Laboratory, Male Ward, Mortuary Block, Incinerator, 4No. Medium Cost Houses from Substructure to Super structure and External works.	Zamin Liny Investments Ltd	22.11.11 to 31.10.12 (52 weeks)	5,695,921,208	3,187,890,844	14
Chinsali	Construction of Mulakupikwa College of Education	Flame promotions and procurement Ltd	11.11.10 to 01.03.13 78 weeks	107,562,504,242	64,837,055,759	9
Chienge (Luapula Province)	District Hospital Phase – 3, Construction of	Hua Jiang Investments	01.2012 to 01.2013	7,276,786,070	6,841,392,969	11

	female, male and children wards and construction of six (6) low cost and four (4) medium three bedroom houses		55 weeks			
Kafue (Lusaka Province)	Construction of the Maternity Ward at Kanyama 1st Level Hospital and Chelstone clinics, Construction of Maternity Ward	Vyanne Enterprises	09.03.12 to 09.08.12	2,299,546,283	1,340,393,480	16
Lusaka (Lusaka Province)	Construction of Centre of Excellence at Munali High School	China Jiangxi Corporation Ltd	17.07.11 16.10.13 130 weeks	110,109,304,910	21,879,012,407	2
Mongu (Western Province)	District Hospital Phase I,	Earthrow Investments	Sept 2010 to Aug 2011 11 months	4,553,415,506	3,659,514,369	28
Kalabo (Western Province)	Construction of Sikongo High School	China Gansu Engineering Corp (Z) Ltd	24.11.10 to 28.11.13 160 weeks	35,878,013,752	19,975,115,789	1
Kalabo (Western Province)	Construction of Libonda Boarding High School	China Jiangxi Corporation Ltd	28.09.10 to 28.09.11 52 weeks	36,126,154,744	13,883,608,218	26
Chavuma (North Western Province)	Construction of Chavuma District Hospital, phase 1 and 2	China Jangxi corporation	09.0910 to 23.11.11	4,715,998,905	4,962,555,562	25
Kabompo ((North Western Province)	Construction of Kayombo Boarding High School	China Jiangxi Corporation Ltd	26.05.09 to 25.06.12 160 weeks	33,289,251,181	26,753,856,470	6
Mkushi (Central Province)	Construction of District Hospital Phase II,	Zafeck Investments Limited	22.10.12 to 30.07.2013 40 weeks	7,830,526,438	938,917,850	5
Kabwe (Central Province)	Construction of Nkrumah College of Education	Hua Jiang Investments Ltd	01.03.09 to 01.09.11 130 weeks	57,518,410,000	38,166,267,534	28

K6,633,616,291 had been paid to the contractor, resulting in an excess payment of K14,049,223. Although the project had been completed, interviews with management and a physical inspection carried out in November 2013 revealed the following:

Dry Boreholes: The two (2) boreholes that were sunk at the hospital were dry.

Defects: Some structures had developed cracks on the walls and floors, while black floor tiles that were fitted in the theatre were painted over with white paint.

Construction of Border Infrastructure at Katima Mulilo

In October 2006, the Ministry of Home affairs engaged Yangst Enterprises Ltd to construct the border facility at Katima Mulilo Border Post at a contract sum of K15,898,883,580 for the period of fifty three (53) weeks from 27 October 2006 to 17 March 2008. The scope of works included the construction of the border post main building, guard houses and various other external works. The Ministry appointed Messrs Nkole Bwalya and Associates as the Supervising Agent on behalf of Government. However, as of March 2008, the works had not been completed. Consequently, in April 2009, the completion period was extended to April 2013, and the contract price was revised to K29,425,641,794. As of December, the contractor had been paid K28,201,343,078. A physical inspection of the site carried out in April 2013 revealed that most of the civil works had been completed except for the access road, and the contractor had partially handed over the infrastructure to the Zambia Revenue Authority, who were using the facility. The following defects were observed on the construction works:

- Cracks had developed on the concrete paving.
- There were spaces in the concrete joints.
- Some portions of the concrete slabs were collapsing.
- The paving along the walkways was dislodging.

Kundalila – Katota Road - Serenje District

A total amount of K444,877,400 was spent on road works on the Kundalila – Katota Road. This included bush clearing, heavy grading and gravelling for a stretch of 30 km. Expenditure included an amount of K332,147,400 on fuel and lubricants and K112,730,000 as allowances for RRU Officers. A physical inspection carried out in April 2013 revealed that only a stretch of 20 km was graded, out of which 12 km bush had cleared, whereas the remaining 8 km was not worked on.

Further, gravelling and spillways were not properly done, resulting in some parts of the road being washed away.

Construction of Rice Dehuller Shelter at Chifwenge

In March 2012, the Provincial Administration engaged Messrs Chikas General Dealers to construct a shelter for the Rice Dehuller at Chifwenge in Chilubi District at a contract sum of K67,000,000 with a completion period of 30 days. The contractor had been given an advance payment of K13,400,000 in April 2012. However, as of December 2013 works had not commenced on the project.

Police Post at Matipa in Chilubi District

In September 2012, the Provincial Administration engaged Messrs Chikas General Dealers to complete a police post at Matipa in Chilubi district at a contract sum of K70,000,000. The contractor had been paid an advance payment of K14,000,000 in September 2012. However, as of December 2013 works had not commenced on the project.

Contract for the Rehabilitation of the Government Rest House in Chinsali

In June 2012, the Provincial Administration engaged Umutanto Investment Ltd to rehabilitate the Government Rest House in Chinsali at a contract sum of K361,532,562.60 with a contract period of six (6) weeks commencing 25 June 2012. The scope of works included construction of a borehole and spoon drain, replacement of the ceiling, painting, varnishing and fixing of tiles. As of March 2013, the contractor had been paid amounts totalling K283,324,200. A physical inspection carried out in June 2013 revealed that the works had not been completed and the contractor was not on site.

Rehabilitation of Office Block and Erection of Diamond Wire Fence - Senanga

On 16 July 2012, the Provincial Administration engaged Nkhunzi Marketing Agency to rehabilitate the meteorological office block and erect a diamond wire fence in Senanga District at a contract sum of K103,410,000. The contract was for the period of eight (8) weeks commencing on 23 July, 2012. The scope of works included block work, glazing, painting and decorations, carpentry, plumbing and drainage works and construction of a diamond wire fence. As of February 2013, the contractor had been paid a total amount of K96,680,500. A physical inspection of the project conducted on 13 May 2013 revealed that although the works had been completed and the contractor had left the site, several cracks had developed in the walls, only the first coat of paint on the interior walls was applied, the wire mesh on top of the windows had not been fitted and the drainage was poorly done in that it had cracks.

Construction of Toilets at Luwingu District Office – Poor Workmanship

In November 2012, the District Commissioner's Office engaged Messrs Kanungwe Construction and General Dealers for the construction of two (2) toilets at Luwingu District Administration Office. As of 12 February 2013, a total amount of K31,880,000 had been spent on the project. A physical inspection of the project carried out in February 2013 revealed poor workmanship in that the toilet was detaching from the main building.

Appendix 3 Theoretical lenses used in past studies on Risk allocation

Authors/Theory	Year	Journal	Application	Research Method	Country
Expectancy theory					
Ward, et al.,	1991	IJPM	Construction Projects	Theoretical	UK
Remuneration Theory					
Barnes	1983	IJPM	Construction contracts	Theoretical	UK
Game theory					
Medda	2007	IJPM	PPP	Theoretical	UK
Fuzzy theory					
Khazaeni, et al.,	2012	IJPM	Construction	Delphi	Iran
Yao-Chen Kuo and Shih-Tiong Lu	2013	IJPM	Metropolitan Construction Projects	Case study	Taiwan
Nasirzadeh, et al.,	2014	IJPM	Tunnelling	Theoretical	Iran
Baloi and Price	2003	IJPM	Construction	Theoretical Discussion	UK
Dikmen, Birgoul	2007	IJPM	International Construction	Experts	Turkey
Nieto-morote & Ruz-Vila	2011	IJPM	Construction Projects	Experts	Spain
Zeng. An and Smiu	2007	IJPM	Construction Projects	Analytical hierarchy process	UK
Carr and Tah	2001	Advances in Engineering Software	Construction Projects	Delphi	UK
Lam, et al.,	2007	IJPM	Construction Contract	Expert panel	China
Shi, Q. et al.,	2014	IJPM	Programme management	Case study	China
Ebrahimnejad, S., Mousav, S. M. i. & Seyrafianpour, H.,	2010	Expert Systems with Application	BOT projects-Power plant	Case study	Iran
Real options theory					
Carbonara,	2013	Built Environment Project and Asset management	Transport PPP	Theoretical-literature	USA
Cruz & Marques,	2013	IJPM	PPP	Case Study	Portugal
Rakić & Rađenović,	2014	Economic Annals	PPP		Serbia
Pellegrino et al	2011	CME	Water projects	Monte Carlo simulation	Italy

Transaction cost theory					
Jin and Doloi	2008	*CME*	PPP	Survey	Australia
Jin	2010	*JCEM*	PFI	Theoretical	Australia
Jin	2012	*AJCEB*	PPP	Case study	Australia
Jin & Zhang,	2011	IJPM	PPP	Case study	Australia
Ebers & Semrau,	2015	Journal of Business Research	Construction	Survey	Germany
Chang	2013	CME	PPP	Theoretical	UK
Wamuziri	2013	ICE-Management, Procurement and Law	Construction projects	Theoretical	UK
Kumaraswamy, et al.,	2002	CME	Construction projects	Case study	China-HK
Contingency theory					
Osipova & Eriksson,	2013	IJPM	Construction projects	Case study	Sweden
Resource based view					
Jin & Zhang	2011	IJPM	PPP		Australia
Principal Agency theory					
Abrahamson	1984	ICLR	Construction contracts	Theoretical	UK
Chang	2014	JCEM	Construction contracts	Theoretical	UK
Fu & Li	2009	IEEE	Construction Projects	Theoretical	China
Bunni	2009	ICLR	Construction contracts	Theoretical	UK
Mead	2007	ICLR	CLJ	Theoretical	UK
Xiang, et al	2012	JCEM	Construction Projects	Theoretical	China
Structuration Theory					
Floricel, et al.,	2014	*IJPM*	Construction	Theoretical	Canada

Appendix 3B Risk management techniques and classification

Technique	Project Phase	Level of maturity
Brainstorming	Conceptualisation, planning, execution	Novice, normalised, Natural
Cause and effect diagram or cause consequence (CCA)	Planning, execution,	normalised, Natural
Change analysis (ChA	Planning, execution,	normalised, Natural
Checklist	Conceptualisation, planning,	Novice, normalised, Natural
Decision tree analysis	Conceptualisation, planning,	normalised, Natural
Delphi	Conceptualisation, planning,	Novice, normalised, Natural
Event and causal factor charting (ECFCh)	planning,	normalised, Natural
Event tree analysis (ETA)	Conceptualisation, planning,	normalised, Natural
Expected monetary value	Planning, execution	Natural
Expert judgement	Conceptualisation, planning,	Normalised, Natural
Fault Tree Analysis (FTA)	Conceptualisation, planning,	Normalised, Natural
Failure Mode analysis (FMEA)	Conceptualisation, planning,	Normalised
Failure Mode and effects criticality analysis (FMECA)	Conceptualisation, planning, execution	Normalised, Natural
Fuzzy logic, Bayesian network	Planning	Natural
Hazard and operability (HAZOP)	Planning	Normalised
Hazard Review (HR)	Planning	Novice, normalised,
Human Reliability Assessment (HRA)	Planning, execution	Novice, normalised,
Incident Reporting	Planning	Normalised, Natural
Interviews	Conceptualisation, planning, execution	Novice, normalised, Natural
Monte Carlo	Planning	Natural
Pareto Analysis (PA) or ABC Analysis	Planning	Natural
Preliminary Hazard Analysis (PHA)	Planning	Novice, normalised
Risk Breakdown Matrix (RBM)	Planning	Normalised, Natural
Risk Breakdown Structure (RBS)	Conceptualisation, planning,	Normalised, Natural
Risk mapping, Risk matrix, Probability and impact Matrix	Planning	Normalised, Natural
Risk probability and impact assessment, risk ranking/ Risk Index	Planning	Normalised, Natural
Sensitivity analysis	Planning, execution	Natural
Strengths Weaknesses opportunities (SWOT)	Conceptualisation, planning	Normalised, Natural
SWIFT Analysis	planning	Normalised, Natural
What-if analysis	Conceptualisation, planning	Normalised, Natural
5 whys' technique	planning	Natural
Plan evaluation	planning	Normalised, Natural

Source: Adapted from Cagliano, Grimaldi and Rafele (2015)

Appendix 4A For client (consultants)

Performance Drivers	Performance questions	Possible Performance deficiencies
Data, information, feedback	• How well is data/ information/feedback given to perform what is needed for risk allocation-e.g. drawings, specifications, brief • What risk factors (internal and external) are mostly in countered on building projects • What factors are considered for contract selection?	• information not given on time • no feedback • Performance standards not adequate • Inability to identify risk factors • Inability to align project characteristics with appropriate contract
Environment, support resources, tools	• Do clients (consultants) have the right tools for a. risk identification, b. assessment and response? • Is there a process or established practice for risk allocation? • Which contract types are available for client (consultants to select from)? • what are the characteristics of building projects	• Insufficient time to carry-out risk identification. assessment , response • tools unavailable • not enough options for selection • unable to identify characteristics
Consequences, incentives, rewards	• How well are consequences of inappropriate risk allocation viewed? • Is there reward/incentive provided for carrying risk? • Are contracts currently in use reflective of building projects characteristics	• No reward for carrying a risk • Consequences not fully appreciated
Skills and Knowledge	• Do the pertinent risks in the ZCI match the a. skill and b. knowledge required for required performance? • What training has been received in risk management/allocation?	• Lack of skill • Lack of knowledge
Motivation and expectations	• How well are people motivated to perform tasks related to risk management/allocation? • Are expectations realistic?	• Lack of motivation • Unrealistic expectations
Individual capacity	• How well can client allocate risk	• Lack of capacity, lack of ability

Appendix 4B For contractor

Performance Drivers	Performance questions	Possible Performance deficiencies
Data, information, feedback	• How well is data/ information/feedback given to perform what is needed given for risk management-e.g. drawings, specifications • What risk factors (internal and external) are mostly in countered on building projects	• information not given on time • no feedback • Performance standards not adequate • Inability to identify risk factors
Environment, support resources, tools	• Does contractor have the right tools for a. risk identification ○ B. assessment and response? • Is there a process or established practice for risk management? • Which contract types do you encounter most, are they appropriate?	• -Insufficient time to carry-out risk identification, assessment , response • tools unavailable • not enough options for selection of contracts
Consequences, incentives, rewards	• How well are consequences of inappropriate risk allocation viewed? • Is there reward/incentive provided for carrying a risk? • Are contracts currently in use reflective of building projects characteristics	• 1.No reward for carrying a risk • Consequences not fully appreciated • contracts not reflective of risks encountered • 4. inappropriate incentive for carrying the risk
Skills and Knowledge	• Do the pertinent risks in the ZCI match the a. skill and b. knowledge required for required performance? • What training has been received in risk management	• Lack of skill • Lack of knowledge
Motivation and expectations	• How well are people motivated to perform tasks, construction? • Are expectations realistic?	• Unrealistic expectations • No motivation
Individual capacity	• How well can contractor identify, assess and respond to risk	• Lack of capacity, • lack of ability

Appendix 5 Ethics Clearance

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Tembo

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H15/06/78**
PROJECT TITLE	Risk allocation on building projects in the Zambian Construction Industry (ZCI)
INVESTIGATOR(S)	Ms C Tembo
SCHOOL/DEPARTMENT	Construction, Economics & Management/
DATE CONSIDERED	26 June 2015
DECISION OF THE COMMITTEE	Approved unconditionally
EXPIRY DATE	02 July 2017
DATE 03 July 2015	**CHAIRPERSON** J. Knight (Professor J Knight)

cc: Supervisor : Dr N Khatleli

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature

7 / 07 / 2015
Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix 6 Consent letters

All communications should be addressed to the Permanent Secretary, Ministry of Education, Science, Vocational Training and Early Education not to any individual by name.

Telephone: +260 211 250855/251315/251303
251298/251318/251291
251300/251319

In reply please quote
No. ....

REPUBLIC OF ZAMBIA

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION

P.O. BOX 50093
LUSAKA

23rd June 2015

Ms Chipozya Tembo
The University of the Witwatersrand
Faculty of Engineering and the Built Environment
School of Construction Economics and Management
1 Jan Smuts Avenue
Braamfontein 2000
Johannesburg, South Africa

RE: APPLICATION FOR WRITTEN CONSENT

We are in receipt of your letter dated 21st May 2015 on the above captioned subject matter.

You have introduced yourself as a research student at the University of the Witwatersrand, Johannesburg on a research scholarship from the Copperbelt University and you are applying for written consent to allow you to collect data for your PHD research project from relevant professionals in the Ministry.

The Ministry has no objection to your request and hereby authorizes you to undertake the data collection stage of your study. The contact details for the contact person in the Ministry as you carry out your research activities are shown below:

Mr. J. F. Nthele
Director of Projects – ZEPIU
Email: josephnthele@yahoo.com.au
+260977870506

Chishimba Nkosha
PERMANENT SECREATARY
MINISTRY OF EDUCATION SCIENCE VOCATIONAL TRAININMG AND EARLY EDUCATION

All Correspondence should be addressed to the
Permanent Secretary
Telephone: +260 211 253040/5
Fax: +260 211 253344

In reply please quote:

MH/101/23/10

REPUBLIC OF ZAMBIA

MINISTRY OF HEALTH

NDEKE HOUSE
P. O. BOX 30205
LUSAKA

11th June, 2015

Chipozya Tembo
The University of the Witwatersrand
Faculty of Engineering and the Built Environment
School of Construction Economics and Management
1 Jan Smuts Avenue
Braamfontenin 2000, Johannesburg
SOUTH AFRICA

Dear Ms.Tembo,

Re: Request for Conditional Permission to do Research

The Ministry of Health is in receipt of your request for conditional permission for a letter of Authority to do research for a study titled **"Risk Allocation on Building Projects in the Zambian Construction Industry."**

I wish to inform you that following submission of your proposal to my Ministry and our review of the same, this request has been approved.

Ensure that you obtain the final Authority to conduct research before data collection commences.

Yours sincerely,

Dr.D.Chikamata
Permanent Secretary
MINISTRY OF HEALTH

HEAD OFFICE
C/L7, NEW BRENTWOOD DRIVE, LONGACRES
P. O. BOX 51084
LUSAKA
ZAMBIA
TEL 0211-255161/256205
Email: eiz@eiz.org.zm
Website: www.eiz.org.zm

15th June, 2015

The University of the Witwatersrand

Faculty of Engineering & the Built Environment

School of Construction Economics & Management

1 Jan Smuts Avenue

Johannesburg

South Africa

Dear Madam,

RE APPLICATION FOR WRITTEN CONSENT-CHIPOZYA TEMBO

Reference is made to your letter dated 21st May, 2015 in which you requested the Institution a consent letter to use to approach registered members of the Engineering Institution of Zambia (EIZ) with regard to your research.

We hereby wish to consent that by copy of this letter you are authorized to approach registered members of the EIZ in a quest to assist you do your research on the topic, "Risk Allocation on Building Projects in the Zambian Construction Industry (ZCI)"

Further, we would like to request the, would be, approached EIZ members to help the bearer of this letter with any relevant information pertaining to her research.

We trust you shall receive favorable consideration during your endeavors in pursuing this assignment.

Yours sincerely

Newton Zulu

Deputy Registrar-South

For/REGISTRAR

Northern Region Office
8 Kantanta Street Nkana East
P.O. Box 23385
Kitwe – Zambia
Tele Fax: +260-212-230111/222608

Southern Region Office
Buildings Department HQ
Fairely Road Ridgeway
P. O. Box 51084 Lusaka - Zambia
Tele Fax:+260-211-256214

All Correspondence must be addressed to the Registrar and Chief Executive Officer

Telephone: 250732 / 250528
Telegrams: LOC GOVT.LUSAKA
Fax: 252680
E-Mail: ps@mlgh.gov.zm

In reply please quote:

No.: ....

REPUBLIC OF ZAMBIA

MINISTRY OF LOCAL GOVERNMENT AND HOUSING

P.O. BOX 50027
15101 RIDGEWAY
LUSAKA

MLGH/101/1/5

5TH June, 2015

The Head of School
School of Construction Economics and Management
University of Witwatersrand
Johannesburg
SOUTH AFRICA

Re: ACADEMIC RESEARCH: - CHIPOZYA KOSTA TEMBO

We acknowledge receipt of your letter ref. 760842 dated 12th May, 2015 concerning the above subject.

Authority is hereby granted for Ms. Chipozya Kosta Tembo, a student at your University to undertake academic research for her Doctrine on the **Risk Allocation on Building Projects in the Zambian Construction Industry (ZCI).**

Kindly advise Ms. Chipozya Kosta Tembo to report to the Director, Department of Housing and Infrastructure Development for guidance.

Brian B. Chirwa
Acting Permanent Secretary
MINISTRY OF LOCAL GOVERNMENT AND HOUSING

National Council for Construction

Head Office
Plot 1612/1623 Luchengo Road,
Off Sheki Sheki Road, Light Industrial Area,
P. O. Box 39548,
Lusaka, Zambia.
Tel: +260 211 247185 / +260 211 240586,
Fax: +260 211 243115 / +260 211 247264

Northern Regional Office
President Avenue
Mukuba Pension House
P. O. Box 23163,
Kitwe, Zambia
Tel: +260 212 220590,
Fax: +260 212 226121

Southern Regional Office
Stand No. 252 Kalima Street,
Mochipapa
P. O. Box 630688
Choma, Zambia
Tel: +260 213 221162
Fax: +260 213 221167

09th June, 2015

The Head of School
School of Construction Economics and Management
University of Witwatersrand
Johannesburg
REPUBLIC OF SOUTH AFRICA

Dear Sir/Madam,

RE: ACADEMIC RESERCH: CHIPOZYA KOSTA TEMBO STUDENT NO. 760842

The National Council for Construction (NCC) is in receipt of your letter regarding the above subject.

The Council wishes to inform you that permission is hereby granted for Ms. Chipozya Kosta Tembo a student at your University to undertake an academic research tilted:
Risk allocation on Building Projects in the Zambian Construction Industry.

The student has been granted permission to contact registered contractors from Grade 1 (One) to 4 (Four) in the General Building and Housing category.

Yours faithfully,

Eng. Golden Makayi
DIRECTOR - REGISTRATION AND REGULATION

cc: Executive Director

Mobile: +260 971 233237 or +260 964 062175 Email: ncc@ncc.org.zm Website: www.ncc.org.zm

REPUBLIC OF ZAMBIA
QUANTITY SURVEYORS REGISTRATION BOARD
(Established under the Quantity Surveyors Act Cap 37 of 1995, Laws of Zambia to provide for the Registration and Regulation of Quantity Surveyors and matters connected with the Quantity Surveying profession).
QSRB Secretariat Room 28 Buildings Department Box 33756 Lusaka Zambia
Tel: 0211 256483; Email: qsrb@zamtel.zm

10th June, 2015

The University of Witwatersrand,
Faculty of Engineering and the Built Environment
School of Construction Economics and Management
1 Jan Smuts Avenue
Johannesburg,
South Africa

ATTENTION: Ms Chipozya Tembo

Dear Sir/Madam

RE: CONSENT TO APPROACH FIRMS AND INDIVIDUALS REGISTERED WITH THE BOARD FOR RESEARCH PURPOSES

Reference is made to the above subject

The Quantity Surveyors Registration Board writes to inform you that we have no objection with you approaching members, individuals and firms registered and regulated under Cap 438 of laws of Zambia in line with your request for ethical clearance as you carry out your research.

We further advise that availability of these individuals and firms remains subject to personal arrangements but we will endeavour to assist you in every possible way.

We trust you find the above is in order

Yours Faithfully,
Quantity Surveryors Registration Board

Matthew Ngulube
Board Chairman

Telephone: 260-11-252475/252458
Fax: 254108

In reply please quote:
No.:...................

REPUBLIC OF ZAMBIA

MINISTRY OF TRANSPORT, WORKS, SUPPLY AND COMMUNICATIONS

OFFICE OF THE PERMANENT SECRETARY
BLOCK 28, INDEPENDENCE AVENUE
P. O. BOX 50236
LUSAKA

CONFIDENTIAL

Chipozya Tembo
The University of the Witwaterstrand
Faculty of Engineering and the Built Environment
Johannesburg
South Africa.

4th June, 2015

STUDENT RESEARCH: YOURSELF

Reference is made to your letter dated 21st May, 2015.

This serves to inform you that permission has been granted for you to approach various professionals (Architects, quantity Surveyors, Civil Engineers) engaged in construction in the Ministry.

You are further advised to conduct this research without interruption of the day to day operations of the institutions you wish to work with.

Bupe Chongo Sinkala
Senior Human Resource Management Officer
MINISTRY OF TRANSPORT, WORKS, SUPPLY AND COMMUNICATIONS

Zambia Institute of Architects

(CONSTITUTED UNDER CAP. 442 of 1995, LAWS OF ZAMBIA)

Buildings Department
P.O. Box 51224
Lusaka, Zambia
Telephone: 254512
Telefax: 254512
Email zia@zamtel.zm

Tuesday, 23rd June, 2015

The University of Witwatersrand
Faculty of Engineering and the Built Environment,
School of Construction Economics and Management,
1 Jan Smuts Avenue,
Braamfontein 2000,
Johannesberg, South Africa.

Attention, Chipozya Tembo

Dear Madam,

RE. PERMISSION TO COLLECT DATA FROM MEMBERS OF THE ZAMBIA INSTITUTE OF ARCHITECTS.

With reference to the above heading and your letter to us dated **21st May, 2015** which we received on the **4th of June, 2015**, we consent to your request to approach our members for the purpose of acquiring data relating to your study.

We sincerely trust that the above is in order and wish you all the best in your undertaking.

Yours faithfully,
Zambia Institute of Architects

Chisomo Chongo
HONORARY SECRETARY
Cc. File

Member of:
Commonwealth Association of Architects
International Union of Architects
SADCC Union of Architects

Appendix 7: Research Instruments

Appendix 7A: Questionnaire-sample questions

Information Sheet for Research Study (Sample)
University of the Witwatersrand

Full title of Project: Risk allocation on Building Projects in the Zambian Construction Industry

Name, position and contact address of Researcher: Chipozya Kosta Tembo, PHD student
University of the Witwatersrand University, chipozya@yahoo.co.uk, +26096 688482 /+2728089806

Description of the research and your participation
You are invited to participate in a research study because your input is very valuable and because of your involvement in the construction of buildings. The purpose of this research is purely academic to understand risk allocation practices in the Zambian construction industry on building projects with a view of developing a framework for enhancing risk allocation. Your participation will involve responding to a questionnaire, which will take between 15 to 20 minutes to fill. The information collected will be used for research purposes only. It is hoped that the information given is reflective of current risk allocation practices in the construction industry. Your participation is so important that the development of the framework depends on it.

Risks and discomforts
There are no known risks associated with this research.

Potential benefits
Ultimately, this research may be published on the Witwatersrand University website and it is hoped that papers are published from the research. There are no known benefits to you that would result from your participation in this research. However, the research may help us to understand how to better allocate risk in building projects in the Zambian construction industry to enhance performance on building projects.

Protection of confidentiality
The records of this study will be kept strictly confidential. Research records will be kept in a locked file and all electronic information will be coded and secured using a password protected file. The questionnaire will be destroyed after five years of award of the degree. We will not include any information in any report we may publish that would make it possible to identify you. Your identity will not be revealed in any publication resulting from this study.

Voluntary participation
Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information
If you have any questions or concerns about this study or if any problems arise, please contact Chipozya Tembo at University of the Witwatersrand at the email address or phone number(s) given on page above. If you have any questions or concerns about your rights as a research participant, please contact the University of Witwatersrand at +27 11 717 7652/77669/777663. Or Research Ethics Committee on +27 11 717 1152

Consent Form for Participation in a Research Study
University of the Witwatersrand

Please
Tick Box

1. I/We confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐

2. I/We understand that my participation is voluntary and that I am/we are free to withdraw at any time, without giving reason. ☐

3. I/We agree to the Questionnaire survey ☐

4. I/We agree to the use of anonymised quotes in publications ☐

____________________ ____________ ____________

Name of Participant Date Signature

Questionnaire sample questions

Purpose of research: *To gain an understanding of risk allocation practices in the Zambian construction industry on building projects with a view of developing a framework for risk allocation. This will include contract selection, contracts in use, important risks, techniques and practices used for risk allocation.*

Section A General information- clients

1. Please indicate type of Client (Please tick)

Government department		Public listed company		Private developer		Financial institution		Local authority	

2. Please indicate the nature of building construction work engaged in (circle as many as possible)
   a) Residential g) Schools
   b) Office block h) Clinics
   c) Shopping mall i) Hospitals
   d) Hospitality resorts etc. j) Factories
   e) Stadia k) Prisons f) Other ………………………………………

Section A: General Information -Consultants

3. Please indicate type of Consultancy (Tick all relevant)

Quantity Surveying		Project management		Architectural		Engineering	

4. Please indicate your primary profession (circle)
a)Quantity Surveyor
b)Construction manager
c)Civil engineer
d)Architect
e)Project manager
f) Other (Please specify) …………..………………………….
5. Please indicate your membership type with your professional body (Tick)
6.
7.
8.

Professional	Member	Associate	Student	Other please specify …………………………

9. Please indicate the nature of construction work engaged in (circle all applicable)
f)New construction Renovations and refurbishing
g)Demolition Rebuilding
h)Extensions
10. Please Indicate your qualification (circle)
A. Certificate. B. Diploma C. Bachelor's degree D. Master's Degree E. Doctoral Degree

Section A.- contractors

1. Please indicate your Contractor grade (tick)

1	2	3	4

2. Please indicate the nature of construction work engaged in (circle)
i)New construction Renovations and refurbishing
j)Demolition Rebuilding Extensions
3. Please Indicate your qualification (circle)

A.Certificate B. Diploma C. Bachelor's degree C. Master's Degree D. Doctoral Degree

11.Section A common for all sub-groups

12.Please indicate the number of years you have been in building construction (Tick)

- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-15
- ☐ Over 15 years

Section B Contracts

13.Tick the standard forms of contracts you encounter/use for building construction projects

- ☐ Federation of international consulting Engineers (FIDIC) Red/ Green book
- ☐ New Engineering Contract (NEC)
- ☐ Joint Liaison Committee (ZIA)
- ☐ Joint Contract Tribunal
- ☐ ZPPA open national bidding
- ☐ ZPPA open international bidding
- ☐ ZPPA small works contract

Other (Please specify) …………………………………………………………………

14.Are standard forms modified before use? If Yes go to the next question if No go to question 7

☐ Yes No ☐

15.Briefly describe the nature of contract clauses amended...

16.What factors do you consider when deciding on a type of contract to use? (Tick)

Factor	No Importance	Little Importance	Moderate Importance	Strongly Important	Very Strongly Important
Type of work to be undertaken					
Type of development					
Status of the design					
Size of the project					
Method for price determination					
Financiers preference					
Degree of price competition					
Client objectives (time, cost quality					
Public benefit (empowering community or contractor					
Procurement method					
Complexity of the requirements					
Risk preference					
Type of contract documentation					
Flexibility in design					
Incentive					
Other (please specify) …………………………………					

17.How effective are the following types of clauses in allocating risk

	Not effective at all	Slightly effective	Effective	Very effective	Exceptionally effective
Escalation clauses e.g. interest for late payment, cost+ profit added for extra/varied work					
Exculpatory/exclusion/disclaimer clauses e.g. indemnification					
Penalty clause e.g. liquidated and ascertained damages					

18.What is your general comment on types of clauses used

………………………………………………………………………………………………

Section C: Risk Management

19.Have you had any formal training in risk management? Circle Yes/ No

Explain ………………………………………………………………………………………………

20.Do you have an established process for risk management? Circle Yes/ No

Explain ………………………………………………...………………………………………

21.How would you describe your risk management abilities (Tick)

	Exceptionally inadequate	Slightly adequate	Not sure	Adequate	Very Much adequate
Risk identification					
Risk analysis					
Risk response					
Monitoring risk					
Controlling risk					
Communication of risk					

22.Please indicate your perception on the following (Please Tick)

Item	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
Roles and performance expectations are clearly defined in building contracts used					
Feedback on your role and adequacy of performance is given by other project team members.					
Adequate information is given to contractors to make decisions on risk (s)					
The allowed level of subcontracting is adequate					
Contracts gives clear guides on risk allocation and responsibilities of contract parties and those involved					
There are incentives for carrying risks in contracts used					
Project team members are recruited based on the realities of project characteristics					
You have resources to carryout risk management and allocation e.g. check lists, brainstorming sessions, meetings and simulation					
You have opportunities to increase your knowledge on risk allocation and management					
You believe that appropriate risk allocation improves project performance					
Obtaining insurance for works is relatively easy					
When contingency sums are provided they are adequate					
Time allowed for project execution is adequate					
The monitoring of risks done on projects is adequate (supervision/inspection)					

23.Please indicate with a tick the method(s) that you use for risk identification. (Tick)

Risk identification	Tick		Tick
Brain storming		Local knowledge	
Delphi Technique		Interview	
Swot analysis		Expert knowledge	
Influence diagram		Document review	
Questionnaire		Site visit	
Check list		Using past projects	
Flowcharts		Other (please specify) ………………………	

24.Please indicate with a tick method(s) that you use for risk analysis

Risk Analysis	Tick		Tick
Brain storming		Risk premium	
Probability and impact matrix		Intuition	
Checklists		Judgement risk analysis process	
Expert judgement		Probability distribution	
Risk breakdown matrix		Sensitivity Analysis	
Interview		Monte Carlo simulation	
Consult specialist		Others (please specify) ……….……………………	

25. Which of the following factors are considered when allocating risk to parties? (Tick)

Consideration	Never considered	Somehow considered	Considered	Very much considered	Exceptionally considered
Ability to control risk					
Ability to sustain the consequence					
When the risk eventuates, the loss falls on that party					
Foreseeability of the risk by the party					
Clients preference					
An understanding of project objectives					
Others (please specify)…………………………………………….					

16.How important are the following risk factors on building construction project performance? (Tick)

Risk factor	Not important at all	Slightly important	Important Moderately	Very important	Exceptionally important
Client Related					
Client's Financial Stability					
elay in Payment Process by the Client					
requent Change Orders by Client					
low Decision Making Process by Client					
nrealistic Contract Duration of the Project					
Lack of interest on delayed payment					
Unclear scope of works					
Suspension of work					
Delay in site handover					
Consultant Related Clarity of Drawings and Technical Specifications					
Delay in Consultant's Approval of Materials Submission					
Delay in Consultant's Approval of Shop Drawings					
Delay in Consultant's Response to Requests for Information (RFI)					
Delay in Contractor's Payment Certification by the consultant					
Errors and Omissions in Design Drawings					
Lack of Coordination among Design Disciplines					
Omission in design contract documents					
Inadequate specification					
In adequate budgeting and contingencies					

Inadequate site investigation					
Lack of inspection of works					
Poor supervision					
Contractor Related Contractor's Financial Difficulties					
Contractor's Underestimate of Construction Cost					
Defective Workmanship and Rework					
Lack of Experience in Similar Projects					
Late Delivery of Materials					
Poor Labour Productivity					
Non-compliance to tender requirement on site (labour and Equipment)					
Construction accidents					
Poor quality materials					
Poor planning of resources -materials, labour, equipment					
Delay in submitting invoices					
Delay in mobilisation					
Poor supervision on site					
Insufficient protection of works					
Unsafe work environment					
External factors					
Delay in Statutory Approvals and Permits					
Escalation in Material Prices					
Frequent Changes in Statutory Regulations					
Inclement Weather					
Unstable exchange rates					
Shortage in Technical Staff and Skilled Labour					
Site Orientation and Restricted Access					
Unavailability of Equipment Required					
Unavailability of Sufficient Storage Space around or on Site					
Unavailability or Shortage in Specified Materials					
Unforeseen Ground Conditions					
High taxes					
Difficulty in getting insurance cover					
Delay in resolving disputes					
Criminal acts vandalism, theft					
Project Manager/Contract administrator					
Ineffective monitoring of risks					
Holding key decisions in isolation					
Poor coordination and communication					

17.How severe are the consequences of risk factors by different source on project performance. (tick)

Source of risk	Not severe at all	Slightly severe	Severe	Very severe	Exceptionally severe
Client					
Consultants					
External					
Contractor					
Project manager/ Site manager					

18.During the execution of a project are you informed of any consequences on project performance related to your role as a client? Explain.

……………………………………………………………………………………….…..……

19.What is the nature of your motivation for performance for your role? You can indicate more than one with a brief explanation. Please circle as appropriate.

A.Financial incentive

…………………………………………………………………………………………………

B.Non- financial

……………………………………………………………………………………..…………

C.Other (Please specify)……………………………………….……………………………………………

20.Explain how the risks you face on building projects influence how you allocate risk on future projects.

…………………………………………………………………………………………………

Thank you very much for your time

Appendix 7B: Interviews

Information Sheet for Participation in a Research Study
University of the Witwatersrand

Full title of Project: Risk allocation on Building Projects in the Zambian Construction Industry

Name, position and contact address of Researcher: Chipozya Kosta Tembo, PHD student University of the Witwatersrand University, Chipozya@yahoo.co.uk, +26096 688482 /+2728089806

Description of the research and your participation
You are invited to participate in a research study. The purpose of this research is to understand risk allocation practices in the Zambian construction industry on building projects with a view of developing a framework for enhancing risk allocation. Your participation is very important and will be very valuable in designing of a questionnaire to be disseminated in the Zambian construction industry. Your participation will involve responding to an interview session which will range from 60 minutes to 1 hour 20 Min. The information collected will be used for research purposes only. It is hoped that the information given is reflective of current risk allocation practices in the construction industry. Your participation is so important that the development of the framework depends on it.

Risks and discomforts
There are no known risks associated with this research. However during the interview session should the participant be seen or indicate to be uncomfortable the interview stopped to enable the interviewee compose themselves and proceeding will based on the advice of the participant.

Potential benefits
Ultimately, this research may be published on the Witwatersrand University website and it is hoped that a paper is published from the research. There are no known benefits to you that would result from your participation in this research. However, this research may help us to understand how to better allocate risks on building projects in the Zambia construction industry thereby enhancing project performance.

Protection of confidentiality
The records of this study will be kept strictly confidential. Research records will be kept in a locked file and all electronic information will be coded and secured using a password protected file. For audio recordings once the transcription is done the original recording will be destroyed to ensure anonymity of participant. The transcribed data will be coded with no indication of any identification data. We will not include any information in any report we may publish that would make it possible to identify you. Your identity will not be revealed in any publication resulting from this study.

Voluntary participation
Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information
If you have any questions or concerns about this study or if any problems arise, please contact Chipozya Kosta Tembo at University of the Witwatersrand at phone number or email given above. If you have any questions or concerns about your rights as a research participant, please contact the University of Witwatersrand at +27 11 717 7652/77669/777663. Or Research Ethics Committee on +27 11 717 1152

Interview Protocol Form

Project: Risk allocation on Building Projects in the Zambian Construction Industry

Date ____________________________ Time _________________Release form signed? ___________

Notes to interviewee:

Introduce interviewer

Thank you for your participation. I believe your input will be valuable to this research and in helping grow all of our professional practice in risk allocation.

Confidentiality of your responses is guaranteed

Reminder that participation is voluntary

Ask for permission to audio tape/take notes

Define risk allocation context for the study

Ask for permission to start the interview

Approximate length of interview: 60 minutes to 1hr: 20 minutes

Purpose of research: *To gain an understanding of risk allocation practices in the Zambian construction projects on building projects to develop a framework for risk allocation. This will include contract selection, contracts in use, significant risks, techniques and practices used for risk allocation.*

A. Can you please tell me about the following?

1. What qualifications do you possess?
2. What type of building construction projects are you engaged in?
3. How long have you been engaged on building projects?
4. How do you perceive risk on building construction projects?
   Probe: is it positive or negative on building project performance
5. Have you had any formal training in risk management and more specifically risk allocation? Kindly explain.

Response from Interviewee:

Observation by Interviewer

B. Can you give me an over view on what is considered on contract types used for building projects

1. Which contracts do you use or have you encountered on building projects?
2. Are clauses in contracts modified in standard contracts, please explain?
   Probe-Do you perceive that all possible risks are covered in standard contracts used?
3. What factors are considered in choosing a contract for use on any given building project?

   Probe- Could you please given specific considerations?

4. From the performance of past projects are the contracts that you use deficient in any way? e.g., method of allocation, omission of certain risks, provisions such as bond or insurance that cannot be obtain in our environment

   Probe- Are there contract provisions you think should be changed based on past experience. Explain?
5. Kindly tell me the risks you encounter on construction building projects?

   Probe- which risks significantly affects performance of building projects?
6. Kindly comment on the following in relation to risk allocation
   a. Contingency provisions in tender documents

      *Probe-A*re these adequate)
   b. Obtaining insurance and bonds for projects

      *Probe-*Are there any challenges faced
   c. Methods of construction suggested in contract documents

      Probe- Are these easy to execute

Response from Interviewee:

Observation by Interviewer

C. Can you describe some details of the practices / techniques and tools you use for risk allocation on building projects?

1. Please tell me the methods you use to identify risks?
2. Which of the methods identified do you use frequently?
3. What methods are used to analyze risks on building projects?
4. Which of the methods identified are mostly used?
5. In your view what is the rationale used to allocate risks e.g. ability to manage, cost, responsibility, impact, consequences?
6. Kindly tell me your general view of types of clauses used to allocate risk in terms of their effectiveness e.g.
   - Liquidated and ascertained damages- penalty clause
   - Interest for late payment or fluctuation provisions - escalation clause
   - Not entitled to claim after a given period- exculpatory clause/exemption clause
7. Would you describe risk allocation on building projects in the Zambian Construction Industry as balanced? Please explain.
8. Are there any barriers to carrying out risk allocation on building projects? E.g. lack of insurance cover for a given risk, etc. Kindly explain
9. How do you use past project knowledge to allocation risk on new or current projects?

Response from Interviewee:

Observation by Interviewer

- Closure
  - Thank you to interviewee
  - reassure confidentiality
  - ask permission to follow-up ______

Appendix 7C: Document Analysis

Information Sheet for Research Study
University of the Witwatersrand

Full title of Project: Risk allocation on Building Projects in the Zambian Construction Industry

Name, position and contact address of Researcher: Chipozya Kosta Tembo, PHD student University of the Witwatersrand University, Chipozya@yahoo.co.uk, +26096 688482 /+2728089806

Description of the research and your participation
You are invited to participate in a research study because your input is very valuable and because of your involvement in the construction of buildings. The purpose of this research is purely academic to understand risk allocation practices in the Zambian construction industry on building projects with a view of developing a framework for enhancing risk allocation. Your participation will involve sharing contract documents used in the last five years for building projects using various standard forms of contract. Ideally signed tender documents will suffice. The information collected will be used for research purposes only. Your participation is so important that the development of the framework depends on it.

Risks and discomforts
There are no known risks associated with this research.

Potential benefits
Ultimately, this research may be published on the Witwatersrand University website and it is hoped that a paper is published from the research. There are no known benefits to you that would result from your participation in this research. This research may help us to understand how to better allocate risk in building projects in the Zambian construction industry to enhance performance on building projects.

Protection of confidentiality
The records of this study will be kept strictly confidential. Research records will be kept in a locked file and all electronic information will be coded and secured using a password protected file. The data sheets used to summarise project information will be destroyed after five years of award of the degree. We will not include any information in any report we may publish that would make it possible to identify the project used. Instead projects will be given project numbers.

Voluntary participation
Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information
If you have any questions or concerns about this study or if any problems arise, please contact Chipozya Tembo at University of the Witwatersrand at the email address or phone number given on page above. If you have any questions or concerns about your rights as a research participant, please contact the University of Witwatersrand at +27 11 717 7652/77669/777663. Or Research Ethics Committee on +27 11 717 1152

Consent Form for Participation in a Research Study

University of the Witwatersrand

Please Tick Box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason. ☐

3. I agree to take part in the above study. ☐

4. I agree to share contract document(s) for projects ☐

_______________________ _______________ _______________

Name of Participant Date Signature

Document analysis templates

Risk Factor	Risk allocation						Impact			Nature of risk		Reimbursement method			Risk owner			
	Acceptance	Ignore	Mitigation	Share	Elimination	Share	Time	cost	Quality	Internal	External	Cost plus	hybrid	Fixed	Client	Contractor	Consultant	Undecided
Total																		

Types of clauses used									
	Express Clause								**Implied clause**
Risk Factor	**Penalty**	**escalation**	**Exclusion/ exemption**	**Assignmen**	**Obligatory**	**Force majeure**	**Indemnific ation**	**Waiver Clause**	
Total									

Risk Response Measure according to contract documentation																
Risk Factor	**modification of contract**	**Advance payment**	**Checking design before tender**	**Selecting stable supplier**	**insurance**	**Contingency sum**	**Contingency resources**	**Contingency float**	**Bonds/guarantees/ warranties**	**Early warning**	**Method of execution**	**Testing/inspection**	**Clear brief from client**	**Regular meetings/communication**	**Monitoring and supervision**	**Sub-contracting**
Total																

Appendix 7D: Model Validation Questionnaire

Information Sheet for Participation in a Research Study
University of the Witwatersrand

Full title of Project: Risk allocation on Building Projects in the Zambian Construction Industry

Name, position and contact address of Researcher: Chipozya Kosta Tembo, PHD student University of the Witwatersrand University, Chipozya@yahoo.co.uk, +26096 688482 /+2728089806

Description of the research and your participation
You are invited to participate in a research study because your participation is very valuable and important. The information given will be used for research purposes only. The purpose of this part of the research is to validate risk allocation framework developed for risk allocation in the Zambian construction industry building sector. The development of the framework depends on your input. Your participation will involve being part of an Expert Delphi panel which may take three (3) rounds. Your participation is so important that the development of the framework depends on it.

Risks and discomforts
There are no known risks associated with this research.

Potential benefits
Ultimately, this research may be published on the Witwatersrand University website and it is hoped that a paper is published from the research. There are no known benefits to you that would result from your participation in this research. This research may help us to discover a risk allocation framework for the building construction sector in the Zambian construction industry to enhance performance of building projects.

Protection of confidentiality
The records of this study will be kept strictly confidential. Research records will be kept in a locked file and all electronic information will be coded and secured using a password protected file. We will not include any information in any report we may publish that would make it possible to identify you. Your identity will not be revealed in any publication resulting from this study.

Voluntary participation
Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information
If you have any questions or concerns about this study or if any problems arise, please contact Chipozya Kosta Tembo at University of the Witwatersrand on details provided above. If you have any questions or concerns about your rights as a research participant, please contact the University of Witwatersrand at +27 11 717 7652/77669/777663. Or Research Ethics Committee on +27 11 717 1152

Consent Form for Participation in a Research Study *(used in the introductory round)*

University of the Witwatersrand

	Item	Yes	NO
1	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.		
2	I agree to be part of the Delphi expert panel		
3	I agree to the use of anonymised quotes in publications		
4	I have at least five years' experience construction industry or construction related field		
5	I possess a minimum of BSC or first Degree		
6	I have Professional registration		
7	I am Faculty member at an accredited institution of higher learning		
8	I have been a primary or secondary writer of at least 3 peer-reviewed journal articles		
9	I have presented at a conference before		
10	I have written or edited a of book or book chapter on risk management		
11	I am or have been a member or chair of a nationally recognized committee		

______________________________ ________________ __________________

Name of Participant Date Signature

Appendix 7E: Questionnaire for Delphi Expert Panel (Round 1)

Purpose: To validate risk allocation framework developed for risk allocation in the Zambian construction industry building sector. A framework is a broad overview, outline or skeleton of interlinked items that support a particular approach to a specific objective (risk allocation) and serves as a guide that can be modified as required by adding or deleting items.

1. What is your Primary professional background

   ……

2. What is your view about the sequencing of steps on risk allocation in the framework (feel free to add or omit or shuffle steps- refer to figure 1)

……………………………………………………………………………………..…………………..………..…..……………………………………

3. The following is a list of steps associated with the framework. Please rate your level of agreement with the following statements (step number and page number are indicated)

Item	Disagree strongly	Disagree	Agree	Strongly agree	Kindly note any general observations here
The initial risk assessment form is adequately formulated (3),pg. 4					
The risks for building works are adequately identified (4), pg. 6					
The form for risk identification is adequately formulated (4.1), pg. 7					
The qualitative assessment sheet is adequately formulated (5), pg. 7					
The quantitative assessment sheet is adequately formulated (6), pg.8					
The risk allocation sheet is adequately formulated (7), pg. 9					
The treatment criteria adequately illustrated (7.2), pg. 10					
The contract selection process adequately is illustrated (9), pg.11					
The contract authoring process is adequately illustrated (10), pg. 12					

4.The following is a list of steps associated with the framework. Please rate your level of agreement with decisions/activities to be made at each step (refer to step 1 to 17 -pages 3-14) (tick)

No.	Step	Disagree strongly	Disagree	Agree	Strongly agree	General observation
1	Decide on nature of building project					
2	Initial risk assessment					
3	Decide of procurement method and payment options					
4	Identify risks of project (contractual and non-contractual					
5	Conduct qualitative risk analysis					
6	Conduct quantitative risk analysis					
7	Decide on treatment options for identified risks					
8	Verification of procurement strategy					
9	Request (decide on contract form and check if initial procurement mode is still viable					
10	Authoring (edit existing form or draft new contract)					
11	Negotiation (among design team)					
12	Approval (of final document by relevant person(s)					
13	Tendering (adjudication and considering of risk concerns from tenders)					
14	Signing contract (final negotiation of risk liability)					
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)					
16	Compliance (reporting and auditing of risks)					
17	Renewal (identification of learns lessons learnt and changes for future practice and considerations for model update)					

5.The following is a list of steps associated with the framework. Please rate your level of agreement with the resources and requirements stated for each step (Refer to table 1-Process map for risk allocation on pages 2/3) (tick)

No.	Step	Disagree strongly	Disagree	Agree	Strongly agree	What additional resources/requirements are needed at this stage?
1	Decide on nature of building project					
2	Initial risk assessment					
3	Decide of procurement method and payment options					
4	Identify risks of project (contractual and non-contractual					
5	Conduct qualitative risk analysis					
6	Conduct quantitative risk analysis					
7	Decide on treatment options for identified risks					
8	Verification of procurement strategy					
9	Request (decide on contract form and check if initial procurement mode is still viable					
10	Authoring (edit existing form or draft new contract)					
11	Negotiation (among design team)					
12	Approval (of final document by relevant person(s)					
13	Tendering (adjudication and considering of risk concerns from tenders)					
14	Signing contract (final negotiation of risk liability)					
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)					
16	Compliance (reporting and auditing of risks)					
17	Renewal (identification of learns lessons learnt and changes for future practice and considerations for model update)					

Thank you for your participation

[Information email round II]

Dear Respondent,

Thank you for completing round 1 questionnaire of the Delphi Survey. A satisfactory group consensus for all questions was achieved as the coefficient of variation was between 0 and 0.5 in round 1 for all items (see attached results). Nevertheless, various issues were raised by various panellists on some improvements to be made.

The raw data collected from round 1 survey were analysed using; group modes, means, standard deviation and coefficient of variation were calculated. Based on the results from round 1, this round is expected to be the final round.

The purpose of round II is to have other panellists express their views on the comments raised from other panel members as suggestions for improvement. The feedback has an additional column were comments can be made. Kindly be very clear and specific in your comments to help us make meaningful improvements to the framework.

If you have any questions regarding this survey. Please do not hesitate to contact me at chipozya@yahoo.co.uk

Thanking you in advance for your favourable response.

Kind Regards

Chipozya

Appendix 7F: Questionnaire for Delphi Expert Panel (Round 2)

1. <u>The sequencing of the framework</u>

	Comments on Sequencing - framework	Round 2 Comment From expert
EXPT01	The generic risk allocation framework outlines how construction practitioners can operate and oversee risk-based project activities through a well sequenced risk management process. Essentially, practitioners have to align the framework with organizational culture.	
EXPT02	The sequencing is appropriate	
EXPT03	Good presentation of the needs. One issue that is not spelt out, but which should be included is integration of the contractor's risk assessment with that of client/consultant (probably at the construction phase, but ideally as soon as possible).	
EXPT04	There is nothing fundamentally flawed with your framework (suggestions were made for activities within)	
EXPT05	Risk management should run throughout the project process. Under project activities the arrow head should be shown for "No" from 2 to 0 (it does from initiation to completion, operation phase is outside the scope of the study)	
EXPT06	The sequencing is well structured consider. What happens if the tender process does not end-up with a successful bidder	
EXPT07	Since the procurement system selected for any project is in large part dependent on the need of the client, designers, and contractors to allocate risk, the logic of deciding on a procurement system then given the sequence you show, identifying key risks is flawed in the extreme. Since the key risks could well come and be predicted on the procurement system selected, you have a situation in which the subsequent observations on risk are predicted on former decisions. In effect the only way that this could work rigorously would be to re-run the process repeatedly taking into account each of the available procurement systems.	
EXPT08	I am confused about where you have placed project activity 3-Procurement and payment options. Surely this activity only occurs after activities 4-7 and agreement of design of the facility to be constructed. Should rather be linked to activity 2.	
EXPT09	The sequencing is acceptable however what happens when tenders are not responsive or when you cant's select any	

2.Adequacy of the form formulation and illustrations

No.	Item	Comments from round 1 questionnaire	Comment from experts- round 2
1	The initial risk assessment form is adequately formulated	003 consider consultant and contractors risk 005 forms to stand alone and not depend on any other documents. Consider site information. 006 consider environmental risks 009 add environmental risks	
2	The risks for building works adequately identified	006 consider separating risk at each stage of the project design, tender construction 009 separate risks depending on phase of the project	
3	The form for risk identification is adequately formulated	005 not satisfied with classification under nature of project 008 where are risks related to client knowledge, complexity, project duration, project team, specification	
4	The qualitative assessment sheet is adequately formulated	003 assess in terms of probability and impact 006 consider use of risk matrix	
5	The quantitative assessment sheet is adequately formulated	005 under risk rating indicate like hood x relative impact	
6	The risk allocation sheet is adequately formulated		
7	The treatment criteria adequately illustrated		
8	The contract selection process adequately is illustrated	003 why are items under consideration different for public and private sector	
9	The contract authoring process is adequately illustrated		

3.Adequacy of decisions/activities at each stage

No.	Item	Comments from round 1 questionnaire	Comments from expert- Round 2 questionnaire
1	Decide on nature of building project	007 use of the word nature in step 1 is considered too broad 008 what about client requirements/ project objectives	
2	Initial risk assessment	004 proposed use of risk register instead	
3	Decide of procurement method and payment options	006 good to make decision for procurement route early to benefit different types of clients 008 client experience and availability of expertise	
4	Identify risks of project (contractual and non-contractual)	004 write all identified risks as risk events, 007 considers activity 2, and 4 to be out of sequence 4 to come earlier	
5	Conduct qualitative risk analysis	003 not clear enough	
6	Conduct quantitative risk analysis	004 use of risk matrix for likelihood X impact; instead of what I have for likelihood to use likelihood -1: <1%, Likelihood 2: 1-5%, Likelihood 3:5-10%, likelihood 4: 10-25%, likelihood 5: 25-50% and so on for impact use impact 1:<1% of budget; impact 3: 5-10% of budget, impact 4: 10-25% of budget, impact 5 : > 25% of budget	
7	Decide on treatment options for identified risks		
8	Verification of procurement strategy	008 probably a party external to the client would give input	
9	Request (decide on contract form and check if initial procurement mode is still viable		
10	Authoring (edit existing form or draft new contract)		
11	Negotiation (among design team)	004 rename as Review and revision to scope & specification	
12	Approval (of final document by relevant person(s)	004 to include list of documents to be approved	

No.	Item	Comments from round 1 questionnaire	Comments from expert- Round 2 questionnaire
13	Tendering (adjudication and considering of risk concerns from tenders)	004 Expand to 4 tasks to include 1. Tender posting and questions 2. Risk based tender evaluation 3. Selection proponent 4. clarification and negotiation 006 consider loop from 13 back to 12 if tender(s) is not acceptable 008 health and safety issues	
14	Signing contract (final negotiation of risk liability)	008 authority to sign (presence of personnel)	
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)		
16	Compliance (reporting and auditing of risks)		
17	Renewal (identification of l lessons learnt and changes for future practice and considerations for model update)	004 retitle renewal to lessons learnt	

4.Adequacy of Resources and requirements

No.	Step	Comments from Experts Round 1 questionnaire	Comments from experts -Round 2
1	Decide on nature of building project		
2	Initial risk assessment		
3	Decide of procurement method and payment options		
4	Identify risks of project (contractual and non-contractual		
5	Conduct qualitative risk analysis		
6	Conduct quantitative risk analysis		
7	Decide on treatment options for identified risks		
8	Verification of procurement strategy		
9	Request (decide on contract form and check if initial procurement mode is still viable		
10	Authoring (edit existing form or draft new contract)		
11	Negotiation (among design team)	003 not clear what is to be negotiated	
12	Approval (of final document by relevant person(s)	003 client has a review function here	
13	Tendering (adjudication and considering of risk concerns from tenders)		
14	Signing contract (final negotiation of risk liability)		
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)	003 need for an integrated risk management plan by client/contractor/consultants	
16	Compliance (reporting and auditing of risks)		
17	Renewal (identification of learns lessons learnt and changes for future practice and considerations for model update)	003 system is needed to capture knowledge; lessons learnt 009 be clear on who is involved in the process	

Thank you for your participation

Appendix 7G: Validation/Verification questionnaire to Professionals in the Zambian construction Industry

Information Sheet for Participation in a Research Study
University of the Witwatersrand

Full title of Project: Risk allocation on Building Projects in the Zambian Construction Industry

Name, position and contact address of Researcher: Chipozya Kosta Tembo, PHD student University of the Witwatersrand University, Chipozya@yahoo.co.uk, +26096 688482 /+2728089806

Description of the research and your participation
You are invited to participate in a research study because your participation is very valuable and important. The information given will be used for research purposes only. The purpose of this part of the research is to validate risk allocation framework developed for risk allocation in the Zambian construction industry building sector. The development of the framework depends on your input. Your participation will involve completing a questionnaire. Your participation is so important that the development of the framework depends on it.

Risks and discomforts
There are no known risks associated with this research.

Potential benefits
Ultimately, this research may be published on the Witwatersrand University website and it is hoped that a paper is published from the research. There are no known benefits to you that would result from your participation in this research. This research may help us to discover a risk allocation framework for the building construction sector in the Zambian construction industry to enhance performance of building projects.

Protection of confidentiality
The records of this study will be kept strictly confidential. Research records will be kept in a locked file and all electronic information will be coded and secured using a password protected file. We will not include any information in any report we may publish that would make it possible to identify you. Your identity will not be revealed in any publication resulting from this study.

Voluntary participation
Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information
If you have any questions or concerns about this study or if any problems arise, please contact Chipozya Kosta Tembo at University of the Witwatersrand on details provided above. If you have any questions or concerns about your rights as a research participant, please contact the University of Witwatersrand at +27 11 717 7652/77669/777663. Or Research Ethics Committee on +27 11 717 1152

Consent Form for Participation in a Research Study

University of the Witwatersrand

Please Initial Box

1. Confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason. ☐

3. I agree to take part in the above study. ☐

4. I agree to be part of the verification process (questionnaire) ☐

6. I agree to the use of anonymised quotes in publications ☐

Name of Participant	Date	Signature
______________________	____________	______________

Validation instrument for Professionals in the ZCI: Purpose of research: ***To validate the generic holistic framework for risk allocation.***
A framework is a broad overview, outline or skeleton of interlinked items that support a particular approach to a specific objective (risk allocation) and serves as a guide that can be modified as required by adding or deleting items.

A. Can you please tell me about the following?

Item	Response
I. Years' in experience in the construction industry	
II. Qualification e.g. B.Sc. Quantity survey etc.	
III. Professional registration e.g. EIZ, SIZ, ZIA, QSRB, RICS etc.	
IV. Nature of building projects engaged in e.g. schools, hotels, shopping malls etc.	

B. What is your view about the sequencing of steps on risk allocation in the framework (feel free to add or omit or shuffle steps- refer to Framework)

………

………

………

………

………

C. The following is a list of steps associated with the framework. Please rate your level of agreement with the following statements (step number and page number are indicated)

Item	Disagree strongly	Disagree	Agree	Strongly agree	Kindly note any general observations here
The initial risk assessment form is adequately formulated (3),pg. 4					
The risks for building works are adequately identified (4), pg. 6					
The form for risk identification is adequately formulated (4.1), pg. 7					
The qualitative assessment sheet is adequately formulated (5), pg. 7					
The quantitative assessment sheet is adequately formulated (6), pg.8					
The risk allocation sheet is adequately formulated (7), pg. 9					
The treatment criteria adequately illustrated (7.2), pg. 10					
The contract selection process adequately is illustrated (9), pg.11					
The contract authoring process is adequately illustrated (10), pg. 12					

D.The following is a list of steps associated with the framework. Please rate your level of agreement with decisions/activities to be made at each step (refer to step 1 to 17 -pages 3-14) (tick)

No.	Step	Disagree strongly	Disagree	Agree	Strongly agree	General observation
1	Decide on nature of building project					
2	Initial risk assessment					
3	Decide of procurement method and payment options					
4	Identify risks of project (contractual and non-contractual					
5	Conduct qualitative risk analysis					
6	Conduct quantitative risk analysis					
7	Decide on treatment options for identified risks					
8	Verification of procurement strategy					
9	Request (decide on contract form and check if initial procurement mode is still viable					
10	Authoring (edit existing form or draft new contract)					
11	Negotiation (among design team)					
12	Approval (of final document by relevant person(s)					
13	Tendering (adjudication and considering of risk concerns from tenders)					
14	Signing contract (final negotiation of risk liability)					
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)					
16	Compliance (reporting and auditing of risks)					
17	Renewal (identification of learns lessons learnt and changes for future practice and considerations for model update)					

E. The following is a list of steps associated with the framework. Please rate your level of agreement with the resources and requirements stated for each step (Refer to table 1-Process map for risk allocation on pages 2/3) (tick)

No.	Step	Disagree strongly	Disagree	Agree	Strongly agree	What additional resources/requirements are needed at this stage?
1	Decide on nature of building project					
2	Initial risk assessment					
3	Decide of procurement method and payment options					
4	Identify risks of project (contractual and non-contractual					
5	Conduct qualitative risk analysis					
6	Conduct quantitative risk analysis					
7	Decide on treatment options for identified risks					
8	Verification of procurement strategy					
9	Request (decide on contract form and check if initial procurement mode is still viable					
10	Authoring (edit existing form or draft new contract)					
11	Negotiation (among design team)					
12	Approval (of final document by relevant person(s)					
13	Tendering (adjudication and considering of risk concerns from tenders)					
14	Signing contract (final negotiation of risk liability)					
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)					
16	Compliance (reporting and auditing of risks)					
17	Renewal (identification of learns lessons learnt and changes for future practice and considerations for model update)					

F.Are there deficiencies in the framework? Kindly explain

………..…………………………

……

……..………………………

………..…………………………

- Permission to follow-up : Yes ______ No ______
- Thank you for your participation

Appendix 8- Document analysis results

Appendix 8A Project 1

Project No 1 Based on Joint liason Committee contract

	Risk Allocation by client						Impact				risk		reimbursement				Party allocated to			
Risk factor	Retention/acceptance	elimination	Tranfer	Ignore	reduction /mitigation	Share	Cost	Time	Quality	Other	Internal	External	cost plus	hybrid	Not applicable	Fixed fee	client	contractor	consultant A, QS, Eng, PM	undecided
Clarity of Drawings and Technical Specifications			X				X	X	X		X				X				X	
Contractor's Underestimate of Construction Cost			X				X	X	X		X		X					X		
Client's Financial Stability	X						X	X			X		X				X			
Contractor's Financial Difficulties					X		X	X			X		X					X		
Defective Workmanship and Rework			X						X		X		X					X		
Poor supervision of contractor	X								X		X				X				X	
Unclear scope of works	X						X	X			X				X		X			
Poor quality materials			X						X		X		X					X	X	
Errors and Omissions in Design Drawings			X				X	X	X		X				X				X	
Poor coordination and communication							X	X	X		X				X				X	
Inadequate site investigation	X						X	X			X		X						X	
Poor supervision on site			X				X	X	X		X				X			X		
In adequate budgeting and contingencies	X						X	X			X		X						X	
Poor planning of resources -materials, labour, equipment			X				X	X	X		X		X					X		
Delay in Payment Process by the Client	X						X	X			X		X				X			
Lack of inspection of works	X								X		X				X				X	
Delay in Consultant's Approval of Materials Submission					X			X	X		X				X				X	
Inadequate specification	X								X		X				X				X	
Escalation in Material Prices				X			X	X				X			X					
Poor Labour Productivity			X					X			X		X					X		
Lack of Experience in Similar Projects			X						X		X				X			X		
Unrealistic contract duration			X				X	X	X		X					X		X		
Slow decision making process by client	X						X	X	X		X		X				X			
Total	9	0	10	1	2	0	15	17	15		22	1	11	0	11	1	4	9	10	0

Risk Factor	Provision details/comments
Clarity of Drawings and Technical Specifications	clause 3 indicates the architect and QS are to be custodians of contract drawings and contract Bills clause 3 (2) indicates that contract should be furnished with such requirements
Contractor's Underestimate of Construction Cost	It is assumed that contractor with provided information should be in a position to estimate effectively. This project had drawings provided and other information of the required quality of materials and how work is to be finished
Client's Financial Stability	No indication was made as to the sources of finance of the client. Assumed that the client has the finances
Contractor's Financial Difficulties	Contractor was not given any advance payment under this contract. Late payment was exhibited under this contract and this affects cash flow of contractor. Insurance at 10 % should enable contractor to perform

Defective Workmanship and Rework	Clause 6 indicates that workmanship should conform to description, testing and inspection. Architect responsible for ensuring these are done in accordance with contract bills clause 12
Poor supervision of contractor	Role of architect according to clause 6 and clerk of works according to clause 10
Unclear scope of works	Scope of works defined and contract bills and drawings give an appreciation of work to be carried. In addition clause 11 gives architect power to give variations and provide for prime cost sums
Poor quality materials	Clause 6 indicates that quality should conform to descriptions in contract bills.
Errors and Omissions in Design Drawings	Clause 12(II) states that error in description or in quantity in or omission of items in contract bills shall be corrected by architect. No mention is made of design drawings this seems to suggest that contract bill are paramount.
Poor coordination and communication	there is no specific clause for communication under this contract but it is assumed that since the architect is contract administrator architect is also the channel for communication
Inadequate site investigation	the project information did not indicate that any investigations were done but did indicate that contract had to satisfy themselves with the site by doing a site visit at their own expense
Poor supervision on site	Clerk of works responsible for supervision of on site. However the sole duty of supervision on site is left to the contractor
In adequate budgeting and contingencies	10 % contingency provided in BOQ
Poor planning of resources - materials, labour, equipment	No requirements indicated for the contractor to meet in terms of labour, plant/equipment. Late completion attracts LAD
Delay in Payment Process by the Client	Contract provides for 21 days for contractor to be paid after submission of claim/valuation. No clause specifically deals with late payment but clause 24 provides for compensation if the architect deems so. This practices contributes to contractors financial difficulty
Lack of inspection of works	Contract provides for clerk of works as client representative on site to inspect works on site (Clause 10)
Delay in Consultant's Approval of Materials Submission	The major clause is 6 and there is no provision indicating that materials have to be approved but practice is that materials have to be submitted for inspection
Inadequate specification	contracts bills specify material quality and drawings also amplify
Escalation in Material Prices	the provisions for escalation/fluctuation are cancelled and therefore not applicable under this project
Poor Labour Productivity	The duty of the contractor is to ensure that progress is as programmed. Clerk of works is on site to observe productivity
Lack of Experience in	Experience required not indicated in the tender documents. The

Similar Projects	bidding process was selective this was looked at short listing of contractors
Unrealistic contract duration	It is implied that contractor should satisfy themselves that they can do the work in the stipulated time
Slow decision making process	Architect is to decision whether client is really slow in giving information

Appendix 8B Project 2 ZIA

Project No 2Based on Joint liason Committee contract

	client						Impact				of risk		reimburseme				allocated to			
Risk factor	**Retention/acceptance**	**elimination**	**Tranfer**	**Ignore**	**reduction /mitigation**	**Share**	**Cost**	**Time**	**Quality**	**Other**	**Internal**	**External**	**cost plus**	**hybrid**	**Not applicable**	**Fixed fee**	**client**	**contractor**	**consultant A, QS, Eng, PM**	**undecided**
Clarity of Drawings and Technical Specifications			X				X	X	X		X				X				X	
Contractor's Underestimate of Construction Cost			X				X	X	X		X		X					X		
Client's Financial Stability	X						X	X			X		X				X			
Contractor's Financial Difficulties					X		X	X			X		X					X		
Defective Workmanship and Rework			X						X		X		X					X		
Poor supervision of contractor	X								X		X				X				X	
Unclear scope of works	X						X	X			X				X		X			
Poor quality materials			X						X		X		X					X	X	
Errors and Omissions in Design Drawings				X			X	X	X		X				X				X	
Poor coordination and communication							X	X	X		X				X				X	
Inadequate site investigation	X						X	X			X		X						X	
Poor supervision on site			X				X	X	X		X				X			X		
In adequate budgeting and contingencies	X						X	X			X		X						X	
Poor planning of resources -materials, labour, equipment			X				X	X	X		X		X					X		
Delay in Payment Process by the Client	X						X	X			X		X				X			
Lack of inspection of works	X								X		X				X				X	
Delay in Consultant's Approval of Materials Submission					X			X	X		X				X				X	
Inadequate specification	X								X		X				X				X	
Escalation in Material Prices				X			X	X				X			X					
Poor Labour Productivity			X					X			X		X					X		
Lack of Experience in Similar Projects			X						X		X				X			X		
Unrealistic contract duration			X				X	X	X		X					X		X		
Slow decision making process by client	X						X	X	X		X		X				X			
Total	9	0	9	2	2	0	15	17	15	0	22	1	11	0	11	1	4	9	10	

Risk Factor	Provisions/ Comments
Clarity of Drawings and Technical Specifications	No drawings were given to tenderers at the time of tender. Clause 8 of contract stated that contract should acquaint themselves with documents
Contractor's Underestimate of Construction Cost	in the absence of drawings the possibility of underestimation was high however bills of quantities were not provided
Client's Financial Stability	clients did not declare their source of funding
Contractor's Financial Difficulties	no advance was paid to the contractor under this project
Defective Workmanship and Rework	Clause 6 indicates that workmanship should conform to description, testing and inspection. Architect responsible for ensuring these are done in accordance with contract bills clause 12
Poor supervision of contractor	Role of architect/project manager according to clause 6

Unclear scope of works	Scope of works defined and contract bills given as appreciation of work to be carried. In addition clause 11 gives architect power to give variations and provide for prime-cost sums
Poor quality materials	Clause 6 indicates that quality should be conforming to descriptions in contract bills.
Errors and Omissions in Design Drawings	Clause 12(II) states that error in description or in quantity in or omission of items in contract bills shall be corrected by architect. No mention is made of design drawings this seems to suggest that contract bill are paramount. Additionally it was stated that client would not be liable for any deficiency or ambiguity in design drawings.
Poor coordination and communication	there is no specific clause for communication under this contract but it is assumed that since the architect is contract administrator architect is also the channel for communication
Inadequate site investigation	The project information did not indicate that any investigations were done but did indicate that contractor had to satisfy themselves with the site by doing a site visit at their own expense. The information to tenderers
Poor supervision on site	Contractor responsible for supervision of on site. However the sole duty of supervision on site is left to the contractor
In adequate budgeting and contingencies	Contingency provided was in the sum of US4 50,000
Poor planning of resources - materials, labour, equipment	No requirements indicated for the contractor to meet in terms of labour, plant/equipment. Item 10 on information to tenders indicated that contract was to decide the actual equipment and personnel needed for the execution of the works
Delay in Payment Process by the Client	Contract provides for 28 days for contractor to be paid after submission of claim/valuation in special conditions. No clause specifically deals with late payment but clause 24 provides for compensation if the architects deems so meaning it’s at the discretion of the architect. This practice contributes to contractors financial difficulty
Lack of inspection of works	Contract provides for architect/project manager to inspect works
Delay in Consultant's Approval of Materials Submission	The major clause is 6 and there is no provision indicating that materials have to be approved but materials have to conform to description in contract bills
Inadequate specification	contracts bills specify material quality and drawings also amplify
Escalation in Material Prices	no escalation clause was applicable under the contract
Poor Labour Productivity	The duty of the contractor is to ensure that progress is as programmed. Clerk of works is on site to observe productivity however no clerk of works was appointed on this project
Lack of Experience in Similar Projects	Experience required not indicated in the tender documents. The bidding process was selective this was looked at short listing of contractors
Unrealistic contract duration	It is implied that contractor should satisfy themselves that they can do the work in the stipulated time
Slow decision making process	Architect is to decision whether client is really slow in giving information

Appendix 8C Project 3 ZPPA Open international Bidding/ FIDIC Red Book

Project No 3 Based on ZPPA open international Bidding

		Risk Allocation by client						Impact				risk		reimbursement				Party allocated to			
	Risk factor	Retention/acceptance	elimination	Tranfer	Ignore	reduction /mitigation	Share	Cost	Time	Quality	Other	Internal	External	cost plus	hybrid	Not applicable	Fixed fee	client	contractor	consultant A, QS, Eng, PM	undecided
1	Clarity of Drawings and Technical Specifications			x				x	x	x		x				x				x	
2	Contractor's Underestimate of Construction Cost			x				x	x	x		x		x					x		
3	Client's Financial Stability	x						x	x			x		x				x			
4	Contractor's Financial Difficulties					x		x	x			x		x					x		
5	Defective Workmanship and Rework			x						x		x		x					x		
6	Poor supervision of contractor			x						x		x				x				x	
7	Unclear scope of works	x						x	x			x				x		x			
8	Poor quality materials			x						x		x		x					x	x	
9	Errors and Omissions in Design Drawings						x	x	x	x		x				x			x	x	
10	Poor coordination and communication						x	x	x	x		x				x			x	x	
11	Inadequate site investigation			x				x	x			x		x						x	
12	Poor supervision on site			x				x	x	x		x				x			x		
13	In adequate budgeting and contingencies			x				x	x			x		x						x	
14	Poor planning of resources - materials, labour, equipment			x				x	x	x		x		x					x		
15	Delay in Payment Process by the Client	x						x	x			x		x				x			
16	Lack of inspection of works			x						x		x				x				x	
17	Delay in Consultant's Approval of Materials Submission						x		x	x		x		x						x	
18	Inadequate specification			x						x		x				x				x	
19	Escalation in Material Prices			x				x	x				x			x					
20	Poor Labour Productivity			x					x			x		x					x		
21	Lack of Experience in Similar Projects			x						x		x				x			x		
22	Unrealistic contract duration			x				x	x			x							x		
23	Slow decision making process by client	x						x	x	x		x					x	x			
	Total	4	0	15	0	1	3	15	17	14	0	22	1	11	0	10	10	4	11	10	0

Risk Factor	Provision details/comments
Clarity of Drawings and Technical Specifications	clause 1.5 prioritises documents as follows specifications, drawings and schedules
Contractor's Underestimate of Construction Cost	clause 4.11 (a) states that contractor should have satisfied himself as to the correctness and sufficiency of the accepted contract sum therefore underestimation is contractors risk
Client's Financial Stability	source of finance not given payment bond not acquired by client
Contractor's Financial Difficulties	contractor to be paid 20% advanced payment under this project
Defective Workmanship and Rework	Clause 4.9 requires the contractor to institute a quality assurance system and clause 7.3 allows employer to inspect the works. Clause 11.5 provides for the removal of defective work at contractors cost and may have to increase the performance security
Poor supervision of contractor	Engineer and other consultants are to ensure that contractor is supervised however this is a design and build and designer and contractor are one consortium

Unclear scope of works	details of project for the facilities and capacities needed were provided under project data however the finishes and materials to be used for construction were left to consortium company
Poor quality materials	clause 7.2 provides for sample s of materials to given to the engineer for consent prior to using materials in or for the works
Errors and Omissions in Design Drawings	this being a design and build the consortium company is responsible for this risk which will be resolved internally
Poor coordination and communication	Design and construction consortium had to coordinate and communicate effectively in this design and build project mainly to ensure that client is happy with project
Inadequate site investigation	The client was to provide the site access and the consortium company was to carry out all the necessary investigations. The risk remains with the consortium company
Poor supervision on site	Engineer would normally supervise but this being a design and build project the consortium company has to ensure adequacy
In adequate budgeting and contingencies	This being a design and build needs the consortium company to prove adequate budgeting and contingencies for their design
Poor planning of resources - materials, labour, equipment	clause 6.1 contractor to make arrangements for labour
Delay in Payment Process by the Client	Clause 14.7 states that the client shall pay the contractor with 56 days after submission of documents. Delayed payment entitles financing charges compounded monthly on amount unpaid.
Lack of inspection of works	7.3 provides for employers personnel access to inspect the work during construction as well as carrying out tests
Delay in Consultant's Approval of Materials Submission	client in this case had to approve materials submission samples according to clause 7.2
Inadequate specification	client requirements were given with indicated capacities but no requirements for finishes or materials for construction materials were given
Escalation in Material Prices	this is a firm fixed price contract not subject to escalation despite the fact that the project is 24 months and that the general conditions provide for escalation
Poor Labour Productivity	Clause 8.6 provides for rate of progress to be observed by employer and to give contractor instructions on how to speed up provided that the causes of delays are not compensation events list in sub-clause 8.4
Lack of Experience in Similar Projects	the documents specifically requested a contractor experience of a least 2 similar stadia built
Unrealistic contract duration	It is implied I clause 8.2 that contractor should satisfy themselves that they can do the work in the stipulated time
Slow decision making process	Architect is to decision whether client is really slow in giving information. Could result in engineer’s determination

Appendix 8D Project 4 ZPPA Open international Bidding- FIDIC Red book

Project No 4 Based on ZPPA Open international

	client				Impact				risk		reimburse		to		
Risk factor	Retention/acceptance	Tranfer	reduction /mitigation	Share	Cost	Time	Quality	Other	Internal	External	cost plus	Not applicable	client	contractor	consultant A, QS, Eng, PM
Clarity of Drawings and Technical Specifications	x				x	x	x		x			x			x
Contractor's Underestimate of Construction Cost		x			x	x	x		x		x			x	
Client's Financial Stability	x				x	x			x		x		x		
Contractor's Financial Difficulties			x		x	x			x		x			x	
Defective Workmanship and Rework		x					x		x		x			x	
Poor supervision of contractor	x						x		x			x			x
Unclear scope of works	x				x	x			x			x	x		
Poor quality materials		x					x		x		x			x	x
Errors and Omissions in Design Drawings	x				x	x	x		x			x			x
Poor coordination and communication				x	x	x	x		x			x		x	x
Inadequate site investigation	x				x	x			x		x				x
Poor supervision on site		x			x	x	x		x			x		x	
In adequate budgeting and contingencies	x				x	x			x		x				x
Poor planning of resources -materials, labour, equipment		x			x	x	x		x		x			x	
Delay in Payment Process by the Client	x				x	x			x		x		x		
Lack of inspection of works	x						x		x			x			x
Delay in Consultant's Approval of Materials Submission	x					x	x		x		x				x
Inadequate specification	x						x		x			x			x
Escalation in Material Prices		x			x	x				x		x			
Poor Labour Productivity		x				x			x		x			x	
Lack of Experience in Similar Projects		x					x		x			x		x	
Unrealistic contract duration		x			x	x	x								
Slow decision making process by client	x				x	x	x								
	12	8	1	2	15	17	15		22	1	11	10	3	9	10

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Risk Factor	Provision details/comments
Clarity of Drawings and Technical Specifications	The drawings were not complete at the time of tender and general information on project indicated that changes were to be expected
Contractor's Underestimate of Construction Cost	while the contractors price was expected to be final the designs were not complete
Client's Financial Stability	It was indicated by the client that sources of finance for the project were borrowed from a disclosed source
Contractor's Financial Difficulties	Whereas the contractor was entitled to 20% advance payment but the pertinent clause 14.4 on schedule of payment was deleted from the project conditions
Defective Workmanship and Rework	workmanship was to be done in accordance with standard specification of materials in the contract document and as stipulated in “workmanship for building works October 1977 “
Poor supervision of contractor	Supervision of the contractor with the project manager and other consultants

Unclear scope of works	the employer deemed to have provided enough detail for pricing purposes and it was expected that changes would be made
Poor quality materials	Specification document provides very detailed requirements on the quality of materials
Errors and Omissions in Design Drawings	the design drawings provided at tender stage were not final therefore amendments, revision and improvement were added along the way
Poor coordination and communication	It was Project manager responsibility to coordinate and ensure communication between all the members of the design team
Inadequate site investigation	The contractor in accordance with information to tenderers information had to bear all the assurance responsibilities themselves and conduct investigations
Poor supervision on site	Engineer would normally supervise but this being a design and build project the consortium company has demonstrate competence
In adequate budgeting and contingencies	the design team was to provide for adequate budgeting and contingencies under the project design
Poor planning of resources - materials, labour, equipment	Clause 6.1 contractor to make arrangements for labour. No indication of corresponding labour or equipment requirements were given
Delay in Payment Process by the Client	Clause 14.7 states that the client shall pay the contractor with 56 days after submission of claims. Delayed payment entitles financing charges compounded monthly on amount unpaid.
Lack of inspection of works	7.3 provides for employers personnel access to inspect and carry out tests during construction
Delay in Consultant's Approval of Materials Submission	client in this case had to approve materials submission samples according to clause 7.2
Inadequate specification	client requirements were given which indicated capacities but no requirements for finishes or materials for construction materials were given
Escalation in Material Prices	this is a firm fixed price contract not subject to escalation despite the fact that the project is 24 months and that the general conditions provide for escalation
Poor Labour Productivity	clause 8.6 provides for rate of progress to be observed by employer and to give contractor instructions on how to speed up provided that the causes of delays are not compensation events list in sub-clause 8.4
Lack of Experience in Similar Projects	the documents specified that the contractor should have experience in similar works and the experience of the contractor was given
Unrealistic contract duration	It is implied I clause 8.2 that contractor should satisfy themselves that they can do the work in the stipulated time
Slow decision making process	Architect is to decision whether client is really slow in giving information. Could result in engineer's determination clause 3.5

Appendix 8E Project 5 ZPPA Open National Bidding

Project No 5 Based on ZPPA Open National

Risk factor	Risk Allocation by client						Impact				risk		reimbursement				Party allocated to			
	Retention/acceptance	elimination	Tranfer	Ignore	reduction /mitigation	Share	Cost	Time	Quality	Other	Internal	External	cost plus	hybrid	Not applicable	Fixed fee	client	contractor	consultant A, QS, Eng, PM	undecided
Clarity of Drawings and Technical Specifications	X						X	X	X		X				X				X	
Contractor's Underestimate of Construction Cost			X				X	X	X		X				X			X		
Client's Financial Stability	X						X	X			X				X		X			
Contractor's Financial Difficulties					X		X	X			X				X			X		
Defective Workmanship and Rework			X						X		X		X					X		
Poor supervision of contractor	X								X		X				X				X	
Unclear scope of works	X						X	X			X				X		X			
Poor quality materials			X						X		X			X				X	X	
Errors and Omissions in Design Drawings	X						X	X	X		X					X			X	
Poor coordination and communication						X	X	X	X		X				X				X	
Inadequate site investigation	X						X	X			X		X						X	
Poor supervision on site			X				X	X	X		X				X			X		
In adequate budgeting and contingencies	X						X	X			X				X				X	
Poor planning of resources - materials, labour, equipment			X				X	X	X		X				X			X		
Delay in Payment Process by the Client	X						X	X			X		X				X			
Lack of inspection of works	X								X		X				X				X	
Delay in Consultant's Approval of Materials Submission					X			X	X		X					X			X	
Inadequate specification	X								X		X					X			X	
Escalation in Material Prices			X				X	X				X			X					
Poor Labour Productivity			X					X			X				X			X		
Lack of Experience in Similar Projects			X						X		X				X			X		
slow decision making process of the client	X						X	X	X		X					X	X			
Unrealistic contract duration			X				X	X	X		X					X		X		
Total	11	0	9	0	2		15	17	15	1	21	1	3	1	14	4	4	9	10	0

Risk Factor	Provisions/comment
Clarity of Drawings and Technical Specifications	No drawing provided at the time of tendering for contractor to appreciate the works. BOQs were to be relied upon.

Contractor's Underestimate of Construction Cost	This is contractors risk with no response measure attached to it. It is made difficult because the contract is fixed with no fluctuations. Lack of drawings and no site data makes it difficult for contractor to price accurately. This may result in a high bid as contractors would want to cover themselves.
Client's Financial Stability	The client declared the source of funding for the project but no payment guarantee was provided for in the contract
Contractor's Financial Difficulties	An advance payment of 10% was given to alleviate the contractors financial difficulty however the bond covers to be taken out (approximately 40% of contract sum) are higher than 10% advance payment which defeats it's the purpose of the advance payment. Additionally, a bond has to be obtained before payment can be made.
Defective Workmanship and Rework	this can only be identified through inspection of works by PM provided for in clause 22 but contractor should provide adequate supervision
Poor supervision of contractor	This is the role of the project manager under the contract
Unclear scope of works	Whereas the client is under obligation to pay for additional work, clause 37.5 of the contract puts the onus on the contractor to provide early warning for such variations as a requirement for the variations to be compensated. If employer issues variation orders there is no justification for the contractors' early warning prescription.
Poor quality materials	contractors materials should be approved before inclusion in the works
Errors and Omissions in Design Drawings	contractor should bring this to the attention of PM as per instructions as stipulated in clause 41-3c
Poor coordination and communication	PM should act as means of communication and liaison for all involved members on the project (design team and construction team)
Inadequate site investigation	The consultants are responsible for site investigations. The contractor is also obligated to verify by conducting a site visit. But for this project a site visit was at the expense of the contractor and not compulsory. Item 14 in the site data provided site information however no results were included in the contract document of tests done on soils or any other aspect of the site etc.
Poor supervision on site	Proper supervision, monitoring and quality assurance responsibility resides with the contractor to avoid rework
In adequate budgeting and contingencies	The project had a contingency amount given and at the same time had too many provisional sums. This affects the accuracy of the contingency sum as there many other works not measured to certainty.
Poor planning of resources -materials, labour, equipment	Clauses 2.5/2.6 provide for the actual labour requirements in terms of personnel, and equipment
Delay in Payment Process by the Client	Payment process should be within 28 days. Any delayed payment entitles the contractor to interest on delayed amount according to clause 40.2

Lack of inspection of works	The PM is responsible to carryout work inspection failure to which the contractor may get away with poorly done work. However should the work be unsatisfactory the PM can order the contractor to rework. But inspections are not done often enough especially in the public sector. Clause 22 indicates that contractor should prove access to works. clause 41-3d provides for uncovering of works by PM
Delay in Consultant's Approval of Materials Submission	Clause 41-3c indicates that if PM delays or does not issue drawings, specifications or instructions required for execution of works on time this is a compensation event. Sadly there are no time bars indicated and this is a challenge for contractor to be success in such claim
Inadequate specification	Apart from the descriptions in the BOQs. There contractor had no supplementary information on specifications as no drawing were present at tender stage and no additional specifications were given in the contract documents
Escalation in Material Prices	no escalation provided for under this contract according to clause 14.6
Poor Labour Productivity	Ensuring that works on site proceed as agreed is the duty of the contractor. PM has the duty to inform contractor to engage more people or give permission to sub contract to speed up the works
Lack of Experience in Similar Projects	Clause 2.5/2.6 provide for the level of experience a contractor should have. Therefore this risk should be averted at tender adjudication stage
Unrealistic contract duration	It is implied that contractor should satisfy themselves that they can do the work in the stipulated time
Slow decision making process	This qualifies to be a compensation event clause 41

Appendix 8F PROJECT 6 on ZPPA Open National

Risk Factor	Provisions/Comments
Clarity of Drawings and Technical Specifications	All necessary drawings were provided under this project at tender stage, with BOQ but no other additional details for specification
Contractor's Underestimate of Construction Cost	contractors risk project not subject to price adjustment
Client's Financial Stability	clause 2 declares that client has funds
Contractor's Financial Difficulties	Contractor given advance payment of 20% of contract sum however performance security is at 30% for insurance security and 10% for bank guarantee. Insurance of works, materials and property are in excess of 30% of contract sum
Defective Workmanship and Rework	Clause 31 provides that the PM shall identify defects and notify the contractor
Poor supervision of contractor	PM should supervise contractor by way of inspections and audits of work clause 22

Unclear scope of works	PM is mandated to clarify scope add or omit to scope but ZPPA regulations provide that scope changes should not exceed 25%
Poor quality materials	no contract provision is in place for inspection of materials on this project
Errors and Omissions in Design Drawings	This could be a compensation when the contractor brings this to the attention of the PM under clause 41.1C which requires that an instruction be given to give clarity
Poor coordination and communication	clause 6.1 provides that all communication should be in writing and clause 30.2 provides that PM and contractor shall cooperate
Inadequate site investigation	this is measured provisionally therefore is the risk of the client and if it's a ground condition it is a compensation event 41.1f
Poor supervision on site	contractor is to offer supervision
In adequate budgeting and contingencies	the project had 10% contingency and Provisional sums in excess of ZMK 500,000 for electrical, air-conditioning and plumbing
Poor planning of resources -materials, labour, equipment	this is the job of the contractor to ensure that planning for resources is done adequately
Delay in Payment Process by the Client	the payment of the contractor should have been monthly according to clause 39 but the client stated that payment could be late and that they would not liable while construction was on-going but would be after 56 days of completion
Lack of inspection of works	Project manager in clause 31 is to inspect works for defects
Delay in Consultant's Approval of Materials Submission	contractor is to construct in accordance to Bill of quantities specification
Inadequate specification	no specific provision for this but early warning could be given so that the PM can issue instruction as to what could be done
Escalation in Material Prices	clause not applicable on this contract
Poor Labour Productivity	The contractor is to ensure that labour productivity is in line with programme submitted. The PM is also to monitor progress and can order contractor to provide revised programme according to clause 25.2
Lack of Experience in Similar Projects	The bidding data provided for the contractor to have had at least 3 years' experience in similar projects
Unrealistic contract duration	It is implied that contractor should satisfy themselves that they can do the work in the stipulated time
Slow decision making process	This qualifies to be a compensation event clause 41

Project 6 ZPPA Open National Bidding

Risk factor	Retention/acceptance	elimination	Tranfer	Ignore	reduction /mitigation	Share	Cost	Time	Quality	Other	Internal	External	cost plus	hybrid	Not applicable	Fixed fee	client	contractor	consultant A, QS, Eng, PM	undecided
Clarity of Drawings and Technical Specifications	X						X	X	X		X				X				X	
Contractor's Underestimate of Construction Cost			X				X	X	X		X		X					X		
Client's Financial Stability	X						X	X			X		X				X			
Contractor's Financial Difficulties					X		X	X			X		X					X		
Defective Workmanship and Rework			X						X		X		X					X		
Poor supervision of contractor	X								X		X				X				X	
Unclear scope of works	X						X	X			X		X				X			
Poor quality materials			X						X		X				X			X	X	
Errors and Omissions in Design Drawings	X						X	X	X		X				X				X	
Poor coordination and communication	X						X	X	X		X				X				X	
Inadequate site investigation	X						X	X			X		X						X	
Poor supervision on site			X				X	X	X		X		X					X		
In adequate budgeting and contingencies	X						X	X			X		X						X	
Poor planning of resources -materials, labour, equipment			X				X	X	X		X		X					X		
Delay in Payment Process by the Client	X						X	X			X		X				X			
Lack of inspection of works	X								X		X		X						X	
Delay in Consultant's Approval of Materials Submission					X			X	X		X		X						X	
Inadequate specification	X								X		X		X						X	
Escalation in Material Prices			X				X	X				X			X			X		
Poor Labour Productivity			X					X			X		X					X		
Lack of Experience in Similar Projects			X						X		X		X					X		
Unrealistic contract duration			X				X	X	X		X					X		X		
Slow decision making process by client	X						X	X	X		X		X				X			
Total	12	0	9	0	2	0	15	17	15	0	22	1	16	0	6	1	4	10	10	0

Appendix 8G Project 7 ZPPA Small works

Risk factor	Risk Allocation by client						Impact				Nature of risk		Method of reimbursement				Party allocated to			
	Retention/acceptance	elimination	Tranfer	Ignore	reduction /mitigation	Share	Cost	Time	Quality	Other	Internal	External	cost plus	hybrid	Not applicable	Fixed fee	client	contractor	consultant A, QS, Eng, PM	undecided
Clarity of Drawings and Technical Specifications	X						X	X	X		X		X						X	
Contractor's Underestimate of Construction Cost			X				X	X	X		X		X					X		
Client's Financial Stability	X						X	X			X		X				X			
Contractor's Financial Difficulties					X		X	X			X		X					X		
Defective Workmanship and Rework			X						X		X		X					X		
Poor supervision of contractor	X								X		X				X				X	
Unclear scope of works	X						X	X			X				X		X			
Poor quality materials			X						X		X		X					X	X	
Errors and Omissions in Design Drawings	X						X	X	X		X		X						X	
Poor coordination and communication	X						X	X	X		X		X						X	
Inadequate site investigation	X						X	X			X		X						X	
Poor supervision on site			X				X	X	X		X				X			X		
In adequate budgeting and contingencies	X						X	X			X		X						X	
Poor planning of resources -materials, labour, equipment			X				X	X	X		X		X					X		
Delay in Payment Process by the Client	X						X	X			X		X				X			
Lack of inspection of works	X								X		X				X				X	
Delay in Consultant's Approval of Materials Submission	X							X	X		X		X						X	
Inadequate specification	X								X		X		X						X	
Escalation in Material Prices			X				X	X				X			X					
Poor Labour Productivity			X					X			X		X					X		
Lack of Experience in Similar Projects			X						X		X				X			X		
Unrealistic contract duration			X				X	X	X		X					X		X		
Slow decision making process by client	X						X	X	X		X		X				X			
Total	13	0	9	0	1	0	15	17	15	0	22	1	16	0	6	1	3	8	10	0

Risk Factor	Provision details/comments
Clarity of Drawings and Technical Specifications	All the necessary drawings for this Project were provided
Contractor's Underestimate of Construction Cost	This is contractors risk
Client's Financial Stability	clause 2 indicated the clients source of finance though no payment bond was provided under the contract
Contractor's Financial Difficulties	20 % advance pay applicable

Defective Workmanship and Rework	this can only be identified through inspection of works by PM provided for in clause 22 but contractor should provide adequate supervision
Poor supervision of contractor	The PM should adequately supervise the contractor in collaboration with other consultants
Unclear scope of works	Variation clause applies and clarification is to be sought in linen with clause 41-3c early warning for compensation
Poor quality materials	Contractors' materials should be approved before inclusion in the works by Project manager and section 1 of documents demands that the origin of materials should give. However no details of formation of proof is given
Errors and Omissions in Design Drawings	contractor should bring this to the attention of PM for instructions Clause 41-3c
Poor coordination and communication	PM should act as means of communication and liaison for all involved in the project. all communication according to clause 6 of conditions should be in writing
Inadequate site investigation	Consultants are responsible for site investigations. The contractor is also supposed to satisfy themselves by doing a site visit. But for this project a site visit was at the expense of the client and was compulsory. item 14 in the site date provided site information however no results are included in the contract document of test done on soils etc.
Poor supervision on site	it is the job of the contractor to supervise on site to avoid rework
In adequate budgeting and contingencies	The project had a contingency sum of 10% of the contract sum given and at the same time had provisional sums for components which could have been easily quantified such as window panes, circuit breakers, toilet cubicles
Poor planning of resources - materials, labour, equipment	Section 1 indicates the actual labour, materials and equipment needed for the project. Contractor could be guided by this
Delay in Payment Process by the Client	Payment process should be within 28 days. Any delayed payment is entitles to interest according to clause 40.2
Lack of inspection of works	The PM is mandated to carryout work inspection to mitigate the installation of shoddy work by the contractor should the work be unsatisfactory the PM can order the contractor to rework. But inspections are not done often especially in the public sector. Clause 22 indicates that contractor should provide access to works. clause 41-3d provides for uncovering of works by PM
Delay in Consultant's Approval of Materials Submission	Clause 41-3c indicates that if PM delays or does not issue drawings, specifications or instructions required for execution of works on time, this is regarded as a compensation event. However, there are no time bars indicated and this is a challenge for contractor to be successful in such claim

Inadequate specification	Apart from the descriptions in the BOQs the contractor had some detailed information of specifications in the contract document in addition to drawings provided at tender stage.
Escalation in Material Prices	Although the special conditions were not put in place the standard General conditions of Contract provide for escalation. This project documentation had no clause providing for escalation
Poor Labour Productivity	Ensuring that works on site proceed as agreed is the duty of the contractor. PM has the duty to inform contractor to engage more people or give permission to sub contract to speed up the works
Lack of Experience in Similar Projects	experience levels needed for this project not specified in the contract document
Unrealistic contract duration	It is implied that contractor should satisfy themselves that they can do the work in the stipulated time
Slow decision making process	This qualifies to be a compensation event clause 41

Appendix 8H Project 8 based on ZPPA Small works

Risk Factor	**Provisions/Comment**
Clarity of Drawings and Technical Specifications	Detailed architectural and structural drawings were provided under the contract. Clause 15 indicated that the PM would clarify contract data and drawings and specifications are part of contract data
Contractor's Underestimate of Construction Cost	This is contractors' risk. Contractor was given drawings and a site visit and contract bills with quantities. This could reduce cost underestimation to some extent
Client's Financial Stability	the instruction to bidders indicated that the client had set aside funds from own resources to finance the project
Contractor's Financial Difficulties	The contract according to special conditions was to be given 30% advance payment clause 35.1. Performance guarantee was set at 10% of contract sum and insurance was to be obtained jointly clause 34.1
Defective Workmanship and Rework	Clause 33 identification of defects is to be done by the PM
Poor supervision of contractor	The PM was to supervise contractor to ensure that project is of good quality within budget and timeline
Unclear scope of works	the scope was defined but it was unclear as to whether the false roof was replacing an existing roof
Poor quality materials	there is no provision in the contract for approval of materials but that the contractor in accordance with clause 16.1 shall construct and install the works in accordance with the specification and drawings

Errors and Omissions in Design Drawings	Clause 15.1 provides for the PM to clarify queries regarding contract data
Poor coordination and communication	communication between parties according to clause 6.1 is to be in writing
Inadequate site investigation	Clause 14 provided for the contractor to rely on any site investigation reports. However, no such information was provided under this project
Poor supervision on site	The PM is to supervise the contractor on site
In adequate budgeting and contingencies	A contingency sum of 10% was provided for
Poor planning of resources - materials, labour, equipment	this is the contractors duty to formulate a programme and ensure that resources are sourced timely
Delay in Payment Process by the Client	clause 42 provides that the payment should be within the 28 days of claim/valuation documentation
Lack of inspection of works	Clause 33 provides for PM to inspect works
Delay in Consultant's Approval of Materials Submission	4.1 provides for PM to decide on contractual matters without giving any guidelines as to time frames for response
Inadequate specification	The PM was to clarify contract matters so that specifications are adequate and this is a compensation event according to 44.1c provided that early warning is given. However sum compensation is difficult to achieve as the response period to be followed by the PM was not given
Escalation in Material Prices	no escalation provided for under this project
Poor Labour Productivity	clause 27 on the programme required the contractor to give programmes monthly which could be used a basis to gauge the contractors progress
Lack of Experience in Similar Projects	no mention was made of the similar experience but health and safety was of concern
Unrealistic contract duration	It is implied that contractor should satisfy themselves that they can do the work in the stipulated time
Slow decision making process	This qualifies to be a compensation event clause 41

Project No 8 Based on ZPPA Small works

	client						Impact				e of		reimburseme				allocated to			
Risk factor	Retention/acceptance	elimination	Tranfer	Ignore	reduction /mitigation	Share	Cost	Time	Quality	Other	Internal	External	cost plus	hybrid	Not applicable	Fixed fee	client	contractor	consultant A, QS, Eng, PM	undecided
Clarity of Drawings and Technical Specifications	X						X	X	X		X		X						X	
Contractor's Underestimate of Construction Cost			X				X	X	X		X		X					X		
Client's Financial Stability	X						X	X			X		X				X			
Contractor's Financial Difficulties					X		X	X			X		X					X		
Defective Workmanship and Rework			X						X		X		X					X		
Poor supervision of contractor	X								X		X				X				X	
Unclear scope of works	X						X	X			X				X		X			
Poor quality materials			X						X		X		X					X	X	
Errors and Omissions in Design Drawings	X						X	X	X		X		X						X	
Poor coordination and communication	X						X	X	X		X		X						X	
Inadequate site investigation	X						X	X			X		X						X	
Poor supervision on site			X				X	X	X		X				X			X		
In adequate budgeting and contingencies	X						X	X			X		X						X	
Poor planning of resources -materials, labour, equipment			X				X	X	X		X		X					X		
Delay in Payment Process by the Client	X						X	X			X		X				X			
Lack of inspection of works	X								X		X				X				X	
Delay in Consultant's Approval of Materials Submission	X							X	X		X		X						X	
Inadequate specification	X								X		X		X						X	
Escalation in Material Prices			X				X	X				X			X					
Poor Labour Productivity			X					X			X		X					X		
Lack of Experience in Similar Projects			X						X		X				X			X		
Unrelistic contract duration			X				X	X	X		X					X		X		
Slow decision making process by client	X						X	X	X		X		X				X			
	13	0	9	0	1	1	15	17	15	0	22	1	16	0	6	1	4	9	10	0

Appendix 9A Risk mitigation

Comment	Concept	Theme
Taking steps to mitigate future risks-QS2	steps to mitigate	Risk mitigation /avoidance
Able to mitigate future risks and handle them better-QS13	ability to mitigate risks	
Eye opener to mitigate future risks-PM3	mitigate future risks	
All enquiries regarding risk are adequately addressed before signing K7B	addressing of risks before signing	
Covering of risk in future projects-QS25	covering risks	
Transfer direct future risks in a manner that is cost efficient- ENG3	cost efficient transfer	
Better future mitigation of risks-ENG1	risk mitigation	
Identify mistakes and implement prevention systems PM2	implement prevention system	
By implementing measures to prevent risks faced on past projects on future ones-PM5	measure to prevent risk	
Risks faced on current projects teach how to handle risk/possible risks on future projects-AR1	teach to handle risks	
helps with mitigation strategy –AR4	mitigation strategy	
Risks faced give better understanding on how best to deal with future risks on other projects-K16B	better understanding of risk	
experience gained helps that a perfect product is achieved ultimately-AR5	helps perfect product	
They make us ready/prepared to face and foresee future risks CL4	prepare to face and foresee risk	
Clear issues on risk before signing for new project-K7B Help to minimise the occurrence of similar risks-K16B	addressing of risks before signing minimize risk	
Its helps to resolve and foresee the future risks-AR33	resolve and foresee risk	
Improves ability to mitigate future risk-AR14	improves ability to mitigate	
Help us to handle risks when they occur on future projects-K16B	handle risks on future projects	
Experience helps mitigation measures employer before occurrence-CL2	experience helps mitigate risks	
Experience helps in resolving future risks because most of our project drawings are standard-AR27	experience helps resolve risks	
Learn from experience and avoid future risk-QS4,	learn from experience	
Lessons learnt become areas of focus to reduce reoccurrence of risks- ENG27,	lessons reduce risk reoccurrence	
The knowledge we get from one project helps us to avoid whatever problems (risks) in the future-AR16	knowledge to mitigate risks	
Planning for mitigation of risks is taken care of -QS16	planning for risk mitigation	
Experience helps in planning and managing future projects-PM10	experience helps planning	

Risks faced give better understanding on how best to deal with future risks on other projects-K16B	better understanding on how to handle risks	
Risks experienced allows one to prepare for similar and possible future risks thus avoiding trouble-AR32 Its helps to resolve and foresee the future risks-AR33	experienced risks help to prepare resolve and foresee risk	
Management of risk so that project does not go over budget-QS15	management of risk	
They help to manage risk of future projects-QS17	manage risk	
Past risk: they help to manage risks on future projects-QS17	manage risk	
Basis for handling future risks-ENG 10	basis for risk handling	
helps handling future risks -ENG 11	risk handling	
Better warning and management systems-ENG23	better management	
Experience helps in planning and managing future projects-PM10	experience helps management	
Past experience helps to determine how to handle similar risks for future projects-AR10	handle similar risks	
Helps to face risks allocated on future projects-AR21	face risks on future projects	
Improves our ability to avoid the likelihood of risks occurring altogether-AR14	ability to avoid risk	
It acts as a caution to do better so as to avoid encountering similar risks –K8A	caution for avoidance of similar risks	
Need to careful before being allocated a project K15A	care before project award	
We learn which work not to do K21B	work to avoid	
You are more careful and thereby provide enough cover for similar encountered risks K9B	cover for risk	
Better able to control or avoid risks based on past experiences-K4C	Risk avoidance	
It acts as caution on type of client to build for K28C	caution on client selection	
Helps to put measures that were not expected so as to manage risk, avoid it or shape it K30C	Risk avoidance	
Risks faced help to identify and avoid risks on future projects K36C	Risk avoidance	
Gaining experience for risk avoidance K37C	Risk avoidance	
Able to improve ability to control or avoid K4C	Risk avoidance	

Appendix 9B- Lessons learnt

Comment	**Concept**	**Theme**
Lessons learnt help in the formulation of future projects-QS14 Helps improve the delivery of next project-QS29 Opportunity to learn- ENG3 Basis for continuous improvement-ENG9 Lessons learnt become areas of focus to reduce reoccurrence of risks ENG27 Learning lessons for future performance-PM1 Lessons learnt to improve future implementation-PM2 risks faced give a learning opportunity and experience for better risk allocation on future projects-AR7 Risks form lessons for improvement in performance of future projects-AR28 Each project is a learning curve –AR37 Used a learning curve help identify what to work on in future-K4A Experience provides a learning curve for future projects -K6B Projects results are a basis of lessons learnt for future projects-K10C Experiences are treated as learning curves K25C	Lessons learnt	Lessons learnt

Appendix 9C- Risk planning

Comment	**Concept**	**Theme**
Helps to plan our future projects based on experience CL6	Proper planning of future projects	Risk planning
Planning for mitigation of risks is taken care of -QS16	planning for risk mitigation	
Better future planning-ENG7	improved planning	
Basis for forecasting as a planning tool using best ways to overcome risks-PM5	planning tool to overcome risks Forecasting for future projects	
It is easier to plan for risks as it helps to know what to anticipate-PM14	eases planning	
Experience helps in planning and managing future projects-PM10	experience helps planning	
Studying cause of risk and come up with solution for future occurrences-AR3	solutions for the future	
Past projects help us to plan for future projects-AR23	plan future projects	
They save as a guide for future projects hence give confidence in executing works AR24	guide for future projects	
Gives a forecast on future projects-AR26	Forecasting for future projects	
Past project knowledge used in Project Structuring-AR22	knowledge gained used to structure projects	
Risks experienced allows one to prepare for similar and possible future risks thus avoiding trouble-AR32	prepare for similar/possible risks	
It's a basis for forecasting as a planning tool since one could find best ways and factors to overcome initial risks CL1	basis for forecasting	
Its helps to resolve and foresee the future risks-AR33	foresee future	
They make us ready/prepared to face and foresee future risks CL4	prepare to face future risk	
Help in risks identification and necessary risk management planning-K2A	risk management planning	
Better planning is adopted for future projects- 10A	better planning	
Give an idea of how future projects should be handled-K12A	handling of future risk	
Response helps to prepare for next project-K13A		
Past risks faced equipment us on how to better prepare for risk in the future –K14A	better preparation	
Help in necessary planning-K1B	planning	
Safety precautions for future projects-K2B	safety precautions	
Use past experience to plan future projects -K4B	plan future projects	
Similar risks provide future information on how better to do the next project-K5B	information on how to improve	
Helps to understand required resources for future project of the same magnitude-K8B	required resources	
They help us to properly forecast future projects-K15B	Forecasting for future projects	
Used to plan future projectsK22B	plan future projects	
Helps in planning effectively by providing a certain percentage for material escalation K16C	effective planning for material escalation	
Experience is used for planning purposes K42C	planning	

Appendix 9 D- Contract documentation

Comment	**Concept**	**Theme**
Detailed documentation-QS3	Detailed documentation	Contract documentation
Clauses in contract that are based on market behaviour-QS5	modify clauses	
Reference is made of past risks that are documented on future projects-ENG26	reference to documentation	
Use knowledge to update our standard form templates-PM9	update standard contracts	
To add clauses in the contract that clearly define how risks will be handled-AR13	modify clauses	
Clear definition of project specifications to avoid ambiguity in project planning –AR29	clear specification	
Clear definition of project specifications to avoid ambiguity in implementation-AR29	clear specification	

Appendix 9E- Risk identification

Comment	**Concept**	**Theme**
Establish the expected risks and resolve them before the project commences-QS31	expected risks	Risk identification
Identify mistakes and implement prevention systems PM2	identify mistakes	
helps with identification -AR4	risk identification	
Similar projects informs on areas likely to be affected and when consequences are adverse-AR9	areas to be affected	
On-going projects expose realistic scenarios that occur during implementationAR26	exposure of realistic scenarios	
Risks on future projects are foreseeable and can be dealt with accordingly –AR31a	risk foreseeability	
It helps to resolve and foresee the future risks-AR33	risk foreseeability	
Experience helps to foresee CL2	risk foreseeability	
Help in risks identification and necessary risk management planning-K2A	risk identification	
Help in risk identification- K1B	risk identification	
Helps to understand client (attractive or not)K1B	client selection	
We learn which materials are problematic to procureK21B	problematic materials	
Risks faced help to identify and avoid risks on future projects K36C	risk identification	

Appendix 9F- Risk response

Comment	**Concept**	**Theme**
Risks faced on projects allow for research for remedies to be established-QS7	remedy establishment	
Where there are more risks more funds are allocated-QS22	allocation of more funds	
Helps to be more inclusive in future projects e.g. time and money-Qs28	realistic time and money	
Helps in designs for future to cater for inadequaciesENG19	adequacy of designs	
Training for personnel dealing with contract management ENG15	training personnel	
Criteria changed depending on the experiences and feedback from previous projects (contractor selection) ENG16	change of criteria	
Helps in setting out the time basis on risks faced especially in same environment-practical time ENG19	practical time	
Better accuracy for project cost and project duration-ENG13	accuracy of project cost and duration	
Past experiences influence future risk response and management-PM11	Future response	
Appointment of competent site supervisor AR1	Competent personnel	
QS to prepare BOQ-AR1	have BOQ on project	
Time allocation to checks and control of risks-AR13	realistic time	
Record of risks assessment is kept for future reference-AR35	record keeping	
Insistence on written consent from relevant authorities-AR38	written communication	
Careful consideration of consultants/ contractors at tender evaluation CL5	selection of consultants/contractor	
Become more proactive to ensure we do not face the same or similar risk -K1A	Proactive on risks	
How past risks are dealt with is applied on future projectsK3A	application on future projects	
Care is taken as financial (rate)/fluctuations as project may cost more than the contract price- K5A	financial planning	
Become more alert to avoid or lessen risks e.g. buy materials in small quantities and employ a guard to avoid theft K6A	material procurement Site security	
Look at cost implications of previous risk and ensure appropriate personnel and plan is mobilised K10B	financial planning, appropriate personnel	
Helps to develop better approach for tendering for new projects-K8B	better tendering	
Insuring the projectK18B	insurance	
Correct material prices and exchange rates are considered at tender stage-K1C	better tendering	
Try to ensure that clients have finance-K2C	Financial planning	
Improve skilled manpower on projects-K3C	appropriate personnel	Risk response

Critical inspections of materials prior to purchase-K3C	material inspection
Increase preliminary amounts to cover for unforeseen risks- K3C	financial planning
Factoring of costs related to cost related risk-K7C	financial planning
Consider the a correct material price, K11C	material procurement
Consider material availability K11C	material procurement
Consider exchanges rates K11C	exchanges
Past projects provide a basis to response to future projects considering site conditions and client-K12C	client selection, site conditions
Having trained work force on site-K13C	appropriate personnel
Having safety talk every morning-K13C	safety
Selecting projects with low risk in terms of client/consultant-K14C	project selection
Direct site instructions-K15C	communication
risks faced on certain projects help you to shun certain projects, K17C	project selection
risks faced on certain projects help you sub-contract some work, K17C	subcontracting
risks faced on certain projects help you raise rates to cover for price escalationK17C	financial planning
financial discipline and financial monitoring of material pricing K18C	Pricing
insuring of injury or accidents K20C	insurance for injury
factor in for risk of price escalation K20C	Financial planning
inflate the profit marginK20C	Pricing
use of own resources when client delays to payK21C	management
Close supervision K22C	supervision
Employment of skilled labour K22C	appropriate personnel
Increase allowances in work pricing-K22C	pricing
Outsourcing depending on risk K23C	subcontracting
Use of insurance to transfer risk K24C	insurance
Subcontracting K24C	subcontracting
Negotiate risk with client K24C	negotiation
More resources are allocated to risks frequently faced on previous project K31C	resource planning
Increase in depreciation in cost of materials borne by clientK32C	financial planning
Helps to put more resources on risks faced on prior projects K36C	resources planning
Demand for more information about project e.g. surveys, tests, drawings & BOQs –K8C	Demand more information

Appendix 9G- Risk analysis

Comment	**Concept**	**Theme**
Past projects do influence the next project for we look at the financier ability -AR15	financier analysis	Risk analysis
Past experience known makes it easier to analyse and tackle future anticipated risks-AR19	analyze and tackle future risk	
The knowledge we obtain as a result of past experience helps in judgement on future projects-AR25	Judgment on future projects	

Appendix 9H- Risk allocation

Comment	**Concept**	**Theme**
Risks faced on projects allow for research for remedies to be established-QS7	Remedies establishment	Risk allocation
Gives information on how to allocate future risksQS8	information on allocation	
Risks faced on building projects influence future risk allocation as lessons learnt provide- QS19	lessons learnt for risk allocation	
useful guide in dealing with future similar situations -QS21	Guide in similar situation	
Current risks set precedence for future risk allocation-ENG4	precedence for risk allocation	
Risks faced influence the allocation of future risks-ENG25	influence future allocation	
risks faced give a learning opportunity and experience for better risk allocation on future projects-AR7	better risk allocation	
Every risk on a project provides a leading opportunity for better risk allocation-AR8	better risk allocation	
It also helps to understand if allocation is adequate and if remedies are sufficient-K17B Experience on past projects help to identify who can manage risks more effectively –QS6	understand adequacy of allocation who should manage risk	

Appendix 9I Cross tabulation of Years of Experience and method of risk identification

Respondent	Years	RI using brainstorming	RI Using Delphi Technique	RI using SWOT analysis	RI using Influence diagram	RI using questionnaire	RI using checklist	RI using Flow charts	RI using Local Knowledge	RI using Interview	RI using Expert knowledge	RI using Document review	RI using Site visit	RI using past projects
Clients	1-5 yrs	0.25	0	0	0	1	0.25	0	0.33	1	0	0	0.167	0.167
	6-10 Yrs	0.5	0	1	0	0	0.5	0	0.66	0	0.66	0.5	0.5	0.5
	11-15 Yrs	0	0	0	0	0	0	0	0	0	0	0.25	0.167	0.167
	0ver 15	0.25	0	0	0	0	0.25	1	0	0	0.33	0.25	0.167	0.167
	Total	**1.000**	**0.000**	**1.000**	**0.000**	**1.000**	**1.000**	**1.000**	**0.990**	**1.000**	**0.990**	**1.000**	**1.001**	**1.001**
Consultants	1-5 Yrs	0.422	0.5	0.378	0.555	0.375	0.31	0.5	0.385	0.367	0.394	0.327	0.435	0.388
	6-10 Yrs	0.203	0	0.162	0.111	0	0.224	0.182	0.214	0.3	0.154	0.218	0.165	0.2
	11-15 Yrs	0.172	0.25	0.216	0.222	0.25	0.155	0.182	0.114	0.1	0.126	0.109	0.117	0.118
	0ver 15	0.203	0.25	0.243	0.111	0.375	0.31	0.136	0.286	0.233	0.324	0.345	0.282	0.294
	Total	**1.000**	**1.000**	**0.999**	**0.999**	**1.000**	**0.999**	**1.000**	**0.999**	**1.000**	**0.998**	**0.999**	**0.999**	**1.000**
Project managers	1-5 Yrs	0.375	0	0.25	0	0	0.3	0.25	0.4	0.333	0.25	0.2	0.308	0.273
	6-10 Yrs	0.25	1	0.125	0	0.25	0.3	0.25	0.2	0.333	0.333	0.3	0.307	0.273
	11-15 Yrs	0.125	0	0.25	0	0.25	0.1	0.25	0.1	0.167	0.167	0.2	0.154	0.182
	0ver 15	0.25	0	0.375	0	0.5	0.3	0.25	0.3	0.167	0.25	0.3	0.231	0.273
	Total	**1.000**	**1.000**	**1.000**	**0.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.001**
Contractor	1-5 Yrs	0.312	0	0.45	0.125	0.454	0.273	0.333	0.35	0.33	0.41	0.421	0.386	0.418
	6-10 Yrs	0.312	0	0.25	0.375	0	0.227	0.389	0.217	0.182	0.245	0.158	0.243	0.218
	11-15 Yrs	0.188	0	0.15	0.125	0.273	0.227	0.111	0.2	0.242	0.184	0.236	0.186	0.145
	0ver 15	0.188	0	0.15	0.375	0.273	0.272	0.167	0.233	0.242	0.163	0.184	0.186	0.218
	Total	**1.000**	**0.000**	**1.000**	**1.000**	**1.000**	**0.999**	**1.000**	**1.000**	**0.996**	**1.002**	**0.999**	**1.001**	**0.999**

Appendix 9J Cross tabulation of Level of education and method of risk identification

Respondent	Level of education	RI using brainstorming	RI Using Delphi Technique	RI using SWOT analysis	RI using Influence diagram	RI using questionnaire	RI using checklist	RI using Flow charts	RI using Local Knowledge	RI using Interview	RI using Expert knowledge	RI using Document review	RI using Site visit
Clients	Certificate	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Diploma	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Bachelors	1.000	0.000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Masters	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	**1.000**	**0.000**	**1.000**	**0.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
Consultants	Certificate	0.016	0.000	0.027	0.111	0.125	0.017	0.045	0.014	0.033	0.014	0.018	0.012
	Diploma	0.047	0.000	0.027	0.000	0.125	0.086	0.136	0.071	0.033	0.028	0.036	0.071
	Bachelors	0.734	0.750	0.676	0.667	0.375	0.603	0.591	0.671	0.700	0.718	0.709	0.729
	Masters	0.203	0.250	0.270	0.222	0.375	0.293	0.227	0.243	0.233	0.239	0.236	0.188
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**0.999**	**0.999**	**0.999**	**0.999**	**0.999**	**0.999**	**1.000**
Project managers	Certificate	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Diploma	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Bachelors	0.875	1.000	0.875	0.000	0.750	0.800	1.000	0.700	0.833	0.833	0.800	0.769
	Masters	0.125	0.000	0.125	0.000	0.250	0.200	0.000	0.300	0.167	0.167	0.200	0.231
	Total	**1.000**	**1.000**	**1.000**	**0.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
Contractor	Certificate	0.042	0.000	0.000	0.000	0.000	0.098	0.056	0.053	0.100	0.044	0.083	0.061
	Diploma	0.125	0.000	0.000	0.125	0.200	0.122	0.111	0.125	0.167	0.089	0.111	0.121
	Bachelors	0.771	1.000	0.833	0.750	0.700	0.732	0.722	0.732	0.667	0.778	0.750	0.742
	Masters	0.069	0.000	0.167	0.125	0.100	0.048	0.111	0.089	0.067	0.089	0.056	0.076
	Total	**1.007**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**0.999**	**1.001**	**1.000**	**1.000**	**1.000**

Appendix 9K-Cross tabulation of Year of experience and risk Analysis (by proportion)

Respondent		Brainstorming	Probability impact matrix	Checklist	Expert judgement	Risk breakdown structure	Interview	Consult specialist	Risk premium	Intuition	Judgement Risk analysisi Process	Probality distribution	Sensitivity analysis	Monte Carlo
	0-5 years	0.000	1.000	0.000	0.000	1.000	0.000	0.333	0.000	0.000	0.000	1.000	0.000	0.000
	6-10 Years	0.600	0.000	0.670	0.670	0.000	0.000	0.333	0.000	1.000	0.000	0.000	0.000	0.000
	11-15 years	0.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Clients	0ver 15 years	0.200	0.000	0.330	0.330	0.000	1.000	0.333	0.000	0.000	0.000	0.000	0.000	0.000
		1.000	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**0.999**	**0.000**	**1.000**	**0.000**	**1.000**	**0.000**	**0.000**
	0-5 years	0.450	0.083	0.391	0.333	0.500	0.346	0.412	0.200	0.444	0.555	0.250	0.470	1.000
	6-10 Years	0.180	0.250	0.239	0.196	0.125	0.346	0.255	0.200	0.111	0.111	0.250	0.059	0.000
	11-15 years	0.180	0.167	0.130	0.107	0.375	0.115	0.157	0.200	0.000	0.222	0.125	0.235	0.000
Consultants	0ver 15 years	0.180	0.500	0.239	0.339	0.000	0.192	0.176	0.400	0.444	0.111	0.375	0.235	0.000
		0.990	**1.000**	**0.999**	**0.975**	**1.000**	**0.999**	**1.000**	**1.000**	**0.999**	**0.999**	**1.000**	**0.999**	**1.000**
	0-5 years	0.333	0.000	0.200	0.220	0.333	0.400	0.375	0.000	0.330	0.330	0.000	0.000	0.000
	6-10 Years	0.167	0.500	0.300	0.330	0.333	0.200	0.250	0.000	0.000	0.000	0.500	0.000	1.000
Project	11-15 years	0.333	0.000	0.200	0.111	0.333	0.200	0.125	0.000	0.000	0.000	0.000	0.000	0.000
managers	0ver 15 years	0.067	0.500	0.300	0.333	0.000	0.200	0.250	0.000	0.660	0.660	0.500	1.000	0.000
		0.9	**1.000**	**1.000**	**0.994**	**0.999**	**1.000**	**1.000**	**0.000**	**0.990**	**0.990**	**1.000**	**1.000**	**1.000**
	0-5 years	0.364	0.545	0.306	0.380	0.200	0.370	0.392	0.167	0.429	0.230	0.600	0.500	0.660
	6-10 Years	0.273	0.180	0.278	0.200	0.300	0.222	0.286	0.330	0.143	0.300	0.100	0.285	0.000
	11-15 years	0.204	0.091	0.222	0.180	0.200	0.185	0.071	0.330	0.190	0.167	0.100	0.071	0.000
Contractor	0ver 15 years	0.159	0.180	0.194	0.240	0.300	0.222	0.250	0.167	0.238	0.300	0.200	0.143	0.330
		1.000	**0.996**	**1.000**	**1.000**	**1.000**	**0.999**	**0.999**	**0.994**	**1.000**	**0.997**	**1.000**	**0.999**	**0.990**

Appendix 9L- Cross tabulation of risk identification practice by level of education Analysis (by proportion)

Respondent		Qualification	Brainstorming	Probability impact matrix	Checklist	Expert judgement	Risk breakdown structure	Interview	Consult specialist	Risk premium	Intuition	Judgement Risk analysis Process	Probability distribution	Se a
Clients		Certificate	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
		Diploma	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
		Bachelors	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	0.000	1.000	
		Masters	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
			1.000	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**0.000**	**1.000**	**0.000**	**1.000**	
Consultants		Certificate	0.017	0.000	0.022	0.019	0.111	0.038	0.019	0.000	0.000	0.000	0	
		Diploma	0.054	0.000	0.043	0.000	0.111	0.038	0.059	0.000	0.000	0.111	0.000	
		Bachelors	0.720	0.583	0.650	0.720	0.444	0.692	0.765	0.800	0.722	0.778	0.625	
		Masters	0.200	0.417	0.283	0.250	0.333	0.231	0.157	0.200	0.278	0.111	0.375	
			0.991	**1.000**	**0.998**	**0.989**	**0.999**	**0.999**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	
Project managers		Certificate	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
		Diploma	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
		Bachelors	0.830	1.000	0.800	0.666	1.000	0.800	1.000	0.000	1.000	1.000	0.833	
		Masters	0.167	0.000	0.200	0.333	0.000	0.200	0.000	0.000	0.000	0.000	0.167	
			0.997	**1.000**	**1.000**	**0.999**	**1.000**	**1.000**	**1.000**	**0.000**	**1.000**	**1.000**	**1.000**	
Contractor		Certificate	0.023	0.000	0.121	0.060	0.000	0.042	0.077	0.000	0.000	0.067	0.000	
		Diploma	0.140	0.000	0.121	0.100	0.000	0.208	0.115	0.270	0.050	0.200	0.111	
		Bachelors	0.767	0.800	0.700	0.760	0.888	0.708	0.731	0.636	0.850	0.633	0.667	
		Masters	0.070	0.200	0.061	0.080	0.111	0.042	0.077	0.091	0.100	0.100	0.222	
			1.000	**1.000**	**1.003**	**1.000**	**0.999**	**1.000**	**1.000**	**0.997**	**1.000**	**1.000**	**1.000**	

Appendix 10 Ha= the contract selection factors come from a normally distributed population

	Kolmogorov-Smirnov[a]			Shapiro-Wilk			
	Statistic	df	Sig.	Statistic	df	Sig.	Decision
Type of work undertaken	.253	72	.000	.799	72	.000	Reject
Type of development	.217	72	.000	.870	72	.000	Reject
status of design	.188	72	.000	.894	72	.000	Reject
size of project	.295	72	.000	.749	72	.000	Reject
method of price determination	.180	72	.000	.899	72	.000	Reject
financiers preference	.241	72	.000	.861	72	.000	Reject
degree of price competition	.181	72	.000	.899	72	.000	Reject
client objectives of time cost quality	.251	72	.000	.789	72	.000	Reject
public benefit (empowering community/ contractor)	.184	72	.000	.907	72	.000	Reject
procurement method	.220	72	.000	.884	72	.000	Reject
complexity of the requirements	.257	72	.000	.841	72	.000	Reject
risk preference	.227	72	.000	.856	72	.000	Reject
type of contract documentation	.237	72	.000	.867	72	.000	Reject
flexibility in design	.219	72	.000	.896	72	.000	Reject
incentive	.206	72	.000	.908	72	.000	Reject

a. Lilliefors Significance Correction

Appendix 10A H_1 :The median of contract selection factors is equal to 4 in the ZCI

		Overall							
Rank	Selection factor	N	Sig	Test Statistic (t)	Standard error	Standardised Test statistics (z)	Effect size r) (r=z/√N)	Holm-Bonferroni correction	Decision
1	Method of price determination	94	0.000	396	140.14	-4.367	-0.45	0.0033	Reject
2	Degree of price competition	90	0.000	675	176.94	-4.027	-0.424	0.0036	Reject
3	Public benefit (communities/contractors)	93	0.000	292.5	159.214	-5.55	-0.576	0.0038	Reject
4	Flexibility of design	96	0.000	203.5	131.895	-5.394	-0.551	0.0042	Reject
5	Incentive available	93	0.000	207	195.407	-6.824	-0.708	0.0045	Reject
6	Status of design	92	0.003	600	138.362	-2.949	-0.307	0.0050	Reject
7	Type of work undertaken	95	0.020	1,060.00	102.764	3.09	0.317	0.0056	Retain
8	Clients objective of cost, time & quality	95	0.026	1,045.00	111.46	2.221	0.228	0.0063	Retain
9	Procurement method	94	0.034	797.5	145.597	-2.115	-0.218	0.0071	Retain
10	Size of project	95	0.035	931	102.252	2.108	0.216	0.0083	Retain
11	Financiers preference	95	0.079	795	139.356	-1.758	-0.18	0.0100	Retain
12	Types of development	95	0.128	676	117.971	-1.5522	-0.159	0.0125	Retain
13	Type of contract documentation availed	95	0.157	710	123.444	-1.414	-0.145	0.0167	Retain
14	Risk preference	96	0.272	750	122.849	-1.099	-0.112	0.0250	Retain
15	Complexity of requirements	94	0.680	648	99.47	-4.112	-0.424	0.0500	Retain

Appendix 10B H_1 :The median of contract selection factors is equal to 4 for Engineers

Rank	Selection factor	Engineers							
		N	Sig	Test Statistic (t)	Standard error	Standardised Test statistics (z)	Effect size (r) r=z/√N	Holm-Bonferroni correction	Decision
1	Incentive available	27	0.000	30	32.892	-3.648	-0.702	0.0033	Reject
2	Flexibility of design	28	0.002	8	19.059	-3.148	-0.112	0.0036	Reject
3	Degree of price competition	25	0.009	37.5	25.683	-2.628	-0.526	0.0038	Reject
4	Method of price determination	27	0.018	16.5	15.2	-2.359	-0.453	0.0042	Reject
5	Types of development	28	0.033	30	17.804	-2.134	-0.403	0.0045	Reject
6	Procurement method	28	0.057	51	23.073	-1.907	0.36	0.0050	Retain
7	Public benefit (communities/contractors)	28	0.085	36	18.598	-1.721	-0.325	0.0056	Retain
8	Financiers preference	27	0.176	32.5	14.765	-1.355	-0.261	0.0063	Retain
9	Clients objective of cost, time & quality	28	0.296	77	16.263	1.045	0.197	0.0071	Retain
10	Type of work undertaken	27	0.593	60	14.031	0.535	0.103	0.0083	Retain
11	Type of contract documentation availed	27	0.742	35	12.14	-0.329	-0.006	0.0100	Retain
12	Size of project	28	0.746	75	15.91	0.943	0.178	0.0125	Retain
13	Status of design	27	0.797	80	21.372	-2.257	-0.434	0.0167	Retain
14	Risk preference	28	0.844	49.5	15.252	-0.197	-0.037	0.0250	Retain
15	Complexity of requirements	27	1.000	52.5	14.031	0.000	0.000	0.0500	Retain

Appendix 10C H1: The median of contract selection factors is equal to 4 for Quantity surveyors

Rank	Selection factor	Quantity Surveyors							
		N	Sig	Test Statistic	Standard error	Standardised Test statistics	Effect size (r) r=z/√N	Holm-Bonferroni correction	Decision
1	Public benefit (communities/contractors	30	0.000	19.5	38.453	-4.057	-0.741	0.0033	Reject
2	Incentive available	31	0.000	21	43.17	-4.216	-0.757	0.0036	Reject
3	Method of price determination	31	0.001	37.5	34.095	-3.3	-0.592	0.0038	Reject
4	Flexibility of design	32	0.001	24	29.599	-3.463	-0.612	0.0042	Reject
5	Status of design	32	0.003	28	25.872	-2.976	-0.526	0.0045	Reject
6	Types of development	32	0.037	66.5	28.764	-2.086	-0.369	0.0050	Retain
7	Degree of price competition	30	0.044	100	37.485	-2.014	-0.368	0.0056	Retain
8	Type of contract documentation availed	31	0.052	85.5	33.204	-1.943	-0.349	0.0063	Retain
9	Financiers preference	32	0.080	110	37.462	-1.748	-0.309	0.0071	Retain
10	Type of work undertaken	32	0.102	157.5	25.72	1.633	0.289	0.0083	Retain
11	Procurement method	32	0.139	121	36.814	-1.48	-0.261	0.0100	Retain
12	Complexity of requirements	32	0.528	72	21.38	-0.631	-0.112	0.0125	Retain
13	Risk preference	32	0.554	100	26.175	-0.592	-0.105	0.0167	Retain
14	Clients objective of cost, time & quality	32	0.628	117	24.799	0.484	0.085	0.0250	Retain
15	Size of project	31	0.635	45.5	14.765	-0.475	0.085	0.0500	Retain

Appendix 10D H_1 :The median of contract selection factors is equal to 4 for Architects

Rank	Selection factor	Architects							
		N	Sig	Test Statistic	Standard error	Standardised Test statistics	r) r=z/√N	Holm-Bonferroni correction	Decision
1	Incentive available	35	0.000	21	38.581	-4.005	-1	0.0033	Reject
2	Public benefit (communities/contractors	35	0.001	48	38.277	-3.331	-1	0.0036	Reject
3	Type of work undertaken	36	0.003	161.5	22.279	2.985	0.5	0.0038	Reject
4	Size of project	36	0.004	241.5	31.678	2.888	0.5	0.0042	Reject
5	Flexibility of design	36	0.006	45	29.814	-2.734	-0	0.0045	Retain
6	Clients objective of cost, time & quality	35	0.014	178.5	25.72	2.449	0.4	0.0050	Retain
7	Degree of price competition	35	0.019	105	41.943	-2.336	-0	0.0056	Retain
8	Types of development	35	0.061	150	23.979	1.877	0.3	0.0063	Retain
9	Method of price determination	36	0.076	100	35.176	-1.777	0.3	0.0071	Retain
10	Status of design	33	0.136	110	35.182	-1.492	-0	0.0083	Retain
11	Risk preference	36	0.289	115.5	32.531	-1.061	-0	0.0100	Retain
12	Procurement method	34	0.781	108	26.917	-0.279	-0	0.0125	Retain
13	Type of contract documentation availed	37	0.867	143	29.806	0.168	0	0.0167	Retain
14	Financiers preference	36	0.901	154	32.131	0.124	0	0.0250	Retain
15	Complexity of requirements	35	0.984	104.5	24.418	-0.02	-0	0.0500	Retain

Appendix 10E H_3 : The perceptions of consultants with regard to contract selection factors are similar across the different roles

		N	QS	Architect	Engineer	Chi-Square	df	Asymp. Sig.	Effect size (η^2)	Holm-Bonferroni correction	Hypothesis
1	Status of design	92	39.52	44.2	60.64	9.257	2	0.01	0.942	0.0033	Retain
2	Public benefit (communities'/contractors	93	37.63	48.35	57.25	7.298	2	0.026	0.579	0.0036	Retain
3	Size of project	95	39.23	53.02	50.77	5.607	2	0.061	0.334	0.0038	Retain
4	Types of development	95	41.27	53.87	46.86	4.216	2	0.121	0.189	0.0042	Retain
5	Incentive available	93	40.61	47.4	55.64	4.222	2	0.121	0.194	0.0045	Retain
6	Method of price determination	94	40.85	49.88	52.55	3.075	2	0.215	0.101	0.0050	Retain
7	Type of contract documentation available	95	41.66	50.98	51.26	2.679	2	0.262	0.076	0.0056	Retain
8	Financiers preference	95	44.59	52.33	44.52	2.02	2	0.364	0.043	0.0063	Retain
9	Type of work undertaken	95	48.81	49.65	43.45	0.89	2	0.641	0.008	0.0071	Retain
10	Risk preference	96	48	46.52	53	0.88	2	0.644	0.008	0.0083	Retain
11	Clients objective of cost, time & quality	95	45.34	50.05	48.05	0.616	2	0.735	0.004	0.0100	Retain
12	flexibility of design	96	46.47	50.43	47.77	0.418	2	0.811	0.002	0.0125	Retain
13	Degree of price competition	90	47.35	45.4	42.93	0.367	2	0.832	0.002	0.0167	Retain
14	Procurement method	94	46.06	47.86	48.93	0.169	2	0.919	0	0.0250	Retain
15	Complexity of requirements	94	46.28	48.45	47.5	0.13	2	0.937	0	0.0500	Retain

Appendix 10F H_4 : The perceptions of consultants with regard to contract selection factors are similar across the different years of experience

	Contract Selection Factor	N	Mean: 1-5 years	6-10 years	11-15 years	Over 15 years	Chi-Square	df	Asymp. Sig.	Effect size (η^2)	Holm-Bonferroni correction	Hypothesis
1	Incentive available	93	46.55	63.13	32.68	43.65	9.977	3	0.019	1.082	0.0033	Retain
2	Types of development	95	43.28	61.32	58.92	41.52	9.382	3	0.025	0.936	0.0036	Retain
3	Method of price determination	94	38.73	48.12	54	57.25	8.591	3	0.035	0.794	0.0038	Retain
4	Risk preference	96	40.65	52.44	58.96	53	6.541	3	0.088	0.45	0.0042	Retain
5	Status of design	92	40.58	51.76	40.86	54.1	5.49	3	0.139	0.331	0.0045	Retain
6	Public benefit (communities/contractors	93	41.26	46.94	58.75	50.36	4.691	3	0.196	0.239	0.0050	Retain
7	flexibility of design	96	47.25	46.69	39.13	55.34	3.46	3	0.326	0.126	0.0056	Retain
8	Degree of price competition	90	42.62	54.32	38.95	47.85	3.162	3	0.367	0.112	0.0063	Retain
9	Type of work undertaken	95	47.58	54.88	49.04	43.67	2.048	3	0.562	0.045	0.0071	Retain
10	Complexity of requirements	94	45.88	44.65	56	47.96	1.709	3	0.635	0.031	0.0083	Retain
11	Financiers preference	95	44.24	51.32	48.79	51.25	1.481	3	0.687	0.233	0.0100	Retain
12	Clients objective of cost, time & quality	95	47.54	42.65	52.42	50.07	1.31	3	0.727	0.018	0.0125	Retain
13	Procurement method	94	44.13	50.68	49.17	49.71	1.128	3	0.77	0.014	0.0167	Retain
14	Size of project	95	47.55	44.74	45.5	51.66	0.991	3	0.803	0.01	0.0250	Retain
15	Type of contract documentation available	95	45.79	46.47	49.04	51.69	0.882	3	0.83	0.008	0.0500	Retain

b. Grouping Variable: Year in Industry

Appendix10G Shows the descriptive statistics for risk factors affecting performance continued

	N	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Clarity of Drawings and Technical Specifications	180	4.3278	.05781	.77554	.601	-.935	.181	0.219	.360
Contractor's Underestimate of Construction Cost	194	4.3093	.05695	.79325	.629	-.990	.175	0.427	.347
Client's Financial Stability	197	4.2538	.05605	.78672	.619	-.800	.173	0.016	.345
Contractor's Financial Difficulties	191	4.1518	.06527	.90204	.814	-1.001	.176	0.738	.350
Defective Workmanship and Rework	193	4.1295	.05541	.76975	.593	-.434	.175	-0.583	.348
Poor supervision	183	4.0984	.06489	.87778	.770	-.785	.180	0.197	.357
Poor quality materials	193	4.0570	.06285	.87313	.762	-.775	.175	0.489	.348
Unclear scope of works	185	4.0541	.06626	.90127	.812	-.692	.179	0.110	.355
Errors and Omissions in Design Drawings	192	4.0521	.06342	.87872	.772	-.757	.175	0.412	.349
Inadequate site investigation	191	4.0366	.06530	.90246	.814	-.767	.176	0.304	.350
Poor supervision on site	190	4.0211	.06015	.82909	.687	-.490	.176	-0.389	.351
In adequate budgeting and contingencies	194	4.0103	.06496	.90474	.819	-.954	.175	1.320	.347
Poor coordination and communication	192	4.0052	.06022	.83445	.696	-.502	.175	-.082	.349
Poor planning of resources -materials, labour, equipment	195	4.0000	.06584	.91944	.845	-.643	.174	-.220	.346
Delay in Payment Process by the Client	194	3.9897	.06071	.84553	.715	-.500	.175	-.124	.347
Delay in Consultant's Approval of Materials Submission	197	3.9848	.06576	.92293	.852	-.992	.173	1.228	.345
Lack of inspection of works	189	3.9788	.06408	.88099	.776	-.525	.177	-.241	.352

Appendix 10G Shows the descriptive statistics for risk factors affecting performance continued

	N	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
Risk Factors	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Inadequate specification	194	3.9742	.06390	.88999	.792	-.707	.175	0.519	.347
Escalation in Material Prices	191	3.9686	.07156	.98892	.978	-.828	.176	0.280	.350
Lack of Coordination among Design Disciplines	190	3.9579	.06792	.93623	.877	-.619	.176	-0.118	.351
Delay in Contractor's Payment Certification by the consultant	193	3.9534	.06542	.90881	.826	-1.043	.175	1.468	.348
Poor Labour Productivity	192	3.9375	.06422	.88988	.792	-.507	.175	-0.053	.349
Omission in design contract documents	189	3.9259	.06343	.87203	.760	-.682	.177	0.659	.352
Delay in Consultant's Approval of Shop Drawings	193	3.9119	.06843	.95061	.904	-.962	.175	0.924	.348
Holding key decisions in isolation	191	3.9058	.06129	.84699	.717	-.239	.176	-0.764	.350
Unstable exchange rates	191	3.9005	.06580	.90934	.827	-.565	.176	-0.205	.350
Delay in Consultant's Response to Requests for Information (RFI)	196	3.8929	.06404	.89657	.804	-.736	.174	0.557	.346
Ineffective monitoring of risks	193	3.8549	.06732	.93524	.875	-.555	.175	0.019	.348
Late Delivery of Materials	192	3.8490	.06493	.89974	.810	-.481	.175	0.132	.349
Lack of Experience in Similar Projects	194	3.8351	.06174	.85994	.739	-.465	.175	0.152	.347
Frequent Change Orders by Client	192	3.8229	.06646	.92090	.848	-.778	.175	0.618	.349
Lack of interest on delayed payment	192	3.8021	.06615	.91663	.840	-.338	.175	-0.514	.349
Non-compliance to tender requirement on site (labour and Equipment)	192	3.7865	.07088	.98216	0.965	0-.397	.175	-0.554	.349
Shortage in Technical Staff and Skilled Labour	193	3.7565	.06804	.94526	0.894	-0.467	.175	-0.137	.348
Unsafe work environment	184	3.7446	.06828	.92623	0.858	-0.262	.179	-0.592	.356

Appendix 10G Shows the descriptive statistics for risk factors affecting performance continued

	N	Mean	Std. Deviation	Variance	Skewness	Kurtosis	N	Mean	Std. Deviation
	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Slow Decision Making Process by Client	195	3.7436	.06322	.88277	0.779	-0.518	.174	0.502	.346
Unrealistic Contract Duration of the Project	194	3.7423	.07256	1.01060	1.021	-0.590	.175	0.021	.347
Unforeseen Ground Conditions	191	3.7277	.06841	.94547	0.894	-0.298	.176	-0.629	.350
Suspension of work	185	3.7135	.07105	.96632	0.934	-0.530	.179	-0.026	.355
Insufficient protection of works	191	3.6963	.06771	.93580	0.876	-0.098	.176	-0.753	.350
Construction accidents	192	3.6406	.06971	.96592	0.933	-0.246	.175	-0.581	.349
Delay in mobilisation	193	3.6218	.06599	.91682	0.841	-0.201	.175	-0.203	.348
Delay in Statutory Approvals and Permits	189	3.6190	.07915	1.08807	1.184	-0.297	.177	-0.824	.352
Inclement Weather	192	3.5417	.06921	.95902	0.920	-0.084	.175	-0.771	.349
Delay in site handover	176	3.5284	.07470	.99098	0.982	-0.222	.183	-0.560	.364
Unavailability or Shortage in Specified Materials	191	3.5079	.06839	.94518	0.893	-0.117	.176	-0.724	.350
Frequent Changes in Statutory Regulations	187	3.4866	.07672	1.04911	1.101	-0.317	.178	-0.652	.354
Unavailability of Equipment Required	191	3.4817	.06550	.90521	0.819	-0.160	.176	-0.589	.350
Delay in resolving disputes	193	3.2902	.07118	.98887	0.978	-0.218	.175	-0.427	.348
High taxes	191	3.2775	.07756	1.07187	1.149	-.159	.176	-0.563	.350
Delay in submitting invoices	191	3.2775	.07540	1.04200	1.086	-.211	.176	-0.531	.350
Difficulty in getting insurance cover	189	3.2751	.07970	1.09567	1.200	-.099	.177	-0.644	.352
Criminal acts vandalism, theft	189	3.2698	.07600	1.04484	1.092	.005	.177	-0.693	.352
Site Orientation and Restricted Access	190	3.1789	.06838	.94257	.888	.018	.176	-0.090	.351
Unavailability of Sufficient Storage Space around or on Site	190	3.0737	.07292	1.00519	1.010	.104	.176	-0.673	.351
Valid N (listwise)	109								

Appendix 10H H_b= Risk factors come from a normally distributed population

	Kolmogorov-Smirnov[a]			Shapiro-Wilk			Decision
	Statistic	df	*Sig.*	Statistic	df	Sig.	
Client's Financial Stability	.258	99	*.000*	.803	99	.000	Reject
Delay in Payment Process by the Client	.268	99	*.000*	.836	99	.000	Reject
Frequent Change Orders by Client	.288	99	*.000*	.849	99	.000	Reject
Slow Decision Making Process by Client	.251	99	*.000*	.863	99	.000	Reject
Unrealistic Contract Duration of the Project	.266	99	*.000*	.857	99	.000	Reject
Lack of interest on delayed payment	.206	99	*.000*	.886	99	.000	Reject
Unclear scope of works	.248	99	*.000*	.823	99	.000	Reject
Suspension of work	.228	99	*.000*	.867	99	.000	Reject
Delay in site handover	.222	99	*.000*	.890	99	.000	Reject
Clarity of Drawings and Technical Specifications	.275	99	*.000*	.799	99	.000	Reject
Delay in Consultant's Approval of Materials Submission	.272	99	*.000*	.817	99	.000	Reject
Delay in Consultant's Approval of Shop Drawings	.276	99	*.000*	.836	99	.000	Reject
Delay in Consultant's Response to Requests for Information (	.291	*99*	*.000*	.840	99	.000	Reject
Delay in Contractor's Payment Certification by the consultant	.288	*99*	*.000*	.820	99	.000	Reject
Errors and Omissions in Design Drawings	.256	*99*	*.000*	.809	99	.000	Reject
Lack of Coordination among Design Disciplines	.264	*99*	*.000*	.840	99	.000	Reject
Omission in design contract documents	.269	*99*	*.000*	.837	99	.000	Reject
Inadequate specification	.263	*99*	*.000*	.814	99	.000	Reject
In adequate budgeting and contingencies	.243	*99*	*.000*	.826	99	.000	Reject
Inadequate site investigation	.224	*99*	*.000*	.841	99	.000	Reject
Lack of inspection of works	.223	*99*	*.000*	.846	99	.000	Reject
Poor supervision	.236	*99*	*.000*	.835	99	.000	Reject
Contractor's Financial Difficulties	.258	*99*	*.000*	.798	99	.000	Reject
Contractor's Underestimate of Construction Cost	.313	*99*	*.000*	.751	99	.000	Reject
Defective Workmanship and Rework	.266	*99*	*.000*	.790	99	.000	Reject
Lack of Experience in Similar Projects	.245	*99*	*.000*	.863	99	.000	Reject
Late Delivery of Materials	.221	*99*	*.000*	.861	99	.000	Reject
Poor Labour Productivity	.209	*99*	*.000*	.852	99	.000	Reject
Non-compliance to tender requirement on site (labour and Equipment)	.207	*99*	*.000*	.870	99	.000	Reject
Construction accidents	.216	*99*	*.000*	.883	99	.000	Reject

Appendix 10H H_b= Risk factors come from a normally distributed population

	Kolmogorov-Smirnov[a]			Shapiro-Wilk			
	Statistic	df	Sig.	Statistic	df	Sig.	Decision
Poor quality materials	.240	99	.000	.806	99	.000	Reject
Poor planning of resources -materials, labour, equipment	.257	99	.000	.823	99	.000	Reject
Delay in submitting invoices	.215	99	.000	.905	99	.000	Reject
Delay in mobilisation	.200	99	.000	.874	99	.000	Reject
Poor supervision on site	.245	99	.000	.824	99	.000	Reject
Insufficient protection of works	.197	99	.000	.872	99	.000	Reject
Unsafe work environment	.238	99	.000	.869	99	.000	Reject
Delay in Statutory Approvals and Permits	.213	99	.000	.886	99	.000	Reject
Escalation in Material Prices	.235	99	.000	.833	99	.000	Reject
Frequent Changes in Statutory Regulations	.276	99	.000	.874	99	.000	Reject
Inclement Weather	.219	99	.000	.874	99	.000	Reject
Unstable exchange rates	.257	99	.000	.827	99	.000	Reject
Shortage in Technical Staff and Skilled Labour	.211	99	.000	.867	99	.000	Reject
Site Orientation and Restricted Access	.258	99	.000	.885	99	.000	Reject
Unavailability of Equipment Required	.255	99	.000	.878	99	.000	Reject
Unavailability of Sufficient Storage Space around or on Site	.199	99	.000	.899	99	.000	Reject
Unavailability or Shortage in Specified Materials	.214	99	.000	.894	99	.000	Reject
Unforeseen Ground Conditions	.251	99	.000	.871	99	.000	Reject
High taxes	.186	99	.000	.908	99	.000	Reject
Difficulty in getting insurance cover	.179	99	.000	.910	99	.000	Reject
Delay in resolving disputes	.202	99	.000	.904	99	.000	Reject
Criminal acts vandalism, theft	.188	99	.000	.909	99	.000	Reject
Ineffective monitoring of risks	.251	99	.000	.850	99	.000	Reject
Holding key decisions in isolation	.242	99	.000	.848	99	.000	Reject
Poor coordination and communication	.247	99	.000	.837	99	.000	Reject

a. Lilliefors Significance Correction

Appendix 10I H_2 :The median for risk factors is =4 overall

Rank	Risk factor	Overall-Contractors and consultants							
		N	Sig	Test Statistic t	Standard error	Standardised Test statistics z	Effect Size r r=z/√N	**Holm-Bonferroni correction**	Decision
1	Client's Financial Stability	177	0.000	3,939.00	277.52	4.167	0.313	0.001	Reject
2	Slow Decision Making Process by Client	175	0.000	1,335.00	260.545	-4.375	-0.331	0.001	Reject
3	Suspension of work	165	0.000	1,435.00	261.764	-3.784	-0.295	0.001	Reject
4	Delay in site handover	158	0.000	1,026.00	270.383	-5.359	-0.426	0.001	Reject
5	Clarity of Drawings and Technical Specifications	164	0.000	4,040.00	272.511	4.807	0.375	0.001	Reject
6	Contractor's Underestimate of Construction Cost	174	0.000	4,357.50	298.323	4.374	0.332	0.001	Reject
7	Construction accidents	172	0.000	1,505.00	300.938	-4.599	-0.351	0.001	Reject
8	Delay in submitting invoices	172	0.000	770	344.417	-7.447	-0.568	0.001	Reject
9	Delay in mobilisation	173	0.000	1,650.00	323.794	-5.006	-0.381	0.001	Reject
10	Insufficient protection of works	171	0.000	2,111.50	336.185	-3.986	-0.305	0.001	Reject
11	Unsafe work environment	165	0.000	1,646.50	274.769	-3.567	-0.278	0.001	Reject
12	Delay in Statutory Approvals and Permits	169	0.000	1,911.00	355.94	-4.661	-0.359	0.001	Reject
13	Frequent Changes in Statutory Regulations	170	0.000	1,050.00	307.527	-5.98	-0.459	0.001	Reject
14	Inclement Weather	172	0.000	1,350.00	331.785	-5.809	-0.443	0.001	Reject
15	Site Orientation and Restricted Access	170	0.000	644	400.542	-8.698	-0.667	0.001	Reject
16	Unavailability of Equipment Required	171	0.000	808.5	283.32	-6.417	-0.49	0.001	Reject
17	Unavailability of Sufficient Storage Space around or on Site	170	0.000	469	370.823	-8.524	-0.654	0.001	Reject
18	Unavailability or Shortage in Specified Materials	171	0.000	1,027.00	305.255	-6.1	-0.468	0.001	Reject
19	Unforeseen Ground Conditions	171	0.000	1,716.00	289.883	-3.679	-0.281	0.001	Reject
20	High taxes	171	0.000	960	357.441	-7.135	-0.546	0.001	Reject
21	Difficulty in getting insurance cover	169	0.000	1,050.00	375.098	-7.202	-0.554	0.001	Reject
22	Delay in resolving disputes	174	0.000	616	344.332	-7.896	-0.599	0.001	Reject
23	Criminal acts vandalism, theft	170	0.000	966	386.614	-7.563	-0.58	0.002	Reject
24	Unrealistic Contract Duration of the Project	174	0.001	1,935.00	302.826	-3.329	-0.252	0.002	Reject
25	Shortage in Technical Staff and Skilled Labour	173	0.002	2.064.000	302.511	-3.086	-0.235	0.002	Reject
26	Non-compliance to tender requirement on site	172	0.003	2,303,000	325.59	-2.993	-0.224	0.002	Retain
27	Lack of interest on delayed payment	172	0.007	2,092.50	295.372	-2.697	-0.206	0.002	Retain
28	Ineffective monitoring of risks	173	0.022	2,002.00	273.016	-2.287	-0.174	0.002	Retain
29	Late Delivery of Materials	172	0.033	2,182.50	281.809	-2.129	-0.162	0.002	Retain
30	Delay in Consultant's Response to Requests for Information	176	0.056	1,892.00	253.827	-1.909	-0.144	0.002	Retain
31	Contractor's Financial Difficulties	172	0.064	3,550.00	298.68	1.85	0.141	0.002	Retain
32	Defective Workmanship and Rework	173	0.096	2,622.00	233.722	1.667	0.127	0.002	Retain
33	Frequent Change Orders by Client	172	0.100	1,387.50	222.033	-2.569	-0.195	0.002	Retain
34	Holding key decisions in isolation	171	0.139	2,185.00	264.252	-1.478	-0.113	0.002	Retain
35	Poor supervision	166	0.186	3,040.00	274.005	1.321	0.103	0.002	Retain
36	Unstable exchange rates	171	0.254	2,131.50	257.605	-1.141	-0.087	0.003	Retain
37	Lack of Coordination among Design Disciplines	170	0.271	2,517.50	288.683	-1.102	-0.085	0.003	Retain
38	Poor Labour Productivity	172	0.313	2,499.00	280.775	-1.01	-0.077	0.003	Retain
39	Poor quality materials	173	0.314	2,897.50	269.133	1.007	0.077	0.003	Retain
40	Delay in Consultant's Approval of Shop Drawings	173	0.358	2,009.00	243.394	-0.918	-0.07	0.003	Retain
41	Omission in design contract documents	169	0.382	2,068.00	242.611	-0.874	-0.067	0.003	Retain
42	Errors and Omissions in Design Drawings	172	0.390	2,802.50	264.26	0.859	0.065	0.004	Retain
43	Unclear scope of works	165	0.548	2,950.00	278.635	0.601	0.047	0.004	Retain
44	Inadequate specification	174	0.559	2,325.00	256.642	-0.584	-0.044	0.004	Retain
45	Delay in Contractor's Payment Certification by the consultant	173	0.560	1,872.00	224.103	-0.582	-0.044	0.005	Retain
46	Delay in Payment Process by the Client	174	0.598	2,457.00	244.327	0.528	0.04	0.005	Retain
47	Lack of Experience in Similar Projects	174	0.605	1,628.00	247.305	-2.831	-0.214	0.006	Retain
48	In adequate budgeting and contingencies	174	0.683	2,736.00	268.097	0.408	0.031	0.006	Retain
49	Lack of inspection of works	169	0.743	2,538.00	270.135	-0.328	0.025	0.007	Retain
50	Delay in Consultant's Approval of Materials Submission	177	0.765	2,392.50	248.253	0.26	0.02	0.008	Retain
51	Inadequate site investigation	171	0.795	2,910.00	286.74	0.26	0.02	0.010	Retain
52	Poor coordination and communication	172	0.867	2,418.00	247.008	0.168	0.013	0.013	Retain
53	Poor planning of resources -materials, labour, equipment	175	0.876	2,989.00	295.645	0.156	0.012	0.017	Retain
54	Poor supervision on site	170	0.902	2,262.00	238.88	0.123	0.009	0.025	Retain
55	Escalation in Material Prices	172	0.914	3,019.50	304.651	-0.108	-0.008	0.050	Retain

Appendix 10J H_2 :The median for risk factors is =4 for contractors

	Risk factor	Contractors							
		N	Sig	Test Statistic t	Standard error	Standardised Test statistics z	Effect size r r=z/√N	**Holm-Bonferroni correction**	Decision
1	Slow Decision Making Process by Client	72	0.000	170	72.144	-3.611	0.426	0.0009	Reject
2	Delay in submitting invoices	71	0.000	160	81.862	-4.092	0.486	0.0009	Reject
3	Frequent Changes in Statutory Regulations	73	0.000	175	96.138	-4.551	0.533	0.0009	Reject
4	Inclement Weather	72	0.000	234	94.532	-4.004	0.472	0.0010	Reject
5	Site Orientation and Restricted Access	72	0.000	102.5	110.093	-5.812	0.685	0.0010	Reject
6	Unavailability of Equipment Required	71	0.000	67.5	57.891	-4.275	0.507	0.0010	Reject
7	Unavailability of Sufficient Storage Space around or on Site	70	0.000	70	94.5	-5.481	0.655	0.0010	Reject
8	High taxes	73	0.000	198	87.401	-3.919	0.459	0.0010	Reject
9	Difficulty in getting insurance cover	71	0.000	198	90.66	-4.037	0.479	0.0011	Reject
10	Delay in resolving disputes	73	0.000	72.5	94.673	-5.445	0.637	0.0011	Reject
11	Criminal acts vandalism, theft	71	0.000	214.5	107.616	-4.655	0.552	0.0011	Reject
12	Delay in mobilisation	73	0.001	322	93.985	-3.357	0.393	0.0011	Reject
13	Delay in Statutory Approvals and Permits	69	0.001	288	92.695	-3.236	0.39	0.0012	Reject
14	Lack of Experience in Similar Projects	73	0.002	192.5	68.669	-3.167	0.388	0.0012	Reject
15	Insufficient protection of works	71	0.002	345	93.975	-3.113	0.369	0.0012	Reject
16	Ineffective monitoring of risks	71	0.002	260	260	-3.167	0.376	0.0013	Reject
17	Unrealistic Contract Duration of the Project	72	0.003	296	89.166	-3.006	0.354	0.0013	Reject
18	Delay in site handover	65	0.003	227.5	74.667	-3	0.372	0.0013	Reject
19	Clarity of Drawings and Technical Specifications	69	0.003	697	74.334	3.013	0.363	0.0014	Reject
20	Unavailability or Shortage in Specified Materials	72	0.003	260	80.268	-2.928	0.344	0.0014	Reject
21	Unforeseen Ground Conditions	72	0.004	292.5	85.02	-2.917	0.344	0.0014	Reject
22	Suspension of work	67	0.005	174	62.716	-2.83	0.346	0.0015	Reject
23	Client's Financial Stability	74	0.011	906.5	95.279	2.556	0.297	0.0015	Retain
24	Construction accidents	71	0.012	247.5	72.545	-2.523	0.299	0.0016	Retain
25	Unsafe work environment	70	0.013	348.5	87.139	-2.473	0.296	0.0016	Retain
26	Contractor's Underestimate of Construction Cost	72	0.056	615	74.334	1.91	0.225	0.0017	Retain
27	Lack of inspection of works	69	0.059	348.5	77.516	-1.89	0.228	0.0017	Retain
28	Shortage in Technical Staff and Skilled Labour	73	0.077	430	89.224	-1.771	0.207	0.0018	Retain
29	Holding key decisions in isolation	72	0.081	378	80.078	-1.742	0.205	0.0019	Retain
30	Inadequate site investigation	70	0.096	400	84.489	-1.663	0.199	0.0019	Retain
31	Contractor's Financial Difficulties	71	0.120	493	66.216	1.556	0.185	0.0020	Retain
32	Non-compliance to tender	71	0.141	380	78.142	-1.472	0.175	0.0021	Retain
33	Unstable exchange rates	70	0.158	280	63.799	-1.411	0.169	0.0022	Retain
34	Poor supervision on site	68	0.175	255	57.472	-1.357	0.165	0.0023	Retain
35	Lack of Coordination among Design Disciplines	69	0.187	409.5	81.866	-1.319	0.158	0.0024	Retain
36	Defective Workmanship and Rework	72	0.194	385	53.939	1.298	0.153	0.0025	Retain
37	Late Delivery of Materials	72	0.220	440	81.989	-1.226	0.144	0.0026	Retain
38	Delay in Consultant's Response to Requests for Information (RI	73	0.259	332.5	68.661	-1.129	0.132	0.0028	Retain
39	Poor coordination and communication	71	0.329	420	76.857	-0.976	0.116	0.0029	Retain
40	Lack of interest on delayed payment	70	0.370	360	86.398	-2.089	0.25	0.0031	Retain
41	Poor Labour Productivity	72	0.384	389.5	71.159	-0.871	0.103	0.0033	Retain
42	Frequent Change Orders by Client	72	0.420	225	62.316	-2.03	0.239	0.0036	Retain
43	Escalation in Material Prices	72	0.450	553.5	77.521	0.755	0.085	0.0038	Retain
44	Delay in Consultant's Approval of Shop Drawings	71	0.461	378	71.143	-0.738	0.088	0.0042	Retain
45	Unclear scope of works	63	0.473	400	71.841	-0.717	0.09	0.0045	Retain
46	Poor quality materials	72	0.527	696	92.57	0.632	0.074	0.0050	Retain
47	Delay in Consultant's Approval of Materials Submission	74	0.610	402.5	62.741	0.51	0.059	0.0056	Retain
48	Inadequate specification	71	0.744	350	62.741	-0.347	0.041	0.0063	Retain
49	Poor planning of resources -materials, labour, equipment	73	0.749	520	78.142	0.32	0.037	0.0071	Retain
50	In adequate budgeting and contingencies	71	0.757	370	64.526	-0.31	0.037	0.0083	Retain
51	Poor supervision	67	0.763	390	66.276	-0.302	0.037	0.0100	Retain
52	Delay in Payment	73	0.819	425.5	67.552	0.229	0.027	0.0125	Retain
53	Delay in Contractor's Payment Certification by the consultant	72	0.852	325.5	56.258	0.187	0.022	0.0167	Retain
54	Errors and Omissions in Design Drawings	72	0.873	440	71.841	-0.16	0.019	0.0250	Retain
55	Omission in design contract documents	69	0.967	448.5	72.482	-0.41	0.049	0.0500	Retain
	Process by the Client								

Appendix 10K H2 :The median for risk factors is =4 for consultants

	Risk factor	Consultants							
		N	Sig	Test Statistic t	Standard error	Standardised Test statistics z	Effect size r r=z/√N	**Holm-Bonferroni correction**	Decision
1	Client's Financial Stability	98	0.000	1,045.00	97.283	3.66	0.37	0.0009	Reject
2	Delay in site handover	88	0.000	280	107.088	-4.067	0.434	0.0010	Reject
3	Clarity of Drawings and Technical Specifications	90	0.000	1,298.00	116.142	3.556	0.375	0.0010	Reject
4	Contractor's Underestimate of Construction Cost	97	0.000	1,581.00	132.786	4.074	0.414	0.0010	Reject
5	Delay in submitting invoices	96	0.000	172	151.055	-6.18	0.631	0.0010	Reject
6	Frequent Changes in Statutory Regulations	92	0.000	331.5	110.857	-3.707	0.386	0.0010	Reject
7	Inclement Weather	95	0.000	459	129.43	-3.759	0.386	0.0011	Reject
8	Site Orientation and Restricted Access	93	0.000	229	159.013	-6.15	0.638	0.0011	Reject
9	Unavailability of Equipment Required	95	0.000	400	133.597	-4.315	0.443	0.0011	Reject
10	Unavailability of Sufficient Storage Space around or on Site	95	0.000	175.5	155.548	-6.194	0.635	0.0011	Reject
11	Unavailability or Shortage in Specified Materials	94	0.000	301	122.697	-4.519	0.466	0.0012	Reject
12	High taxes	93	0.000	288	153.033	-5.561	0.577	0.0012	Reject
13	Difficulty in getting insurance cover	93	0.000	300	163.238	-5.774	0.599	0.0012	Reject
14	Delay in resolving disputes	96	0.000	264	138.264	-5.381	0.549	0.0013	Reject
15	Criminal acts vandalism, theft	94	0.000	276	157.05	-5.712	0.589	0.0013	Reject
16	Construction accidents	96	0.001	540	134.983	-3.467	0.354	0.0013	Reject
17	Delay in mobilisation	95	0.001	513	127.574	-3.39	0.348	0.0014	Reject
18	Insufficient protection of works	95	0.015	660	130.604	-2.423	0.249	0.0014	Retain
19	Shortage in Technical Staff and Skilled Labour	95	0.015	525	112.137	-2.435	0.25	0.0014	Retain
20	Delay in Statutory Approvals and Permits	95	0.017	755	146.769	-2.388	0.245	0.0015	Retain
21	Inadequate site investigation	96	0.025	1,151.00	118.69	2.241	0.229	0.0015	Retain
22	Non-compliance to tender requirement on site	96	0.025	756	141.196	-2.242	0.229	0.0016	Retain
23	Poor supervision	94	0.04	1,204.00	126.156	2.049	0.211	0.0016	Retain
24	Unsafe work environment	90	0.057	480	96.012	-1.906	0.201	0.0017	Retain
25	Unclear scope of works	97	0.064	1,102.00	117.027	1.854	0.188	0.0017	Retain
26	Delay in Consultant's Response to Requests for Information (RI	98	0.073	575	108.598	-1.796	0.181	0.0018	Retain
27	Lack of interest on delayed payment	97	0.091	660	115.765	-1.689	0.171	0.0019	Retain
28	Poor supervision on site	97	0.097	980.5	109.998	1.659	0.168	0.0019	Retain
29	Lack of inspection of works	95	0.121	936	107.154	1.549	0.159	0.0020	Retain
30	Late Delivery of Materials	95	0.123	650	114.351	-1.543	0.158	0.0021	Retain
31	Unforeseen Ground Conditions	94	0.144	588	105.742	-1.461	0.151	0.0022	Retain
32	Unrealistic Contract Duration of the Project	97	0.159	688.5	118.637	-1.408	0.143	0.0023	Retain
33	Frequent Change Orders by Client	95	0.162	484	91.914	-1.398	0.143	0.0024	Retain
34	Slow Decision Making Process by Client	98	0.18	540	109.215	-2.362	0.239	0.0025	Retain
35	Poor quality materials	96	0.213	697.5	87.93	1.245	0.127	0.0026	Retain
36	Poor coordination and communication	95	0.236	775	94.506	1.185	0.122	0.0028	Retain
37	Omission in design contract documents	95	0.248	552	96.016	-1.156	0.119	0.0029	Retain
38	Defective Workmanship and Rework	96	0.259	952	111.248	1.128	0.115	0.0031	Retain
39	Errors and Omissions in Design Drawings	95	0.294	945	112.873	1.05	0.108	0.0033	Retain
40	Delay in Contractor's Payment Certification by the consultant	96	0.313	611	103.587	-1.009	0.103	0.0036	Retain
41	Contractor's Financial Difficulties	96	0.318	1,209.00	136.705	0.999	0.102	0.0038	Retain
42	Escalation in Material Prices	95	0.342	852.5	130.613	-0.949	0.097	0.0042	Retain
43	Delay in Consultant's Approval of Shop Drawings	97	0.426	585	98.01	-0.796	0.081	0.0045	Retain
44	In adequate budgeting and contingencies	97	0.429	1,044.00	124.6	0.791	0.08	0.0050	Retain
45	Lack of Experience in Similar Projects	96	0.439	637.5	100.778	-0.778	0.079	0.0056	Retain
46	Delay in Payment Process by the Client	96	0.442	821	102.764	0.769	0.078	0.0063	Retain
47	Suspension of work	93	0.46	598	114.343	-1.998	0.207	0.0071	Retain
48	Inadequate specification	98	0.54	841	120.811	-0.613	0.062	0.0083	Retain
49	Unstable exchange rates	96	0.606	795	117.259	-0.516	0.053	0.0100	Retain
50	Poor Labour Productivity	95	0.618	912	129.158	-1.499	0.154	0.0125	Retain
51	Poor planning of resources -materials, labour, equipment	97	0.69	837	120.198	-0.399	0.041	0.0167	Retain
52	Holding key decisions in isolation	94	0.696	702	103.565	-0.391	0.04	0.0250	Retain
53	Delay in Consultant's Approval of Materials Submission	98	0.767	765	111.467	-0.296	0.03	0.0500	Retain
54	Ineffective monitoring of risks	96	0.854	750	108.585	-0.184	0.018	0.0250	Retain
55	Lack of Coordination among Design Disciplines	97	0.877	896	122.418	-0.155	0.012	-0.0500	Retain

Appendix 10L H4: The perceptions of consultants and contractors with regard to risk factors influencing performance are similar for varying years of experience

	Risk Factors	N	Test statistic-t	Chi-Square	df	Asymp. Sig.	Holm-Bonferroni correction	1-5 years	6-10 years	11-15 years	Over 15 years	Effect size $Ŋ^2 = x^2/N-1$	Decision
1	Frequent Changes in Statutory Regulations	170	9.886	7.131	3	0.02	0.0009	77.82	92.91	74.79	98.23	0.3009	Retain
2	Omission in design contract documents	169	8.968	15.037	3	0.03	0.0009	73.65	97.69	70.66	101.93	1.346	Retain
3	Holding key decisions in isolation	171	8.43	5.622	3	0.038	0.0009	89.78	92.93	67.43	86.81	0.1859	Retain
4	Delay in Consultant's Response to Requests for Information	176	8.368	15.02	3	0.039	0.0010	89.49	89.49	87.33	97.73	1.289	Retain
5	Delay in Contractor's Payment Certification by the consultant	173	8.384	9.602	3	0.039	0.0010	72.91	98.01	86.03	106.65	0.536	Retain
6	Delay in site handover	158	6.631	8.271	3	0.085	0.0010	67.27	89.73	80.16	89.15	0.434	Retain
7	Unrealistic Contract Duration of the Project	174	6.547	8.758	3	0.088	0.0010	77.62	106.47	91.23	84.58	0.443	Retain
8	In adequate budgeting and contingencies	174	6.376	6.116	3	0.095	0.0010	77.79	89.74	87.27	100.39	0.216	Retain
9	Slow Decision Making Process by Client	175	6.043	14.299	3	0.11	0.0011	74.66	94.06	80.82	107.12	1.175	Retain
10	Poor coordination and communication	172	5.264	8.144	3	0.153	0.0011	90.98	85.64	64.57	94.73	0.3879	Retain
11	Clarity of Drawings and Technical Specifications	164	5.048	1.503	3	0.168	0.0011	78.09	85.75	86.72	87.79	0.014	Retain
12	Delay in Statutory Approvals and Permits	169	4.463	9.674	3	0.216	0.0011	74.26	89.01	79.05	102.55	0.5571	Retain
13	Defective Workmanship and Rework	173	4.181	2.634	3	0.243	0.0012	86.16	81.76	81.48	96.37	0.0401	Retain
14	Inclement Weather	172	4.062	1.549	3	0.255	0.0012	89.06	84.66	77.47	90.22	0.014	Retain
15	Delay in resolving disputes	174	3.911	2.074	3	0.271	0.0012	84.15	90.08	80.67	95.08	0.0249	Retain
16	Unavailability or Shortage in Specified Materials	171	3.787	6.419	3	0.285	0.0013	84.61	91.56	70.65	93.34	0.2424	Retain
17	Unavailability of Equipment Required	171	3.672	5.149	3	0.299	0.0013	82.18	95.6	72.54	92.98	0.156	Retain
18	Delay in Consultant's Approval of Shop Drawings	173	3.62	4.727	3	0.305	0.0013	83.51	95.61	84.14	95.27	0.13	Retain
19	Lack of interest on delayed payment	172	3.396	2.546	3	0.334	0.0014	80.57	92.07	83.07	93.3	0.038	Retain
20	Non-compliance to tender requirement on site	172	1.929	2.551	3	0.339	0.0014	80.3	95.54	84.93	89.22	0.0381	Retain
21	Unstable exchange rates	171	3.338	4.116	3	0.342	0.0014	87.69	80.08	75.72	96.1	0.0997	Retain
22	Criminal acts vandalism, theft	170	3.203	3.393	3	0.361	0.0015	83.26	95.62	74.34	88.15	0.0681	Retain
23	High taxes	171	3.07	8.213	3	0.381	0.0015	79.93	103.79	73.29	88.57	0.3969	Reject
24	Delay in Consultant's Approval of Materials Submission	177	3.063	2.646	3	0.382	0.0016	83.51	95.61	84.14	95.27	0.04	Retain
25	Delay in mobilisation	173	2.805	4.553	3	0.423	0.0016	89.1	97.83	73.45	83.9	0.1205	Retain
26	Unforeseen Ground Conditions	171	2.755	7.172	3	0.431	0.0017	80.03	101.13	71.38	85.64	0.3026	Retain
27	Inadequate specification	174	2.702	3.712	3	0.44	0.0017	79.55	96.82	86.4	92.35	0.08	Retain
28	Suspension of work	165	2.639	4.38	3	0.451	0.0018	74.95	82.14	86.77	93.46	0.117	Retain
29	Errors and Omissions in Design Drawings	172	2.504	3.26	3	0.475	0.0019	78.08	90.27	77.47	103.86	0.062	Retain
30	Shortage in Technical Staff and Skilled Labour	173	2.456	4.351	3	0.483	0.0019	80.12	83.51	88.81	99.09	0.11	Retain
31	Ineffective monitoring of risks	173	2.205	3.421	3	0.531	0.0020	86.36	89.74	73.61	94.42	0.0677	Retain
32	Lack of Coordination among Design Disciplines	170	2.142	11.242	3	0.543	0.0021	77.19	96.17	69.54	100.11	0.748	Retain
33	Lack of Experience in Similar Projects	174	2.142	5.886	3	0.544	0.0022	83.02	90.31	75.19	100.34	0.1991	Retain
34	Poor supervision on site	170	2.003	1.676	3	0.572	0.0023	83.77	78.76	88.16	91.62	0.0166	Retain
35	Late Delivery of Materials	172	1.976	6.639	3	0.577	0.0024	78.73	90.41	78.74	100.57	0.2578	Retain
36	Construction accidents	172	3.365	7.906	3	0.587	0.0025	79.06	92.75	88.5	90.99	0.3565	Retain
37	Site Orientation and Restricted Access	170	1.836	1.514	3	0.607	0.0026	82.21	90.77	80.21	89.77	0.0135	Retain
38	Unsafe work environment	165	1.798	0.694	3	0.615	0.0028	81.94	86.67	77.78	85.05	0.0029	Retain
39	Frequent Change Orders by Client	172	1.762	3.232	3	0.623	0.0029	84.82	87.82	75.36	95.02	0.061	Retain
40	Poor supervision	166	1.643	6.087	3	0.65	0.0031	73.28	88.79	82.05	94.4	0.225	Retain
41	Difficulty in getting insurance cover	169	1.48	6.332	3	0.687	0.0033	79.03	101.14	75.52	80.67	0.2379	Retain
42	Escalation in Material Prices	172	1.476	4.655	3	0.688	0.0036	81.75	98.94	76.64	89.99	0.126	Retain
43	Inadequate site investigation	171	1.021	6.448	3	0.796	0.0038	77.87	93.53	77.25	97.5	0.245	Retain
44	Insufficient protection of works	171	0.982	1.213	3	0.805	0.0042	83.58	86.49	81.34	92.28	0.0087	Retain
45	Poor Labour Productivity	172	0.894	1.462	3	0.827	0.0045	81.69	90.56	84.9	91.55	0.0125	Retain
46	Unavailability of Sufficient Storage Space around or on Site	170	0.876	4.602	3	0.831	0.0050	83.09	101.13	71.38	85.64	0.1253	Retain
47	Contractor's Underestimate of Construction Cost	174	0.837	0.935	3	0.841	0.0056	84.36	92.01	84.666	90.45	0.0051	Retain
48	Poor planning of resources -materials, labour, equipment	175	0.675	4.01	3	0.879	0.0063	78.88	92.03	95.05	94.08	0.0924	Retain
49	Delay in submitting invoices	172	0.642	3.006	3	0.887	0.0071	81.17	96.22	80.84	90.54	0.0528	Retain
50	Delay in Payment Process by the Client	174	0.5	4.808	3	0.919	0.0083	88.92	80.71	76.34	98.52	0.134	Retain
51	Lack of inspection of works	169	0.456	3.112	3	0.928	0.0100	83.15	89.53	72.98	91.47	0.058	Retain
52	Client's Financial Stability	177	0.438	0.706	3	0.932	0.0125	85.63	88.75	92.76	91.94	0.003	Retain
53	Contractor's Financial Difficulties	172	0.262	3.007	3	0.967	0.0167	80.66	86.88	84.41	96.37	0.053	Retain
54	Poor quality materials	173	0.196	2.079	3	0.978	0.0250	80.64	89.01	90.76	92.68	0.0251	Retain
55	Unclear scope of works	165	0.167	2.516	3	0.983	0.0500	77.18	81.5	86.04	91.18	0.039	Retain

Appendix 10M H5: The perceptions of consultants and contractors with regard to risk factors influencing performance are similar

Rank	Risk Factor	Role	N	Mean Ranks	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)	Holm-Bonferroni correction	Effect size r=Z /√N	Decision
1	Lack of inspection of works	consultants	95	93.29	2727.5	5502.5	-2.641	0.008	0.0009	-0.203	Retain
		Contractors	74	74.36							
2	Poor supervision on site	consultants	97	93.27	2786.5	5487.5	-2.539	0.011	0.0009	-0.038	Retain
		Contractors	73	75.17							
3	Ineffective monitoring of risks	consultants	96	95.02	2926.5	5929.5	-2.484	0.013	0.0009	-0.189	Retain
		Contractors	77	77.01							
4	Inadequate site investigation	consultants	96	93.66	2865	5715	-2.422	0.015	0.0010	-0.185	Retain
		Contractors	75	76.2							
5	Poor supervision	consultants	94	89.88	2784	5412	-2.082	0.037	0.0010	-0.161	Retain
		Contractors	72	75.17							
6	Unforeseen Ground Conditions	consultants	94	92.64	2995	5998	-2.034	0.042	0.0010	-0.156	Retain
		Contractors	77	77.9							
7	Lack of Experience in Similar Projects	consultants	96	93.92	3128	6209	-1.991	0.046	0.0010	-0.151	Retain
		Contractors	78	79.6							
8	Unclear scope of works	consultants	97	88.53	2761.5	5107.5	-1.881	0.06	0.0010	-0.146	Retain
		Contractors	68	75.11							
9	Unrealistic Contract Duration of the Project	consultants	97	93.14	3187	6190	-1.738	0.082	0.0011	-0.132	Retain
		Contractors	77	80.39							
10	Delay in resolving disputes	consultants	94	92.64	3216.5	6297.5	-1.671	0.095	0.0011	-0.127	Retain
		Contractors	77	77.9							
11	Delay in submitting invoices	consultants	96	81.18	3137.5	7793.5	-1.64	0.101	0.0011	-0.125	Retain
		Contractors	76	93.22							
12	Frequent Changes in Statutory Regulations	consultants	92	90.61	3118	6199	-1.532	0.125	0.0011	-0.117	Retain
		Contractors	78	79.47							
14	Contractor's Underestimate of Construction Cost	consultants	97	92.03	3295	6298	-1.453	0.146	0.0012	-0.11	Retain
		Contractors	77	81.79							
15	Poor coordination and communication	consultants	95	91.14	3216.5	6219.5	-1.45	0.147	0.0012	-0.111	Retain
		Contractors	77	80.77							
16	Delay in Statutory Approvals and Permits	consultants	95	89.31	3105.5	5880.5	-1.344	0.179	0.0013	-0.1034	Retain
		Contractors	74	79.47							
17	Suspension of work	consultants	93	87.05	2971	5599	-1.305	0.192	0.0013	-0.102	Retain
		Contractors	72	77.76							
18	Escalation in Material Prices	consultants	95	82.35	3263.5	7823.5	-1.28	0.201	0.0013	-0.098	Retain
		Contractors	77	91.62							
19	Unsafe work environment	consultants	90	87.06	3010	5860	-1.257	0.209	0.0014	-0.098	Retain
		Contractors	75	78.13							
20	Inclement Weather	consultants	95	90.49	3278	6281	-1.223	0.221	0.0014	-0.093	Retain
		Contractors	77	81.57							
21	Holding key decisions in isolation	consultants	94	89.34	3305.5	6308.5	-1.032	0.302	0.0014	-0.079	Retain
		Contractors	77	81.93							
22	Insufficient protection of works	consultants	95	89.26	3300	6226	-1.011	0.312	0.0015	-0.077	Retain
		Contractors	76	81.92							
23	Delay in Contractor's Payment Certification by the consultant	consultants	96	84.05	3412.5	8068.5	-0.934	0.35	0.0015	-0.071	Retain
		Contractors	77	90.68							
24	Lack of Coordination among Design Disciplines	Consultants	97	88.27	3272	5973	-0.89	0.374	0.0016	-0.068	Retain
		Contractors	73	81.82							
25	In adequate budgeting and contingencies	consultants	97	90.33	3460	6463	-0.885	0.376	0.0016	-0.067	Retain
		Contractors	77	83.94							

Appendix 10M H5: The perceptions of consultants and contractors with regard to risk factors influencing performance are similar

Rank	Risk Factor	Role	N	Mean Ranks	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)	Holm-Bonferroni correct	Effect size r=Z /√N	Decision
26	Difficulty in getting insurance cover	consultants	93	82.13	3267	7638	-0.875	0.381	0.0017	-0.067	Retain
		Contractors	76	88.51							
27	Poor planning of resources -materials, labour, equipment	consultants	97	85.16	3508	8261	-0.874	0.382	0.0017	-0.066	Retain
		Contractors	78	91.53							
28	High taxes	consultants	93	83.11	3358	7729	-0.866	0.387	0.0018	-0.066	Retain
		Contractors	78	89.45							
29	Omission in design contract documents	Consultants	95	82.36	3264	7824	-0.847	0.397	0.0019	-0.065	Retain
		Contractors	74	88.39							
30	Site Orientation and Restricted Access	consultants	93	88.09	3339.5	6342.5	-0.802	0.423	0.0019	-0.061	Retain
		Contractors	77	82.37							
31	Contractor's Financial Difficulties	consultants	96	84.09	3417	8073	-0.761	0.447	0.0020	-0.058	Retain
		Contractors	76	89.54							
32	Delay in Consultant's Response to Requests for Information (RFI)	consultants	98	86.19	3595.5	8446.5	-0.719	0.472	0.0021	-0.054	Retain
		Contractors	78	91.4							
33	Errors and Omissions in Design Drawings	Consultants	95	88.79	3439.5	6442.5	-0.715	0.474	0.0022	-0.054	Retain
		Contractors	77	83.67							
34	Delay in Consultant's Approval of Materials Submission	consultants	98	86.7	3646	8497	-0.712	0.476	0.0023	-0.054	Retain
		Contractors	79	91.85							
35	Frequent Change Orders by Client	consultants	95	88.76	3443	6446	-0.711	0.477	0.0024	-0.054	Retain
		Contractors	77	83.71							
36	Delay in mobilisation	consultants	95	89.21	3495.5	6576.5	-0.675	0.5	0.0025	-0.051	Retain
		Contractors	78	84.31							
37	Unavailability of Equipment Required	consultants	95	88.08	3412	6338	-0.65	0.516	0.0026	-0.05	Retain
		Contractors	76	83.39							
38	Poor Labour Productivity	consultants	95	88.39	3478	6481	-0.584	0.559	0.0028	-0.044	Retain
		Contractors	77	84.17							
39	Unstable exchange rates	consultants	96	87.52	3454	6304	-0.482	0.63	0.0029	-0.037	Retain
		Contractors	75	84.05							
40	Inadequate specification	Consultants	98	86.25	3601.5	8452.5	-0.396	0.692	0.0031	-0.03	Retain
		Contractors	76	89.11							
41	Poor quality materials	consultants	96	88.25	3576	6579	-0.391	0.696	0.0033	-0.03	Retain
		Contractors	77	85.44							
42	Lack of interest on delayed payment	consultants	97	87.72	3519	6369	-0.384	0.701	0.0036	-0.029	Retain
		Contractors	75	84.92							
43	Delay in Payment Process by the Client	consultants	96	88.73	3626	6707	-0.383	0.702	0.0038	-0.029	Retain
		Contractors	78	85.99							
44	Unavailability of Sufficient Storage Space around or on Site	consultants	95	86.71	3447.5	6297.5	-0.376	0.707	0.0042	-0.029	Retain
		Contractors	75	83.97							
45	Delay in Consultant's Approval of Shop Drawings	consultants	97	86.21	3609	8362	-0.252	0.801	0.0045	-0.019	Retain
		Contractors	76	88.01							
46	Clarity of Drawings and Technical Specifications	consultants	90	81.92	3278	7373	-0.188	0.851	0.0050	-0.014	Retain
		Contractors	74	83.2							
47	Construction accidents	consultants	96	85.9	3590.5	8246.5	-0.186	0.853	0.0056	-0.014	Retain
		Contractors	76	87.26							
48	Late Delivery of Materials	consultants	95	87.02	3608.5	6611.5	-0.159	0.873	0.0063	0.002	Retain
		Contractors	77	85.86							
49	Shortage in Technical Staff and Skilled Labour	consultants	95	86.53	3660	8220	-0.144	0.885	0.0071	-0.011	Retain
		Contractors	78	87.58							
50	Client's Financial Stability	consultants	98	89.33	3839	6999	-0.103	0.918	0.0083	-0.008	Retain
		Contractors	79	88.59							
51	Unavailability or Shortage in Specified Materials	consultants	94	86.24	3596	6599	-0.075	0.94	0.0100	-0.006	Retain
		Contractors	77	85.7							
52	Defective Workmanship and Rework	consultants	96	87.16	3680.5	6683.5	-0.051	0.959	0.0125	-0.004	Retain
		Contractors	77	86.8							
53	Delay in site handover	consultants	88	79.64	3067.5	5552.5	-0.046	0.963	0.0167	-0.003	Retain
		Contractors	70	79.32							
54	Criminal acts vandalism, theft	consultants	94	85.37	3559.5	8024.5	-0.041	0.967	0.0250	-0.003	Retain
		Contractors	76	85.66							
55	Non-compliance to tender requirement on site (labour and Equipment)	consultants	96	86.42	3640	8296	-0.026	0.979	0.0500	-0.002	Retain
		Contractors	76	86.61							

Appendix 10N H_8: There is no (moderate to high) relationship between risk factors

Spearman's rho			RF1	RF2	RF3	RF4	RF5	RF6	RF7	RF8	RF9	RF10	RF11	RF12	RF13
RF1	Client's Financial Stability	C.C	1.000	.548**	.361**	.191*	.358**	.343**	.354**	.400**	.177*	.361**	.395**	.351**	.419**
		Sig.		.0000	.0000	.0113	.0000	.0000	.0000	.0000	.0262	.0000	.0000	.0000	.0000
		N	177	174	172	175	174	172	165	165	158	164	177	173	176
RF2	Delay in Payment Process by the Client	C.C	.548**	1.000	.484**	.382**	.151*	.372**	.323**	.247**	.100	.243**	.316**	.307**	.359**
		Sig.	.0000		.0000	.0000	.0486	.0000	.0000	.0015	.2121	.0019	.0000	.0000	.0000
		N	174	174	170	172	171	169	162	162	156	161	174	170	173
RF3	Frequent Change Orders by Client	C.C	.361**	.484**	1.000	.366**	.187*	.293**	.281**	.364**	.159*	.209**	.351**	.292**	.395**
		Sig.	.0000	.0000		.0000	.0146	.0001	.0003	.0000	.0489	.0080	.0000	.0001	.0000
		N	172	170	172	171	170	168	161	161	154	160	172	168	171
RF4	Slow Decision Making Process by Client	C.C	.191*	.382**	.366**	1.000	.303**	.356**	.443**	.362**	.295**	.137	.417**	.385**	.383**
		Sig.	.0113	.0000	.0000		.0001	.0000	.0000	.0000	.0002	.0826	.0000	.0000	.0000
		N	175	172	171	175	173	171	164	164	156	162	175	171	174
RF5	Unrealistic Contract Duration of the Project	C.C	.358**	.151*	.187*	.303**	1.000	.496**	.451**	.410**	.364**	.223**	.378**	.317**	.405**
		Sig.	.0000	.0486	.0146	.0001		.0000	.0000	.0000	.0000	.0044	.0000	.0000	.0000
		N	174	171	170	173	174	171	164	164	156	162	174	170	173
RF6	Lack of interest on delayed payment	C.C	.343**	.372**	.293**	.356**	.496**	1.000	.358**	.293**	.273**	.257**	.320**	.310**	.475**
		Sig.	.0000	.0000	.0001	.0000	.0000		.0000	.0001	.0006	.0010	.0000	.0000	.0000
		N	172	169	168	171	171	172	162	163	154	160	172	168	171
RF7	Unclear scope of works	C.C	.354**	.323**	.281**	.443**	.451**	.358**	1.000	.477**	.237**	.299**	.415**	.377**	.402**
		Sig.	.0000	.0000	.0003	.0000	.0000	.0000		.0000	.0034	.0002	.0000	.0000	.0000
		N	165	162	161	164	164	162	165	159	151	155	165	163	164
RF8	Suspension of work	C.C	.400**	.247**	.364**	.362**	.410**	.293**	.477**	1.000	.457**	.059	.354**	.314**	.405**
		Sig.	.0000	.0015	.0000	.0000	.0000	.0001	.0000		.0000	.4652	.0000	.0000	.0000
		N	165	162	161	164	164	163	159	165	151	154	165	164	164
RF9	Delay in site handover	C.C	.177*	.100	.159*	.295**	.364**	.273**	.237**	.457**	1.000	-.030	.215**	.146	.257**
		Sig.	.0262	.2121	.0489	.0002	.0000	.0006	.0034	.0000		.7182	.0067	.0690	.0012
		N	158	156	154	156	156	154	151	151	158	147	158	156	157
RF10	Clarity of Drawings and Technical Specifications	C.C	.361**	.243**	.209**	.137	.223**	.257**	.299**	.059	-.030	1.000	.506**	.498**	.419**
		Sig.	.0000	.0019	.0080	.0826	.0044	.0010	.0002	.4652	.7182		.0000	.0000	.0000
		N	164	161	160	162	162	160	155	154	147	164	164	161	163
RF11	Delay in Consultant's Approval of Materials Submission	C.C	.395**	.316**	.351**	.417**	.378**	.320**	.415**	.354**	.215**	.506**	1.000	.823**	.585**
		Sig.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0067	.0000		.0000	.0000
		N	177	174	172	175	174	172	165	165	158	164	177	173	176
RF12	Delay in Consultant's Approval of Shop Drawings	C.C	.351**	.307**	.292**	.385**	.317**	.310**	.377**	.314**	.146	.498**	.823**	1.000	.657**
		Sig.	.0000	.0000	.0001	.0000	.0000	.0000	.0000	.0000	.0690	.0000	.0000		.0000
		N	173	170	168	171	170	168	163	164	156	161	173	173	172
RF13	Delay in Consultant's Response to Requests for Information (RFI)	C.C	.419**	.359**	.395**	.383**	.405**	.475**	.402**	.405**	.257**	.419**	.585**	.657**	1.000
		Sig.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0012	.0000	.0000	.0000	
		N	176	173	171	174	173	171	164	164	157	163	176	172	176
RF14	Delay in Contractor's Payment Certification by the consultant	C.C	.366**	.278**	.377**	.361**	.298**	.343**	.308**	.287**	.250**	.398**	.542**	.490**	.544**
		Sig.	.0000	.0002	.0000	.0000	.0001	.0000	.0001	.0002	.0015	.0000	.0000	.0000	.0000
		N	173	171	169	171	170	168	163	163	158	161	173	170	172
RF15	Errors and Omissions in Design Drawings	C.C	.347**	.241**	.205**	.221**	.394**	.269**	.387**	.234**	.223**	.400**	.454**	.472**	.628**
		Sig.	.0000	.0015	.0074	.0037	.0000	.0004	.0000	.0029	.0055	.0000	.0000	.0000	.0000
		N	172	170	169	171	170	168	162	161	154	160	172	168	171
RF16	Lack of Coordination among Design Disciplines	C.C	.239**	.221**	.249**	.365**	.410**	.216**	.458**	.411**	.325**	.261**	.481**	.395**	.502**
		Sig.	.0017	.0041	.0012	.0000	.0000	.0050	.0000	.0000	.0000	.0009	.0000	.0000	.0000
		N	170	168	167	169	169	168	162	160	154	158	170	166	169
RF17	Omission in design contract documents	C.C	.311**	.227**	.278**	.296**	.400**	.381**	.271**	.341**	.355**	.385**	.492**	.505**	.570**
		Sig.	.0000	.0032	.0003	.0001	.0000	.0000	.0005	.0000	.0000	.0000	.0000	.0000	.0000
		N	169	167	166	168	167	166	159	160	154	156	169	165	168
RF18	Inadequate specification	C.C	.249**	.146	.218**	.205**	.411**	.209**	.380**	.191*	.274**	.393**	.459**	.420**	.480**
		Sig.	.0009	.0573	.0044	.0068	.0000	.0064	.0000	.0141	.0005	.0000	.0000	.0000	.0000
		N	174	171	170	173	172	170	165	164	156	161	174	171	173

Spearman's rho			RF14	RF15	RF16	RF17	RF18	RF19	RF20	RF21	RF22	RF23	RF24	RF25	RF26
RF1	Client's Financial Stability	C.C	.366**	.347**	.239**	.311**	.249**	.326**	.209**	.209**	.327**	.438**	.281**	.265**	.091
		Sig.	.0000	.0000	.0017	.0000	.0009	.0000	.0061	.0064	.0000	.0000	.0002	.0004	.2299
		N	173	172	170	169	174	174	171	169	166	172	174	173	174
RF2	Delay in Payment Process by the Client	C.C	.278**	.241**	.221**	.227**	.146	.218**	.184*	.165*	.242**	.316**	.214**	.258**	.109
		Sig.	.0002	.0015	.0041	.0032	.0573	.0041	.0172	.0334	.0019	.0000	.0050	.0007	.1560
		N	171	170	168	167	171	171	168	166	163	169	171	170	171
RF3	Frequent Change Orders by Client	C.C	.377**	.205**	.249**	.278**	.218**	.210**	.316**	.267**	.252**	.197*	.266**	.304**	.191*
		Sig.	.0000	.0074	.0012	.0003	.0044	.0060	.0000	.0005	.0013	.0102	.0005	.0001	.0128
		N	169	169	167	166	170	170	166	164	161	169	170	169	170
RF4	Slow Decision Making Process by Client	C.C	.361**	.221**	.365**	.296**	.205**	.240**	.262**	.112	.119	.285**	.358**	.284**	.177*
		Sig.	.0000	.0037	.0000	.0001	.0068	.0015	.0006	.1474	.1271	.0002	.0000	.0002	.0201
		N	171	171	169	168	173	173	170	168	165	171	173	172	173
RF5	Unrealistic Contract Duration of the Project	C.C	.298**	.394**	.410**	.400**	.411**	.250**	.388**	.240**	.266**	.324**	.359**	.402**	.201**
		Sig.	.0001	.0000	.0000	.0000	.0000	.0009	.0000	.0017	.0006	.0000	.0000	.0000	.0083
		N	170	170	169	167	172	172	168	167	163	170	172	171	172
RF6	Lack of interest on delayed payment	C.C	.343**	.269**	.216**	.381**	.209**	.195*	.256**	.145	.213**	.310**	.319**	.238**	.175*
		Sig.	.0000	.0004	.0050	.0000	.0064	.0105	.0009	.0635	.0067	.0000	.0000	.0018	.0223
		N	168	168	168	166	170	171	166	164	161	168	170	169	170
RF7	Unclear scope of works	C.C	.308**	.387**	.458**	.271**	.380**	.206**	.314**	.173*	.287**	.361**	.490**	.320**	.074
		Sig.	.0001	.0000	.0000	.0005	.0000	.0084	.0000	.0287	.0003	.0000	.0000	.0000	.3454
		N	163	162	162	159	165	163	161	160	156	162	164	163	163
RF8	Suspension of work	C.C	.287**	.234**	.411**	.341**	.191*	.294**	.348**	.258**	.345**	.267**	.332**	.273**	.239**
		Sig.	.0002	.0029	.0000	.0000	.0141	.0001	.0000	.0011	.0000	.0006	.0000	.0004	.0021
		N	163	161	160	160	164	164	161	158	156	162	164	163	164
RF9	Delay in site handover	C.C	.250**	.223**	.325**	.355**	.274**	.173*	.317**	.082	.108	.132	.287**	.208**	.254**
		Sig.	.0015	.0055	.0000	.0000	.0005	.0308	.0001	.3180	.1895	.1038	.0003	.0093	.0014
		N	158	154	154	154	156	156	156	152	150	154	156	155	156
RF10	Clarity of Drawings and Technical Specifications	C.C	.398**	.400**	.261**	.385**	.393**	.352**	.283**	.207**	.358**	.330**	.300**	.201*	.011
		Sig.	.0000	.0000	.0009	.0000	.0000	.0000	.0003	.0094	.0000	.0000	.0001	.0108	.8865
		N	161	160	158	156	161	161	159	156	154	160	162	160	161
RF11	Delay in Consultant's Approval of Materials Submission	C.C	.542**	.454**	.481**	.492**	.459**	.390**	.401**	.279**	.360**	.386**	.403**	.322**	.159*
		Sig.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0002	.0000	.0000	.0000	.0000	.0362
		N	173	172	170	169	174	174	171	169	166	172	174	173	174
RF12	Delay in Consultant's Approval of Shop Drawings	C.C	.490**	.472**	.395**	.505**	.420**	.433**	.388**	.295**	.373**	.349**	.375**	.308**	.160*
		Sig.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0001	.0000	.0000	.0000	.0000	.0377
		N	170	168	166	165	171	170	168	166	164	169	171	169	170
RF13	Delay in Consultant's Response to Requests for Information (RFI)	C.C	.544**	.628**	.502**	.570**	.480**	.396**	.449**	.320**	.389**	.418**	.440**	.339**	.194*
		Sig.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0107
		N	172	171	169	168	173	173	170	168	165	171	173	172	173
RF14	Delay in Contractor's Payment Certification by the consultant	C.C	1.000	.444**	.397**	.403**	.371**	.244**	.364**	.248**	.266**	.388**	.323**	.315**	.167*
		Sig.		.0000	.0000	.0000	.0000	.0013	.0000	.0013	.0006	.0000	.0000	.0000	.0288
		N	173	169	168	168	170	171	169	165	163	169	171	170	171
RF15	Errors and Omissions in Design Drawings	C.C	.444**	1.000	.639**	.443**	.473**	.337**	.561**	.358**	.352**	.323**	.333**	.391**	.172*
		Sig.	.0000		.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0251
		N	169	172	167	166	170	170	166	165	161	168	170	169	170
RF16	Lack of Coordination among Design Disciplines	C.C	.397**	.639**	1.000	.535**	.568**	.337**	.515**	.379**	.316**	.256**	.293**	.275**	.248**
		Sig.	.0000	.0000		.0000	.0000	.0000	.0000	.0000	.0000	.0009	.0001	.0003	.0012
		N	168	167	170	165	169	169	164	163	159	166	168	168	168
RF17	Omission in design contract documents	C.C	.403**	.443**	.535**	1.000	.610**	.483**	.504**	.388**	.405**	.323**	.407**	.267**	.142
		Sig.	.0000	.0000	.0000		.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0005	.0659
		N	168	166	165	169	167	168	164	161	159	165	167	167	168
RF18	Inadequate specification	C.C	.371**	.473**	.568**	.610**	1.000	.442**	.490**	.302**	.333**	.305**	.385**	.284**	.133
		Sig.	.0000	.0000	.0000	.0000		.0000	.0000	.0001	.0000	.0001	.0000	.0002	.0809
		N	170	170	169	167	174	172	168	168	164	170	172	172	172

Very strong correlation | Strong correlations | Moderate correlations above 0.5 | Moderate correlations 0.4≤ 0.5

Appendix 10N H_8: There is no (moderate to high) relationship between risk factors

	RF27	RF28	RF29	RF30	RF31	RF32	RF33	RF34	RF35	RF36	RF37	RF38	RF39	RF40	RF41
RF1	.265** .0004 172	.259** .0006 172	.142 .0636 172	.118 .1234 172	.196** .0096 173	.225** .0027 175	.186* .0147 172	.182* .0163 173	.254** .0008 170	.123 .1085 171	.184* .0182 165	.272** .0003 169	.231** .0023 172	.180* .0189 170	.083 .2813 172
RF2	.244** .0014 169	.250** .0010 169	.151 .0502 169	.033 .6676 169	.209** .0064 170	.200** .0084 172	.137 .0759 169	.080 .3024 170	.174* .0243 167	.153* .0480 168	.167* .0332 163	.131 .0922 166	.099 .1980 170	.162* .0361 168	.155* .0446 169
RF3	.262** .0006 169	.379** .0000 168	.276** .0003 168	.173* .0250 168	.252** .0009 169	.137 .0733 171	.250** .0011 168	.214** .0053 169	.294** .0001 167	.229** .0030 167	.171* .0293 162	.168* .0313 165	.145 .0601 169	.308** .0000 169	.277** .0003 168
RF4	.353** .0000 171	.411** .0000 171	.172* .0245 171	.181* .0181 171	.366** .0000 172	.406** .0000 174	.290** .0001 171	.338** .0000 172	.340** .0000 169	.273** .0003 170	.244** .0016 164	.308** .0000 168	.140 .0680 171	.310** .0000 169	.156* .0413 171
RF5	.297** .0001 170	.349** .0000 170	.232** .0023 170	.171* .0254 170	.337** .0000 172	.343** .0000 173	.302** .0001 171	.307** .0000 171	.316** .0000 168	.295** .0001 169	.355** .0000 163	.342** .0000 167	.185* .0160 170	.222** .0039 168	.146 .0570 170
RF6	.359** .0000 168	.357** .0000 168	.258** .0007 168	.121 .1170 168	.362** .0000 170	.244** .0013 171	.284** .0002 169	.278** .0003 169	.277** .0003 166	.255** .0009 167	.299** .0001 161	.276** .0003 165	.225** .0033 168	.207** .0074 166	.085 .2755 168
RF7	.338** .0000 161	.452** .0000 162	.256** .0010 163	.182* .0198 163	.392** .0000 163	.391** .0000 164	.316** .0000 162	.292** .0002 162	.329** .0000 162	.335** .0000 162	.398** .0000 154	.374** .0000 161	.283** .0003 161	.299** .0001 159	.200* .0106 162
RF8	.328** .0000 161	.427** .0000 162	.280** .0003 164	.233** .0027 164	.369** .0000 164	.273** .0004 164	.235** .0025 163	.333** .0000 163	.298** .0001 161	.372** .0000 163	.408** .0000 155	.267** .0006 160	.022 .7801 161	.133 .0954 159	.155* .0492 162
RF9	.305** .0001 154	.256** .0014 154	.321** .0000 156	.244** .0021 156	.247** .0019 156	.292** .0002 156	.217** .0067 155	.432** .0000 155	.272** .0006 154	.317** .0001 156	.279** .0005 150	.226** .0049 154	.169* .0351 155	.163* .0442 153	.243** .0022 156
RF10	.309** .0001 159	.296** .0002 159	.258** .0010 160	.145 .0677 160	.235** .0027 161	.229** .0033 162	.199* .0118 160	.154 .0517 160	.295** .0002 158	.242** .0021 159	.259** .0012 154	.391** .0000 157	.271** .0005 159	.178* .0251 158	.068 .3952 159
RF11	.499** .0000 172	.438** .0000 172	.287** .0001 172	.236** .0018 172	.346** .0000 173	.351** .0000 175	.398** .0000 172	.382** .0000 173	.286** .0002 170	.332** .0000 171	.355** .0000 165	.387** .0000 169	.242** .0014 172	.268** .0004 170	.149 .0513 172
RF12	.456** .0000 168	.486** .0000 169	.233** .0023 170	.195* .0107 170	.375** .0000 169	.359** .0000 171	.444** .0000 168	.352** .0000 169	.271** .0004 168	.302** .0001 169	.293** .0002 161	.382** .0000 167	.212** .0057 168	.249** .0012 166	.138 .0751 168
RF13	.486** .0000 171	.494** .0000 171	.313** .0000 171	.313** .0000 171	.346** .0000 172	.399** .0000 174	.363** .0000 171	.230** .0024 172	.255** .0008 169	.330** .0000 170	.362** .0000 164	.456** .0000 168	.301** .0001 171	.357** .0000 169	.162* .0338 171
RF14	.440** .0000 168	.336** .0000 169	.286** .0002 170	.207** .0068 170	.274** .0003 170	.241** .0015 171	.330** .0000 169	.320** .0000 170	.286** .0002 168	.298** .0001 169	.276** .0004 163	.322** .0000 167	.283** .0002 169	.255** .0009 167	.186* .0151 170
RF15	.343** .0000 168	.268** .0004 168	.288** .0002 168	.293** .0001 168	.239** .0017 169	.324** .0000 171	.222** .0039 168	.094 .2226 169	.117 .1345 166	.339** .0000 167	.380** .0000 163	.426** .0000 165	.251** .0010 169	.332** .0000 167	.160* .0383 168
RF16	.435** .0000 166	.390** .0000 167	.345** .0000 166	.344** .0000 166	.432** .0000 168	.385** .0000 169	.233** .0024 167	.299** .0001 167	.320** .0000 165	.361** .0000 165	.456** .0000 160	.432** .0000 164	.295** .0001 167	.409** .0000 165	.225** .0035 167
RF17	.346** .0000 165	.414** .0000 166	.324** .0000 166	.272** .0004 166	.408** .0000 167	.425** .0000 168	.293** .0001 167	.356** .0000 167	.364** .0000 164	.396** .0000 165	.470** .0000 160	.347** .0000 163	.286** .0002 166	.331** .0000 164	.217** .0048 167
RF18	.316** .0000 170	.328** .0000 170	.323** .0000 171	.304** .0001 171	.376** .0000 171	.414** .0000 173	.296** .0001 170	.302** .0001 171	.367** .0000 169	.381** .0000 170	.423** .0000 163	.350** .0000 168	.334** .0000 170	.269** .0004 168	.247** .0011 170

	RF42	RF43	RF44	RF45	RF46	RF47	RF48	RF49	RF50	RF51	RF52	RF53	RF54	RF55	
RF1	.177* .0204 171	.238** .0016 173	.022 .7760 170	.177* .0209 171	.043 .5781 170	.161* .0356 171	.180* .0188 171	.199** .0090 171	.221** .0039 169	.164* .0303 174	.016 .8389 170	.067 .3786 173	.194* .0109 171	.193* .0111 172	RF1
RF2	.186* .0157 168	.260** .0006 171	.055 .4834 167	.270** .0004 168	.049 .5304 167	.115 .1366 168	.082 .2917 169	.090 .2467 168	.051 .5113 166	.064 .4063 171	-.006 .9425 167	.059 .4446 170	.100 .1950 168	.144 .0624 169	RF2
RF3	.181* .0193 167	.284** .0002 170	.203** .0086 166	.280** .0003 167	.155* .0460 167	.181* .0192 167	.179* .0202 168	.135 .0810 167	.139 .0741 165	.256** .0007 170	.172* .0265 166	.242** .0015 169	.308** .0001 167	.328** .0000 168	RF3
RF4	.146 .0579 170	.262** .0005 172	.209** .0065 169	.313** .0000 170	.202** .0082 170	.194* .0112 170	.139 .0693 171	.114 .1394 170	.189* .0141 168	.188* .0134 173	.307** .0000 169	.285** .0001 172	.141 .0674 170	.199** .0091 171	RF4
RF5	.287** .0002 169	.234** .0021 171	.206** .0075 168	.278** .0002 169	.120 .1222 168	.133 .0847 169	.264** .0005 169	.340** .0000 169	.229** .0029 167	.265** .0004 172	.281** .0002 169	.344** .0000 171	.304** .0001 169	.275** .0003 170	RF5
RF6	.357** .0000 167	.236** .0020 169	.078 .3178 166	.184* .0167 168	.045 .5678 166	.109 .1594 168	.083 .2847 167	.270** .0004 167	.072 .3552 165	.172* .0248 170	.087 .2661 166	.197* .0103 169	.232** .0025 167	.236** .0020 168	RF6
RF7	.253** .0012 161	.264** .0007 162	.231** .0033 160	.330** .0000 161	.140 .0779 159	.138 .0819 160	.322** .0000 160	.189* .0169 160	.149 .0598 160	.297** .0001 163	.277** .0004 160	.266** .0006 162	.242** .0021 160	.290** .0002 161	RF7
RF8	.228** .0038 160	.191* .0149 162	.135 .0894 160	.257** .0010 162	.209** .0079 160	.217** .0056 162	.379** .0000 161	.317** .0000 161	.176* .0257 161	.275** .0004 163	.199* .0115 160	.168* .0326 162	.209** .0079 160	.291** .0002 162	RF8
RF9	.315** .0001 153	.296** .0002 156	.220** .0060 154	.202* .0121 154	.205* .0111 153	.168* .0373 154	.314** .0001 155	.295** .0002 154	.260** .0011 155	.287** .0003 156	.191* .0177 154	.214** .0075 155	.211** .0086 154	.265** .0009 154	RF9
RF10	.178* .0249 158	.264** .0007 160	.145 .0692 157	.226** .0043 158	.055 .4913 157	.134 .0938 158	.112 .1626 158	.072 .3682 159	.096 .2297 157	.159* .0445 161	.209** .0086 157	.255** .0012 160	.306** .0001 159	.265** .0007 159	RF10
RF11	.138 .0712 171	.286** .0001 173	.084 .2776 170	.139 .0705 171	.083 .2811 170	.121 .1145 171	.091 .2369 171	.204** .0073 171	.211** .0060 169	.206** .0063 174	.235** .0021 170	.263** .0005 173	.340** .0000 171	.309** .0000 172	RF11
RF12	.118 .1290 167	.338** .0000 169	.099 .2062 166	.152* .0498 167	.136 .0802 166	.098 .2057 167	.149 .0543 167	.189* .0144 167	.213** .0056 167	.225** .0031 170	.249** .0012 166	.228** .0029 169	.242** .0016 167	.223** .0036 169	RF12
RF13	.217** .0046 170	.392** .0000 172	.213** .0053 169	.318** .0000 170	.202** .0083 169	.255** .0008 170	.226** .0030 170	.344** .0000 170	.293** .0001 168	.343** .0000 173	.278** .0003 169	.313** .0000 172	.382** .0000 170	.404** .0000 171	RF13
RF14	.172* .0260 167	.282** .0002 170	.192* .0131 167	.199** .0098 167	.183* .0182 167	.193* .0123 168	.150 .0512 169	.295** .0001 168	.282** .0002 167	.232** .0023 170	.153* .0472 168	.223** .0035 169	.301** .0001 167	.261** .0006 168	RF14
RF15	.189* .0144 167	.258** .0007 170	.297** .0001 166	.285** .0002 167	.178* .0219 166	.196* .0112 167	.204** .0080 168	.169* .0291 167	.204** .0087 165	.241** .0015 170	.253** .0010 166	.391** .0000 169	.357** .0000 167	.400** .0000 168	RF15
RF16	.239** .0020 165	.349** .0000 168	.356** .0000 164	.352** .0000 165	.249** .0013 164	.256** .0009 165	.320** .0000 166	.268** .0005 165	.197* .0117 163	.286** .0002 168	.231** .0028 165	.421** .0000 167	.390** .0000 165	.431** .0000 166	RF16
RF17	.272** .0004 164	.340** .0000 167	.165* .0349 164	.309** .0001 165	.229** .0031 164	.247** .0013 166	.269** .0005 166	.289** .0002 165	.281** .0003 163	.251** .0011 167	.274** .0004 165	.348** .0000 166	.352** .0000 164	.331** .0000 165	RF17
RF18	.176* .0218 169	.170* .0263 171	.263** .0006 168	.286** .0002 169	.201** .0090 168	.152* .0491 169	.196* .0107 169	.198* .0100 169	.232** .0025 168	.256** .0007 172	.264** .0005 168	.371** .0000 171	.367** .0000 169	.342** .0000 170	RF18

Appendix 10N H_8: There is no (moderate to high) relationship between risk factors

Spearman's rho			RF1	RF2	RF3	RF4	RF5	RF6	RF7	RF8	RF9	RF10	RF11	RF12
RF19	In adequate budgeting and contingencies	C.C	.326**	.218**	.210**	.240**	.250**	.195*	.206**	.294**	.173*	.352**	.390**	.433**
		Sig.	.0000	.0041	.0060	.0015	.0009	.0105	.0084	.0001	.0308	.0000	.0000	.0000
		N	174	171	170	173	172	171	163	164	156	161	174	170
RF20	Inadequate site investigation	C.C	.209**	.184*	.316**	.262**	.388**	.256**	.314**	.348**	.317**	.283**	.401**	.388**
		Sig.	.0061	.0172	.0000	.0006	.0000	.0009	.0000	.0000	.0001	.0003	.0000	.0000
		N	171	168	166	170	168	166	161	161	156	159	171	168
RF21	Lack of inspection of works	C.C	.209**	.165*	.267**	.112	.240**	.145	.173*	.258**	.082	.207**	.279**	.295**
		Sig.	.0064	.0334	.0005	.1474	.0017	.0635	.0287	.0011	.3180	.0094	.0002	.0001
		N	169	166	164	168	167	164	160	158	152	156	169	166
RF22	Poor supervision	C.C	.327**	.242**	.252**	.119	.266**	.213**	.287**	.345**	.108	.358**	.360**	.373**
		Sig.	.0000	.0019	.0013	.1271	.0006	.0067	.0003	.0000	.1895	.0000	.0000	.0000
		N	166	163	161	165	163	161	156	156	150	154	166	164
RF23	Contractor's Financial Difficulties	C.C	.438**	.316**	.197*	.285**	.324**	.310**	.361**	.267**	.132	.330**	.386**	.349**
		Sig.	.0000	.0000	.0102	.0002	.0000	.0000	.0000	.0006	.1038	.0000	.0000	.0000
		N	172	169	169	171	170	168	162	162	154	160	172	169
RF24	Contractor's Underestimate of Construction Cost	C.C	.281**	.214**	.266**	.358**	.359**	.319**	.490**	.332**	.287**	.300**	.403**	.375**
		Sig.	.0002	.0050	.0005	.0000	.0000	.0000	.0000	.0000	.0003	.0001	.0000	.0000
		N	174	171	170	173	172	170	164	164	156	162	174	171
RF25	Defective Workmanship and Rework	C.C	.265**	.258**	.304**	.284**	.402**	.238**	.320**	.273**	.208**	.201*	.322**	.308**
		Sig.	.0004	.0007	.0001	.0002	.0000	.0018	.0000	.0004	.0093	.0108	.0000	.0000
		N	173	170	169	172	171	169	163	163	155	160	173	169
RF26	Lack of Experience in Similar Projects	C.C	.091	.109	.191*	.177*	.201**	.175*	.074	.239**	.254**	.011	.159*	.160*
		Sig.	.230	.156	.013	.020	.008	.022	.345	.002	.001	.887	.036	.038
		N	174	171	170	173	172	170	163	164	156	161	174	170
RF27	Late Delivery of Materials	C.C	.265**	.244**	.262**	.353**	.297**	.359**	.338**	.328**	.305**	.309**	.499**	.456**
		Sig.	.0004	.0014	.0006	.0000	.0001	.0000	.0000	.0000	.0001	.0001	.0000	.0000
		N	172	169	169	171	170	168	161	161	154	159	172	168
RF28	Poor Labour Productivity	C.C	.259**	.250**	.379**	.411**	.349**	.357**	.452**	.427**	.256**	.296**	.438**	.486**
		Sig.	.0006	.0010	.0000	.0000	.0000	.0000	.0000	.0000	.0014	.0002	.0000	.0000
		N	172	169	168	171	170	168	162	162	154	159	172	169
RF29	Non-compliance to tender requirement on site (labour and Equipment)	C.C	.142	.151	.276**	.172*	.232**	.258**	.256**	.280**	.321**	.258**	.287**	.233**
		Sig.	.064	.050	.000	.024	.002	.001	.001	.000	.000	.001	.000	.002
		N	172	169	168	171	170	168	163	164	156	160	172	170
RF30	Construction accidents	C.C	.118	.033	.173*	.181*	.171*	.121	.182*	.233**	.244**	.145	.236**	.195*
		Sig.	.123	.668	.025	.018	.025	.117	.020	.003	.002	.068	.002	.011
		N	172	169	168	171	170	168	163	164	156	160	172	170
RF31	Poor quality materials	C.C	.196**	.209**	.252**	.366**	.337**	.362**	.392**	.369**	.247**	.235**	.346**	.375**
		Sig.	.0096	.0064	.0009	.0000	.0000	.0000	.0000	.0000	.0019	.0027	.0000	.0000
		N	173	170	169	172	172	170	163	164	156	161	173	169
RF32	Poor planning of resources -materials, labour, equipment	C.C	.225**	.200**	.137	.406**	.343**	.244**	.391**	.273**	.292**	.229**	.351**	.359**
		Sig.	.0027	.0084	.0733	.0000	.0000	.0013	.0000	.0004	.0002	.0033	.0000	.0000
		N	175	172	171	174	173	171	164	164	156	162	175	171
RF33	Delay in submitting invoices	C.C	.186*	.137	.250**	.290**	.302**	.284**	.316**	.235**	.217**	.199*	.398**	.444**
		Sig.	.0147	.0759	.0011	.0001	.0001	.0002	.0000	.0025	.0067	.0118	.0000	.0000
		N	172	169	168	171	171	169	162	163	155	160	172	168
RF34	Delay in mobilisation	C.C	.182*	.080	.214**	.338**	.307**	.278**	.292**	.333**	.432**	.154	.382**	.352**
		Sig.	.016	.302	.005	.000	.000	.000	.000	.000	.000	.052	.000	.000
		N	173	170	169	172	171	169	162	163	155	160	173	169
RF35	Poor supervision on site	C.C	.254**	.174*	.294**	.340**	.316**	.277**	.329**	.298**	.272**	.295**	.286**	.271**
		Sig.	.0008	.0243	.0001	.0000	.0000	.0003	.0000	.0001	.0006	.0002	.0002	.0004
		N	170	167	167	169	168	166	162	161	154	158	170	168
RF36	Insufficient protection of works	C.C	.123	.153*	.229**	.273**	.295**	.255**	.335**	.372**	.317**	.242**	.332**	.302**
		Sig.	.109	.048	.003	.000	.000	.001	.000	.000	.000	.002	.000	.000
		N	171	168	167	170	169	167	162	163	156	159	171	169

Spearman's rho			RF13	RF14	RF15	RF16	RF17	RF18	RF19	RF20	RF21	RF22	RF23	RF24	RF25
RF19	In adequate budgeting and contingencies	C.C	.396**	.244**	.337**	.337**	.483**	.442**	1.000	.545**	.377**	.396**	.277**	.342**	.226**
		Sig.	.0000	.0013	.0000	.0000	.0000	.0000		.000	.000	.000	.000	.000	.003
		N	173	171	170	169	168	172	174	169	166	164	170	172	172
RF20	Inadequate site investigation	C.C	.449**	.364**	.561**	.515**	.504**	.490**	.545**	1.000	.522**	.502**	.322**	.358**	.301**
		Sig.	.0000	.0000	.0000	.0000	.0000	.0000	.0000		.0000	.0000	.0000	.0000	.0001
		N	170	169	166	164	164	168	169	171	166	163	167	169	168
RF21	Lack of inspection of works	C.C	.320**	.248**	.358**	.379**	.388**	.302**	.377**	.522**	1.000	.624**	.211**	.193*	.223**
		Sig.	.0000	.0013	.0000	.0000	.0000	.0001	.0000	.0000		.0000	.0067	.0128	.0038
		N	168	165	165	163	161	168	166	166	169	161	164	166	166
RF22	Poor supervision	C.C	.389**	.266**	.352**	.316**	.405**	.333**	.396**	.502**	.624**	1.000	.377**	.307**	.310**
		Sig.	.0000	.0006	.0000	.0000	.0000	.0000	.0000	.0000	.0000		.0000	.0001	.0001
		N	165	163	161	159	159	164	164	163	161	166	161	163	163
RF23	Contractor's Financial Difficulties	C.C	.418**	.388**	.323**	.256**	.323**	.305**	.277**	.322**	.211**	.377**	1.000	.454**	.419**
		Sig.	.0000	.0000	.0000	.0009	.0000	.0001	.0003	.0000	.0067	.0000		.0000	.0000
		N	171	169	168	166	165	170	170	167	164	161	172	172	170
RF24	Contractor's Underestimate of Construction Cost	C.C	.440**	.323**	.333**	.293**	.407**	.385**	.342**	.358**	.193*	.307**	.454**	1.000	.536**
		Sig.	.0000	.0000	.0000	.0001	.0000	.0000	.0000	.0000	.0128	.0001	.0000		.0000
		N	173	171	170	168	167	172	172	169	166	163	172	174	172
RF25	Defective Workmanship and Rework	C.C	.339**	.315**	.391**	.275**	.267**	.284**	.226**	.301**	.223**	.310**	.419**	.536**	1.000
		Sig.	.0000	.0000	.0000	.0003	.0005	.0002	.0028	.0001	.0038	.0001	.0000	.0000	
		N	172	170	169	168	167	172	172	168	166	163	170	172	173
RF26	Lack of Experience in Similar Projects	C.C	.194*	.167*	.172*	.248**	.142	.133	.118	.277**	.214**	.172*	.139	.197**	.262**
		Sig.	.011	.029	.025	.001	.066	.081	.1213	.0003	.0055	.0273	.0706	.0094	.0005
		N	173	171	170	168	168	172	173	169	166	164	171	173	173
RF27	Late Delivery of Materials	C.C	.486**	.440**	.343**	.435**	.346**	.316**	.206**	.352**	.219**	.324**	.407**	.446**	.371**
		Sig.	.0000	.0000	.0000	.0000	.0000	.0000	.0071	.0000	.0048	.0000	.0000	.0000	.0000
		N	171	168	168	166	165	170	170	166	164	161	170	171	170
RF28	Poor Labour Productivity	C.C	.494**	.336**	.268**	.390**	.414**	.328**	.195*	.189*	.210**	.274**	.316**	.501**	.382**
		Sig.	.0000	.0000	.0004	.0000	.0000	.0000	.0110	.0148	.0069	.0004	.0000	.0000	.0000
		N	171	169	168	167	166	170	170	166	165	161	169	171	170
RF29	Non-compliance to tender requirement on site (labour and Equipment)	C.C	.313**	.286**	.288**	.345**	.324**	.323**	.189*	.277**	.183*	.186*	.164*	.353**	.245**
		Sig.	.000	.000	.000	.000	.000	.000	.0131	.0003	.0185	.0174	.0326	.0000	.0012
		N	171	170	168	166	166	171	171	168	165	163	170	172	171
RF30	Construction accidents	C.C	.313**	.207**	.293**	.344**	.272**	.304**	.093	.185*	.085	.087	.197*	.151*	.217**
		Sig.	.000	.007	.000	.000	.000	.000	.2271	.0164	.2766	.2690	.0100	.0475	.0044
		N	171	170	168	166	166	171	171	168	165	163	170	172	171
RF31	Poor quality materials	C.C	.346**	.274**	.239**	.432**	.408**	.376**	.201**	.301**	.182*	.159*	.328**	.370**	.365**
		Sig.	.0000	.0003	.0017	.0000	.0000	.0000	.0082	.0001	.0192	.0423	.0000	.0000	.0000
		N	172	170	169	168	167	171	172	168	165	163	170	172	172
RF32	Poor planning of resources -materials, labour, equipment	C.C	.399**	.241**	.324**	.385**	.425**	.414**	.420**	.355**	.084	.189*	.337**	.402**	.359**
		Sig.	.0000	.0015	.0000	.0000	.0000	.0000	.0000	.0000	.2814	.0151	.0000	.0000	.0000
		N	174	171	171	169	168	173	173	169	167	164	172	174	173
RF33	Delay in submitting invoices	C.C	.363**	.330**	.222**	.233**	.293**	.296**	.201**	.137	.055	.150	.272**	.365**	.213**
		Sig.	.0000	.0000	.0039	.0024	.0001	.0001	.0083	.0764	.4844	.0561	.0003	.0000	.0052
		N	171	169	168	167	167	170	171	167	164	162	169	171	171
RF34	Delay in mobilisation	C.C	.230**	.320**	.094	.299**	.356**	.302**	.151*	.180*	.160*	.111	.168*	.367**	.156*
		Sig.	.002	.000	.223	.000	.000	.000	.0485	.0198	.0404	.1583	.0286	.0000	.0414
		N	172	170	169	167	167	171	172	168	165	163	170	172	172
RF35	Poor supervision on site	C.C	.255**	.286**	.117	.320**	.364**	.367**	.197*	.271**	.352**	.302**	.362**	.364**	.316**
		Sig.	.0008	.0002	.1345	.0000	.0000	.0000	.0104	.0004	.0000	.0001	.0000	.0000	.0000
		N	169	168	166	165	164	169	168	165	163	160	169	170	168
RF36	Insufficient protection of works	C.C	.330**	.298**	.339**	.361**	.396**	.381**	.205**	.402**	.294**	.319**	.285**	.297**	.259**
		Sig.	.000	.000	.000	.000	.000	.000	.0074	.0000	.0001	.0000	.0002	.0001	.0007
		N	170	169	167	165	165	170	170	167	164	163	169	171	170

Appendix 10N H_8: There is no (moderate to high) relationship between risk factors

	RF27	RF28	RF29	RF30	RF31	RF32	RF33	RF34	RF35	RF36	RF37	RF38	RF39	RF40	RF41
RF19	.206** .007 170	.195* .011 170	.189* .013 171	.093 .227 171	.201** .008 172	.420** .000 173	.201** .008 171	.151* .049 172	.197* .010 168	.205** .007 170	.293** .0001 164	.269** .0004 167	.241** .0016 170	.248** .0012 168	.161* .0353 171
RF20	.352** .0000 166	.189* .0148 166	.277** .0003 168	.185* .0164 168	.301** .0001 168	.355** .0000 169	.137 .0764 167	.180* .0198 168	.271** .0004 165	.402** .0000 167	.429** .0000 160	.292** .0002 164	.262** .0006 166	.247** .0015 164	.199* .0100 167
RF21	.219** .0048 164	.210** .0069 165	.183* .0185 165	.085 .2766 165	.182* .0192 165	.084 .2814 167	.055 .4844 164	.160* .0404 165	.352** .0000 163	.294** .0001 164	.290** .0002 157	.125 .1126 162	.024 .7625 164	.141 .0736 162	.070 .3757 164
RF22	.324** .0000 161	.274** .0004 161	.186* .0174 163	.087 .2690 163	.159* .0423 163	.189* .0151 164	.150 .0561 162	.111 .1583 163	.302** .0001 160	.319** .0000 163	.385** .0000 156	.232** .0033 159	.162* .0398 161	.131 .1003 159	.167* .0339 162
RF23	.407** .0000 170	.316** .0000 169	.164* .0326 170	.197* .0100 170	.328** .0000 170	.337** .0000 172	.272** .0003 169	.168* .0286 170	.362** .0000 169	.285** .0002 169	.302** .0001 162	.298** .0001 167	.348** .0000 169	.220** .0043 167	.131 .0896 169
RF24	.446** .0000 171	.501** .0000 171	.353** .0000 172	.151* .0475 172	.370** .0000 172	.402** .0000 174	.365** .0000 171	.367** .0000 172	.364** .0000 170	.297** .0001 171	.281** .0003 164	.315** .0000 169	.327** .0000 171	.288** .0001 169	.227** .0028 171
RF25	.371** .0000 170	.382** .0000 170	.245** .0012 171	.217** .0044 171	.365** .0000 172	.359** .0000 173	.213** .0052 171	.156* .0414 172	.316** .0000 168	.259** .0007 170	.319** .0000 164	.241** .0017 167	.198** .0095 170	.180* .0197 168	.102 .1848 171
RF26	.428** .0000 171	.345** .0000 171	.218** .0040 172	.270** .0003 172	.332** .0000 173	.298** .0001 174	.158* .0390 172	.254** .0007 173	.341** .0000 169	.341** .0000 171	.252** .0011 165	.173* .0253 168	.020 .7964 171	.090 .2450 169	.153* .0449 172
RF27	1.000 172	.648** .0000 169	.396** .0000 169	.337** .0000 169	.578** .0000 170	.466** .0000 172	.406** .0000 169	.388** .0000 170	.435** .0000 168	.394** .000 168	.361** .0000 162	.360** .0000 166	.302** .0001 169	.340** .0000 167	.187* .0150 169
RF28	.648** .0000 169	1.000 172	.416** .0000 169	.293** .0001 169	.543** .0000 170	.462** .0000 172	.402** .0000 169	.447** .0000 170	.434** .0000 168	.314** .000 168	.320** .0000 162	.349** .0000 167	.285** .0002 169	.277** .0003 167	.229** .0026 170
RF29	.396** .0000 169	.416** .0000 169	1.000 172	.362** .0000 172	.318** .0000 171	.292** .0001 172	.315** .0000 170	.250** .0010 171	.193* .0120 169	.471** .0000 171	.466** .0000 163	.216** .0048 168	.197* .0104 169	.310** .0000 167	.272** .0003 170
RF30	.337** .0000 169	.293** .0001 169	.362** .0000 172	1.000 172	.476** .0000 171	.256** .0007 172	.307** .0000 170	.225** .0031 171	.279** .0002 169	.443** .0000 171	.481** .0000 163	.360** .0000 168	.092 .2324 169	.338** .0000 167	.091 .2402 170
RF31	.578** .0000 170	.543** .0000 170	.318** .0000 171	.476** .0000 171	1.000 173	.613** .0000 173	.363** .0000 172	.361** .0000 172	.545** .0000 168	.389** .0000 170	.426** .0000 164	.338** .0000 167	.221** .0038 170	.320** .0000 168	.245** .0012 171
RF32	.466** .0000 172	.462** .0000 172	.292** .0001 172	.256** .0007 172	.613** .0000 173	1.000 175	.322** .0000 172	.297** .0001 173	.420** .0000 170	.359** .0000 171	.369** .0000 165	.371** .0000 169	.270** .0003 172	.280** .0002 170	.262** .0005 172
RF33	.406** .0000 169	.402** .0000 169	.315** .0000 170	.307** .0000 170	.363** .0000 172	.322** .0000 172	1.000 172	.548** .0000 171	.279** .0003 167	.417** .0000 169	.328** .0000 163	.312** .0000 166	.227** .0030 169	.308** .0001 167	.203** .0080 170
RF34	.388** .0000 170	.447** .0000 170	.250** .0010 171	.225** .0031 171	.361** .0000 172	.297** .0001 173	.548** .0000 171	1.000 173	.458** .0000 168	.392** .0000 170	.362** .0000 164	.274** .0003 167	.209** .0062 170	.187* .0151 168	.271** .0003 171
RF35	.435** .0000 168	.434** .0000 168	.193* .0120 169	.279** .0002 169	.545** .0000 168	.420** .0000 170	.279** .0003 167	.458** .0000 168	1.000 170	.353** .0000 168	.446** .0000 160	.321** .0000 167	.224** .0036 167	.283** .0002 165	.225** .0033 168
RF36	.394** .0000 168	.314** .0000 168	.471** .0000 171	.443** .0000 171	.389** .0000 170	.359** .0000 171	.417** .0000 169	.392** .0000 170	.353** .0000 168	1.000 171	.641** .0000 162	.335** .0000 167	.102 .1874 168	.359** .0000 166	.294** .0001 169

	RF42	RF43	RF44	RF45	RF46	RF47	RF48	RF49	RF50	RF51	RF52	RF53	RF54	RF55	
RF19	.217** .0046 169	.220** .0038 171	.114 .1404 169	.201** .0089 169	.151* .0493 169	.085 .2724 170	.160* .0377 170	.180* .0190 170	.252** .0010 168	.103 .1775 172	.144 .0620 169	.273** .0003 171	.334** .0000 169	.317** .0000 170	RF19
RF20	.210** .0066 166	.203** .0084 167	.152 .0506 166	.218** .0049 165	.104 .1812 166	.103 .1884 166	.286** .0002 167	.223** .0039 166	.253** .0010 165	.224** .0036 168	.171* .0280 165	.408** .0000 167	.389** .0000 165	.476** .0000 166	RF20
RF21	-.039 .6208 164	.294** .0001 165	.105 .1822 163	.189* .0160 163	.220** .0047 163	.104 .1863 163	.153* .0499 164	.152 .0527 163	.056 .4761 162	.138 .0758 166	.047 .5492 163	.369** .0000 165	.313** .0000 163	.362** .0000 164	RF21
RF22	.132 .0946 161	.313** .0001 162	.130 .1000 161	.253** .0013 160	.114 .1486 161	.153 .0528 161	.248** .0015 162	.221** .0049 161	.160* .0439 160	.209** .0074 163	.140 .0770 161	.343** .0000 162	.313** .0001 160	.317** .0000 161	RF22
RF23	.245** .0013 168	.250** .0010 170	.148 .0571 167	.206** .0072 168	.174* .0243 168	.192* .0124 168	.210** .0064 168	.174* .0245 168	.257** .0008 167	.095 .2187 171	.179* .0209 167	.196* .0104 170	.299** .0001 168	.300** .0001 169	RF23
RF24	.336** .0000 170	.302** .0001 172	.104 .1787 169	.257** .0007 170	.090 .2448 169	.155* .0434 170	.226** .0031 170	.186* .0152 170	.204** .0079 169	.215** .0045 173	.169* .0279 169	.226** .0029 172	.250** .0010 170	.240** .0016 171	RF24
RF25	.202** .0086 169	.206** .0068 171	.141 .0677 169	.182* .0181 169	.100 .1938 169	-.002 .9802 170	.178* .0201 170	.106 .1701 170	.113 .1433 168	.129 .0916 172	.184* .0165 169	.255** .0008 171	.255** .0008 169	.241** .0015 170	RF25
RF26	.169* .0278 170	.109 .1552 172	.246** .0012 170	.209** .0062 170	.233** .0023 170	.086 .2660 171	.159* .0384 171	.200** .0087 171	.082 .2885 169	.155* .0413 173	.150 .0507 170	.105 .1700 172	.108 .1619 170	.110 .1539 171	RF26
RF27	.263** .0006 168	.433** .0000 170	.206** .0074 168	.307** .0001 168	.157* .0415 168	.322** .0000 168	.219** .0043 168	.310** .0000 168	.200** .0097 166	.248** .0011 171	.209** .0068 167	.242** .0015 170	.301** .0001 169	.317** .0000 169	RF27
RF28	.239** .0018 168	.313** .0000 170	.199** .0098 167	.272** .0004 168	.180* .0196 167	.179* .0204 168	.216** .0050 168	.299** .0001 168	.160* .0399 166	.338** .0000 171	.305** .0001 168	.280** .0002 170	.241** .0016 168	.264** .0005 170	RF28
RF29	.335** .0000 168	.317** .0000 170	.267** .0005 168	.247** .0012 168	.314** .0000 168	.176* .0223 169	.199** .0095 169	.407** .0000 169	.143 .0636 169	.286** .0002 171	.295** .0001 168	.251** .0010 170	.277** .0003 168	.255** .0008 169	RF29
RF30	.060 .4368 168	.191* .0125 170	.403** .0000 168	.251** .0010 168	.260** .0007 168	.279** .0002 169	.148 .0544 169	.268** .0004 169	.185* .0162 169	.345** .0000 171	.414** .0000 168	.246** .0012 170	.275** .0003 168	.314** .0000 169	RF30
RF31	.278** .0003 169	.346** .0000 171	.386** .0000 169	.303** .0001 169	.268** .0004 169	.230** .0026 170	.286** .0002 170	.188* .0139 170	.196* .0108 168	.238** .0016 172	.320** .0000 169	.259** .0006 171	.254** .0009 169	.256** .0007 170	RF31
RF32	.313** .0000 171	.300** .0001 173	.264** .0005 170	.350** .0000 171	.193* .0117 170	.098 .2024 171	.223** .0034 171	.180* .0187 171	.236** .0020 169	.202** .0075 174	.308** .0000 170	.274** .0003 173	.313** .0000 171	.252** .0008 172	RF32
RF33	.247** .0013 168	.347** .0000 170	.319** .0000 168	.263** .0006 168	.317** .0000 168	.257** .0008 169	.171* .0264 169	.451** .0000 169	.339** .0000 167	.284** .0002 171	.425** .0000 168	.224** .0034 170	.191* .0129 168	.140 .0691 169	RF33
RF34	.234** .0022 169	.256** .0007 171	.212** .0056 169	.283** .0002 169	.289** .0001 169	.234** .0021 170	.308** .0000 170	.382** .0000 170	.242** .0016 168	.300** .0001 172	.261** .0006 169	.279** .0002 171	.204** .0078 169	.176* .0215 170	RF34
RF35	.293** .0001 166	.321** .0000 168	.165* .0342 165	.352** .0000 166	.192* .0134 166	.144 .0643 166	.278** .0003 166	.190* .0141 166	.187* .0159 166	.326** .0000 169	.191* .0136 166	.367** .0000 168	.369** .0000 166	.373** .0000 167	RF35
RF36	.271** .0004 167	.318** .0000 169	.327** .0000 167	.442** .0000 167	.361** .0000 167	.234** .0022 168	.238** .0019 168	.325** .0000 168	.269** .0004 168	.371** .0000 170	.420** .0000 167	.371** .0000 169	.273** .0004 167	.310** .0000 168	RF36

Appendix 10N H_{8}: There is no (moderate to high) relationship between risk factors

Spearman's rho			RF1	RF2	RF3	RF4	RF5	RF6	RF7	RF8	RF9	RF10	RF11	RF12	RF13
RF37	Unsafe work environment	C.C	.184*	.167*	.171*	.244**	.355**	.299**	.398**	.408**	.279**	.259**	.355**	.293**	.362**
		Sig.	.0182	.0332	.0293	.0016	.0000	.0001	.0000	.0000	.0005	.0012	.0000	.0002	.0000
		N	165	163	162	164	163	161	154	155	150	154	165	161	164
RF38	Delay in Statutory Approvals and Permits	C.C	.272**	.131	.168*	.308**	.342**	.276**	.374**	.267**	.226**	.391**	.387**	.382**	.456**
		Sig.	.0003	.0922	.0313	.0000	.0000	.0003	.0000	.0006	.0049	.0000	.0000	.0000	.0000
		N	169	166	165	168	167	165	161	160	154	157	169	167	168
RF39	Escalation in Material Prices	C.C	.231**	.099	.145	.140	.185*	.225**	.283**	.022	.169*	.271**	.242**	.212**	.301**
		Sig.	.0023	.1980	.0601	.0680	.0160	.0033	.0003	.7801	.0351	.0005	.0014	.0057	.0001
		N	172	170	169	171	170	168	161	161	155	159	172	168	171
RF40	Frequent Changes in Statutory Regulations	C.C	.180*	.162*	.308**	.310**	.222**	.207**	.299**	.133	.163*	.178*	.268**	.249**	.357**
		Sig.	.0189	.0361	.0000	.0000	.0039	.0074	.0001	.0954	.0442	.0251	.0004	.0012	.0000
		N	170	168	169	169	168	166	159	159	153	158	170	166	169
RF41	Inclement Weather	C.C	.083	.155*	.277**	.156*	.146	.085	.200*	.155*	.243**	.068	.149	.138	.162*
		Sig.	.2813	.0446	.0003	.0413	.0570	.2755	.0106	.0492	.0022	.3952	.0513	.0751	.0338
		N	172	169	168	171	170	168	162	162	156	159	172	168	171
RF42	Unstable exchange rates	C.C	.177*	.186*	.181*	.146	.287**	.357**	.253**	.228**	.315**	.178*	.138	.118	.217**
		Sig.	.0204	.0157	.0193	.0579	.0002	.0000	.0012	.0038	.0001	.0249	.0712	.1290	.0046
		N	171	168	167	170	169	167	161	160	153	158	171	167	170
RF43	Shortage in Technical Staff and Skilled Labour	C.C	.238**	.260**	.284**	.262**	.234**	.236**	.264**	.191*	.296**	.264**	.286**	.338**	.392**
		Sig.	.0016	.0006	.0002	.0005	.0021	.0020	.0007	.0149	.0002	.0007	.0001	.0000	.0000
		N	173	171	170	172	171	169	162	162	156	160	173	169	172
RF44	Site Orientation and Restricted Access	C.C	.022	.055	.203**	.209**	.206**	.078	.231**	.135	.220**	.145	.084	.099	.213**
		Sig.	.7760	.4834	.0086	.0065	.0075	.3178	.0033	.0894	.0060	.0692	.2776	.2062	.0053
		N	170	167	166	169	168	166	160	160	154	157	170	166	169
RF45	Unavailability of Equipment Required	C.C	.177*	.270**	.280**	.313**	.278**	.184*	.330**	.257**	.202*	.226**	.139	.152*	.318**
		Sig.	.0209	.0004	.0003	.0000	.0002	.0167	.0000	.0010	.0121	.0043	.0705	.0498	.0000
		N	171	168	167	170	169	168	161	162	154	158	171	167	170
RF46	Unavailability of Sufficient Storage Space around or on Site	C.C	.043	.049	.155*	.202**	.120	.045	.140	.209**	.205*	.055	.083	.136	.202**
		Sig.	.5781	.5304	.0460	.0082	.1222	.5678	.0779	.0079	.0111	.4913	.2811	.0802	.0083
		N	170	167	167	170	168	166	159	160	153	157	170	166	169
RF47	Unavailability or Shortage in Specified Materials	C.C	.161*	.115	.181*	.194*	.133	.109	.138	.217**	.168*	.134	.121	.098	.255**
		Sig.	.0356	.1366	.0192	.0112	.0847	.1594	.0819	.0056	.0373	.0938	.1145	.2057	.0008
		N	171	168	167	170	169	168	160	162	154	158	171	167	170
RF48	Unforeseen Ground Conditions	C.C	.180*	.082	.179*	.139	.264**	.083	.322**	.379**	.314**	.112	.091	.149	.226**
		Sig.	.019	.2917	.0202	.0693	.0005	.2847	.0000	.0000	.0001	.1626	.2369	.0543	.0030
		N	171	169	168	171	169	167	160	161	155	158	171	167	170
RF49	High taxes	C.C	.199**	.090	.135	.114	.340**	.270**	.189*	.317**	.295**	.072	.204**	.189*	.344**
		Sig.	.0090	.2467	.0810	.1394	.0000	.0004	.0169	.0000	.0002	.3682	.0073	.0144	.0000
		N	171	168	167	170	169	167	160	161	154	159	171	167	170
RF50	Difficulty in getting insurance cover	C.C	.221**	.051	.139	.189*	.229**	.072	.149	.176*	.260**	.096	.211**	.213**	.293**
		Sig.	.0039	.5113	.0741	.0141	.0029	.3552	.0598	.0257	.0011	.2297	.0060	.0056	.0001
		N	169	166	165	168	167	165	160	161	155	157	169	167	168
RF51	Delay in resolving disputes	C.C	.164*	.064	.256**	.188*	.265**	.172*	.297**	.275**	.287**	.159*	.206**	.225**	.343**
		Sig.	.0303	.4063	.0007	.0134	.0004	.0248	.0001	.0004	.0003	.0445	.0063	.0031	.0000
		N	174	171	170	173	172	170	163	163	156	161	174	170	173
RF52	Criminal acts vandalism, theft	C.C	.016	-.006	.172*	.307**	.281**	.087	.277**	.199*	.191*	.209**	.235**	.249**	.278**
		Sig.	.839	.9425	.0265	.0000	.0002	.2661	.0004	.0115	.0177	.0086	.0021	.0012	.0003
		N	170	167	166	169	169	166	160	160	154	157	170	166	169
RF53	Ineffective monitoring of risks	C.C	.067	.059	.242**	.285**	.344**	.197*	.266**	.168*	.214**	.255**	.263**	.228**	.313**
		Sig.	.379	.4446	.0015	.0001	.0000	.0103	.0006	.0326	.0075	.0012	.0005	.0029	.0000
		N	173	170	169	172	171	169	162	162	155	160	173	169	172
RF54	Holding key decisions in isolation	C.C	.194*	.100	.308**	.141	.304**	.232**	.242**	.209**	.211**	.306**	.340**	.242**	.382**
		Sig.	.0109	.1950	.0001	.0674	.0001	.0025	.0021	.0079	.0086	.0001	.0000	.0016	.0000
		N	171	168	167	170	169	167	160	160	154	159	171	167	170
RF55	Poor coordination and communication	C.C	.193*	.144	.328**	.199**	.275**	.236**	.290**	.291**	.265**	.265**	.309**	.223**	.404**
		Sig.	.0111	.0624	.0000	.0091	.0003	.0020	.0002	.0002	.0009	.0007	.0000	.0036	.0000
		N	172	169	168	171	170	168	161	162	154	159	172	169	171

Spearman's rho			RF14	RF15	RF16	RF17	RF18	RF19	RF20	RF21	RF22	RF23	RF24	RF25	RF26
RF37	Unsafe work environment	C.C	.276**	.380**	.456**	.470**	.423**	.293**	.429**	.290**	.385**	.302**	.281**	.319**	.252**
		Sig.	.0004	.0000	.0000	.0000	.0000	.0001	.0000	.0002	.0000	.0001	.0003	.0000	.0011
		N	163	163	160	160	163	164	160	157	156	162	164	164	165
RF38	Delay in Statutory Approvals and Permits	C.C	.322**	.426**	.432**	.347**	.350**	.269**	.292**	.125	.232**	.298**	.315**	.241**	.173*
		Sig.	.0000	.0000	.0000	.0000	.0000	.0004	.0002	.1126	.0033	.0001	.0000	.0017	.0253
		N	167	165	164	163	168	167	164	162	159	167	169	167	168
RF39	Escalation in Material Prices	C.C	.283**	.251**	.295**	.286**	.334**	.241**	.262**	.024	.162*	.348**	.327**	.198**	.020
		Sig.	.0002	.0010	.0001	.0002	.0000	.0016	.0006	.7625	.0398	.0000	.0000	.0095	.7964
		N	169	169	167	166	170	170	166	164	161	169	171	170	171
RF40	Frequent Changes in Statutory Regulations	C.C	.255**	.332**	.409**	.331**	.269**	.248**	.247**	.141	.131	.220**	.288**	.180*	.090
		Sig.	.0009	.0000	.0000	.0000	.0004	.0012	.0015	.0736	.1003	.0043	.0001	.0197	.2450
		N	167	167	165	164	168	168	164	162	159	167	169	168	169
RF41	Inclement Weather	C.C	.186*	.160*	.225**	.217**	.247**	.161*	.199*	.070	.167*	.131	.227**	.102	.153*
		Sig.	.0151	.0383	.0035	.0048	.0011	.0353	.0100	.3757	.0339	.0896	.0028	.1848	.0449
		N	170	168	167	167	170	171	167	164	162	169	171	171	172
RF42	Unstable exchange rates	C.C	.172*	.189*	.239**	.272**	.176*	.217**	.210**	-.039	.132	.245**	.336**	.202**	.169*
		Sig.	.0260	.0144	.0020	.0004	.0218	.0046	.0066	.6208	.0946	.0013	.0000	.0086	.0278
		N	167	167	165	164	169	169	166	164	161	168	170	169	170
RF43	Shortage in Technical Staff and Skilled Labour	C.C	.282**	.258**	.349**	.340**	.170*	.220**	.203**	.294**	.313**	.250**	.302**	.206**	.109
		Sig.	.0002	.0007	.0000	.0000	.0263	.0038	.0084	.0001	.0001	.0010	.0001	.0068	.1552
		N	170	170	168	167	171	171	167	165	162	170	172	171	172
RF44	Site Orientation and Restricted Access	C.C	.192*	.297**	.356**	.165*	.263**	.114	.152	.105	.130	.148	.104	.141	.246**
		Sig.	.0131	.0001	.0000	.0349	.0006	.1404	.0506	.1822	.1000	.0571	.1787	.0677	.0012
		N	167	166	164	164	168	169	166	163	161	167	169	169	170
RF45	Unavailability of Equipment Required	C.C	.199**	.285**	.352**	.309**	.286**	.201**	.218**	.189*	.253**	.206**	.257**	.182*	.209**
		Sig.	.0098	.0002	.0000	.0001	.0002	.0089	.0049	.0160	.0013	.0072	.0007	.0181	.0062
		N	167	167	165	165	169	169	165	163	160	168	170	169	170
RF46	Unavailability of Sufficient Storage Space around or on Site	C.C	.183*	.178*	.249**	.229**	.201**	.151*	.104	.220**	.114	.174*	.090	.100	.233**
		Sig.	.0182	.0219	.0013	.0031	.0090	.0493	.1812	.0047	.1486	.0243	.2448	.1938	.0023
		N	167	166	164	164	168	169	166	163	161	168	169	169	170
RF47	Unavailability or Shortage in Specified Materials	C.C	.193*	.196*	.256**	.247**	.152*	.085	.103	.104	.153	.192*	.155*	-.002	.086
		Sig.	.0123	.0112	.0009	.0013	.0491	.2724	.1884	.1863	.0528	.0124	.0434	.9802	.2660
		N	168	167	165	166	169	170	166	163	161	168	170	170	171
RF48	Unforeseen Ground Conditions	C.C	.150	.204**	.320**	.269**	.196*	.160*	.286**	.153*	.248**	.210**	.226**	.178*	.159*
		Sig.	.0512	.0080	.0000	.0005	.0107	.0377	.0002	.0499	.0015	.0064	.0031	.0201	.0384
		N	169	168	166	166	169	170	167	164	162	168	170	170	171
RF49	High taxes	C.C	.295**	.169*	.268**	.289**	.198*	.180*	.223**	.152	.221**	.174*	.186*	.106	.200**
		Sig.	.0001	.0291	.0005	.0002	.0100	.0190	.0039	.0527	.0049	.0245	.0152	.1701	.0087
		N	168	167	165	165	169	170	166	163	161	168	170	170	171
RF50	Difficulty in getting insurance cover	C.C	.282**	.204**	.197*	.281**	.232**	.252**	.253**	.056	.160*	.257**	.204**	.113	.082
		Sig.	.0002	.0087	.0117	.0003	.0025	.0010	.0010	.4761	.0439	.0008	.0079	.1433	.2885
		N	167	165	163	163	168	168	165	162	160	167	169	168	169
RF51	Delay in resolving disputes	C.C	.232**	.241**	.286**	.251**	.256**	.103	.224**	.138	.209**	.095	.215**	.129	.155*
		Sig.	.0023	.0015	.0002	.0011	.0007	.1775	.0036	.0758	.0074	.2187	.0045	.0916	.0413
		N	170	170	168	167	172	172	168	166	163	171	173	172	173
RF52	Criminal acts vandalism, theft	C.C	.153*	.253**	.231**	.274**	.264**	.144	.171*	.047	.140	.179*	.169*	.184*	.150
		Sig.	.0472	.0010	.0028	.0004	.0005	.0620	.0280	.5492	.0770	.0209	.0279	.0165	.0507
		N	168	166	165	165	168	169	165	163	161	167	169	169	170
RF53	Ineffective monitoring of risks	C.C	.223**	.391**	.421**	.348**	.371**	.273**	.408**	.369**	.343**	.196*	.226**	.255**	.105
		Sig.	.0035	.0000	.0000	.0000	.0000	.0003	.0000	.0000	.0000	.0104	.0029	.0008	.1700
		N	169	169	167	166	171	171	167	165	162	170	172	171	172
RF54	Holding key decisions in isolation	C.C	.301**	.357**	.390**	.352**	.367**	.334**	.389**	.313**	.313**	.299**	.250**	.255**	.108
		Sig.	.0001	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0001	.0001	.0010	.0008	.1619
		N	167	167	165	164	169	169	165	163	160	168	170	169	170
RF55	Poor coordination and communication	C.C	.261**	.400**	.431**	.331**	.342**	.317**	.476**	.362**	.317**	.300**	.240**	.241**	.110
		Sig.	.0006	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0001	.0016	.0015	.1539
		N	168	168	166	165	170	170	166	164	161	169	171	170	171

Appendix 10N $H_{8:}$ There is no (moderate to high) relationship between risk factors

	RF27	RF28	RF29	RF30	RF31	RF32	RF33	RF34	RF35	RF36	RF37	RF38	RF39	RF40	RF41
RF37	.361** .0000 162	.320** .0000 162	.466** .0000 163	.481** .0000 163	.426** .0000 164	.369** .0000 165	.328** .0000 163	.362** .0000 164	.446** .0000 160	.641** .0000 162	1.000 165	.396** .0000 160	.213** .0063 164	.309** .0001 162	.279** .0003 164
RF38	.360** .0000 166	.349** .0000 167	.216** .0048 168	.360** .0000 168	.338** .0000 167	.371** .0000 169	.312** .0000 166	.274** .0003 167	.321** .0000 167	.335** .0000 167	.396** .0000 160	1.000 169	.391** .0000 167	.524** .0000 165	.286** .0002 168
RF39	.302** .0001 169	.285** .0002 169	.197* .0104 169	.092 .2324 169	.221** .0038 170	.270** .0003 172	.227** .0030 169	.209** .0062 170	.224** .0036 167	.102 .187 168	.213** .0063 164	.391** .0000 167	1.000 172	.414** .0000 169	.270** .0004 170
RF40	.340** .0000 167	.277** .0003 167	.310** .0000 167	.338** .0000 167	.320** .0000 168	.280** .0002 170	.308** .0001 167	.187* .0151 168	.283** .0002 165	.359** .0000 166	.309** .0001 162	.524** .0000 165	.414** .0000 169	1.000 170	.270** .0004 168
RF41	.187* .0150 169	.229** .0026 170	.272** .0003 170	.091 .2402 170	.245** .0012 171	.262** .0005 172	.203** .0080 170	.271** .0003 171	.225** .0033 168	.294** .0001 169	.279** .0003 164	.286** .0002 168	.270** .0004 170	.270** .0004 168	1.000 172
RF42	.263** .0006 168	.239** .0018 168	.335** .0000 168	.060 .4368 168	.278** .0003 169	.313** .0000 171	.247** .0013 168	.234** .0022 169	.293** .0001 166	.271** .0004 167	.261** .0008 162	.295** .0001 167	.440** .0000 170	.214** .0055 167	.407** .0000 169
RF43	.433** .0000 170	.313** .0000 170	.317** .0000 170	.191* .0125 170	.346** .0000 171	.300** .0001 173	.347** .0000 170	.256** .0007 171	.321** .0000 168	.318** .0000 169	.255** .0009 165	.352** .0000 168	.304** .0000 172	.460** .0000 170	.322** .0000 171
RF44	.206** .0074 168	.199** .0098 167	.267** .0005 168	.403** .0000 168	.386** .0000 169	.264** .0005 170	.319** .0000 168	.212** .0056 169	.165* .0342 165	.327** .0000 167	.390** .0000 162	.402** .0000 165	.155* .0452 168	.352** .0000 166	.386** .0000 169
RF45	.307** .0001 168	.272** .0004 168	.247** .0012 168	.251** .0010 168	.303** .0001 169	.350** .0000 171	.263** .0006 168	.283** .0002 169	.352** .0000 166	.442** .0000 167	.459** .0000 162	.464** .0000 166	.266** .0005 169	.384** .0000 167	.345** .0000 169
RF46	.157* .0415 168	.180* .0196 167	.314** .0000 168	.260** .0007 168	.268** .0004 169	.193* .0117 170	.317** .0000 168	.289** .0001 169	.192* .0134 166	.361** .0000 167	.371** .0000 162	.298** .0001 165	.146 .0596 168	.293** .0001 166	.175* .0231 169
RF47	.322** .0000 168	.179* .0204 168	.176* .0223 169	.279** .0002 169	.230** .0026 170	.098 .2024 171	.257** .0008 169	.234** .0021 170	.144 .0643 166	.234** .0022 168	.302** .0001 163	.321** .0000 166	.238** .0019 169	.313** .0000 167	.222** .0036 170
RF48	.219** .0043 168	.216** .0050 168	.199** .0095 169	.148 .0544 169	.286** .0002 170	.223** .0034 171	.171* .0264 169	.308** .0000 170	.278** .0003 166	.238** .0019 168	.263** .0007 164	.401** .0000 166	.271** .0003 170	.248** .0012 168	.274** .0003 170
RF49	.310** .0000 168	.299** .0001 168	.407** .0000 169	.268** .0004 169	.188* .0139 170	.180* .0187 171	.451** .0000 169	.382** .0000 170	.190* .0141 166	.325** .0000 168	.405** .0000 163	.334** .0000 166	.368** .0000 169	.388** .0000 167	.260** .0006 170
RF50	.200** .0097 166	.160* .0399 166	.143 .0636 169	.185* .0162 169	.196* .0108 168	.236** .0020 169	.339** .0000 167	.242** .0016 168	.187* .0159 166	.269** .0004 168	.258** .0010 161	.368** .0000 166	.280** .0003 167	.342** .0000 165	.235** .0022 168
RF51	.248** .0011 171	.338** .0000 171	.286** .0002 171	.345** .0000 171	.238** .0016 172	.202** .0075 174	.284** .0002 171	.300** .0001 172	.326** .0000 169	.371** .0000 170	.339** .0000 165	.460** .0000 169	.221** .0036 172	.437** .0000 170	.259** .0006 172
RF52	.209** .0068 167	.305** .0001 168	.295** .0001 168	.414** .0000 168	.320** .0000 169	.308** .0000 170	.425** .0000 168	.261** .0006 169	.191* .0136 166	.420** .0000 167	.405** .0000 163	.380** .0000 166	.137 .0764 168	.327** .0000 166	.312** .0000 170
RF53	.242** .0015 170	.280** .0002 170	.251** .0010 170	.246** .0012 170	.259** .0006 171	.274** .0003 173	.224** .0034 170	.279** .0002 171	.367** .0000 168	.371** .0000 169	.403** .0000 165	.341** .0000 168	.204** .0075 171	.273** .0003 169	.252** .0009 171
RF54	.301** .0001 169	.241** .0016 168	.277** .0003 168	.275** .0003 168	.254** .0009 169	.313** .0000 171	.191* .0129 168	.204** .0078 169	.369** .0000 166	.273** .0004 167	.380** .0000 163	.316** .0000 166	.254** .0009 169	.281** .0002 167	.121 .1183 169
RF55	.317** .0000 169	.264** .0005 170	.255** .0008 169	.314** .0000 169	.256** .0007 170	.252** .0008 172	.140 .0691 169	.176* .0215 170	.373** .0000 167	.310** .0000 168	.436** .0000 164	.345** .0000 167	.254** .0008 170	.259** .0007 168	.108 .1609 170

	RF42	RF43	RF44	RF45	RF46	RF47	RF48	RF49	RF50	RF51	RF52	RF53	RF54	RF55	
RF37	.261** .0008 162	.255** .0009 165	.390** .0000 162	.459** .0000 162	.371** .0000 162	.302** .0001 163	.263** .0007 164	.405** .0000 163	.258** .0010 161	.339** .0000 165	.405** .0000 163	.403** .0000 165	.380** .0000 163	.436** .0000 164	RF37
RF38	.295** .0001 167	.352** .0000 168	.402** .0000 165	.464** .0000 166	.298** .0001 165	.321** .0000 166	.401** .0000 166	.334** .0000 166	.368** .0000 166	.460** .0000 169	.380** .0000 166	.341** .0000 168	.316** .0000 166	.345** .0000 167	RF38
RF39	.440** .0000 170	.304** .0000 172	.155* .0452 168	.266** .0005 169	.146 .0596 168	.238** .0019 169	.271** .0003 170	.368** .0000 169	.280** .0003 167	.221** .0036 172	.137 .0764 168	.204** .0075 171	.254** .0009 169	.254** .0008 170	RF39
RF40	.214** .0055 167	.460** .0000 170	.352** .0000 166	.384** .0000 167	.293** .0001 166	.313** .0000 167	.248** .0012 168	.388** .0000 167	.342** .0000 165	.437** .0000 170	.327** .0000 166	.273** .0003 169	.281** .0002 167	.259** .0007 168	RF40
RF41	.407** .0000 169	.322** .0000 171	.386** .0000 169	.345** .0000 169	.175* .0231 169	.222** .0036 170	.274** .0003 170	.260** .0006 170	.235** .0022 168	.259** .0006 172	.312** .0000 170	.252** .0009 171	.121 .1183 169	.108 .1609 170	RF41
RF42	1.000 171	.234** .0021 170	.174* .0238 168	.273** .0003 168	.150 .0528 167	.108 .1653 168	.332** .0000 168	.323** .0000 168	.166* .0327 166	.303** .0001 171	.209** .0067 167	.168* .0281 170	.183* .0179 168	.147 .0564 169	RF42
RF43	.234** .0021 170	1.000 173	.301** .0001 169	.467** .0000 170	.329** .0000 169	.364** .0000 170	.271** .0003 171	.289** .0001 170	.262** .0006 168	.327** .0000 173	.266** .0005 169	.323** .0000 172	.364** .0000 170	.342** .0000 171	RF43
RF44	.174* .0238 168	.301** .0001 169	1.000 170	.531** .0000 167	.609** .0000 167	.484** .0000 168	.325** .0000 168	.306** .0001 168	.284** .0002 166	.278** .0002 170	.514** .0000 167	.273** .0003 169	.242** .0016 168	.256** .0008 168	RF44
RF45	.273** .0003 168	.467** .0000 170	.531** .0000 167	1.000 171	.607** .0000 167	.613** .0000 169	.439** .0000 168	.310** .0000 168	.350** .0000 166	.416** .0000 171	.443** .0000 167	.342** .0000 170	.312** .0000 168	.336** .0000 169	RF45
RF46	.150 .0528 167	.329** .0000 169	.609** .0000 167	.607** .0000 167	1.000 170	.608** .0000 168	.394** .0000 169	.447** .0000 168	.332** .0000 166	.337** .0000 170	.541** .0000 167	.278** .0003 169	.222** .0040 167	.217** .0047 168	RF46
RF47	.108 .1653 168	.364** .0000 170	.484** .0000 168	.613** .0000 169	.608** .0000 168	1.000 171	.397** .0000 169	.410** .0000 169	.345** .0000 167	.348** .0000 171	.432** .0000 168	.191* .0125 170	.282** .0002 168	.242** .0016 169	RF47
RF48	.332** .0000 168	.271** .0003 171	.325** .0000 168	.439** .0000 168	.394** .0000 169	.397** .0000 169	1.000 171	.338** .0000 169	.373** .0000 167	.440** .0000 171	.264** .0005 168	.233** .0022 170	.146 .0584 168	.174* .0239 169	RF48
RF49	.323** .0000 168	.289** .0001 170	.306** .0001 168	.310** .0000 168	.447** .0000 168	.410** .0000 169	.338** .0000 169	1.000 171	.457** .0000 167	.438** .0000 171	.443** .0000 168	.194* .0112 170	.245** .0014 168	.209** .0063 169	RF49
RF50	.166* .0327 166	.262** .0006 168	.284** .0002 166	.350** .0000 166	.332** .0000 166	.345** .0000 167	.373** .0000 167	.457** .0000 167	1.000 169	.584** .0000 169	.484** .0000 166	.344** .0000 168	.278** .0003 166	.220** .0043 167	RF50
RF51	.303** .0001 171	.327** .0000 173	.278** .0002 170	.416** .0000 171	.337** .0000 170	.348** .0000 171	.440** .0000 171	.438** .0000 171	.584** .0000 169	1.000 174	.515** .0000 170	.358** .0000 173	.278** .0002 171	.338** .0000 172	RF51
RF52	.209** .0067 167	.266** .0005 169	.514** .0000 167	.443** .0000 167	.541** .0000 167	.432** .0000 168	.264** .0005 168	.443** .0000 168	.484** .0000 166	.515** .0000 170	1.000 170	.373** .0000 169	.292** .0001 167	.257** .0008 168	RF52
RF53	.168* .0281 170	.323** .0000 172	.273** .0003 169	.342** .0000 170	.278** .0003 169	.191* .0125 170	.233** .0022 170	.194* .0112 170	.344** .0000 168	.358** .0000 173	.373** .0000 169	1.000 173	.705** .0000 171	.708** .0000 172	RF53
RF54	.183* .0179 168	.364** .0000 170	.242** .0016 168	.312** .0000 168	.222** .0040 167	.282** .0002 168	.146 .0584 168	.245** .0014 168	.278** .0003 166	.278** .0002 171	.292** .0001 167	.705** .0000 171	1.000 171	.820** .0000 170	RF54
RF55	.147 .0564 169	.342** .0000 171	.256** .0008 168	.336** .0000 169	.217** .0047 168	.242** .0016 169	.174* .0239 169	.209** .0063 169	.220** .0043 167	.338** .0000 172	.257** .0008 168	.708** .0000 172	.820** .0000 170	1.000 172	RF55

Appendix 11A Adequacy of forms and illustrations

Table 7.24 Adequacy of forms and illustrations

No.	Item	Min Value	Max Value	Mode	Mean	Standard deviation	Coefficient of Variation	Comments from round 1 questionnaire
1	The initial risk assessment form is adequately formulated	2	4	3	3.00	0.47	0.16	003 consider consultant and contractors risk 005 forms to stand alone and not depend on any other documents. Consider site information. 006 consider environmental risks 009 add environmental risks
2	The risks for building works adequately identified	3	4	3	3.11	0.31	0.10	006 consider separating risk at each stage of the project design, tender construction 009 separate risks depending on phase of the project
3	The form for risk identification is adequately formulated	2	4	3	3.00	0.67	0.22	005 not satisfied with classification under nature of project 008 where are risks related to client knowledge, complexity, project duration, project team, specification
4	The qualitative assessment sheet is adequately formulated	2	4	3	3.00	0.67	0.22	003 assess in terms of probability and impact 006 consider use of risk matrix
5	The quantitative assessment sheet is adequately formulated	2	4	3	3.00	0.82	0.27	005 under risk rating indicate likelihood x relative impact
6	The risk allocation sheet is adequately formulated	2	4	3	3.11	0.74	0.24	
7	The treatment criteria adequately illustrated	2	4	3	3.22	0.63	0.20	
8	The contract selection process adequately is illustrated	2	4	3	3.00	1.05	0.35	003 why are items under consideration different for public and private sector
9	The contract authoring process is adequately illustrated	3	4	3	3.11	0.31	0.10	

No.	Item	Min	Max	Mode	Mean	S.D	CV	Comments from round 1 questionnaire
1	Decide on nature of building project	2	4	3	3.00	0.50	0.17	007 use of the word nature in step 1 is considered too broad 008 what about client requirements/ project objectives
2	Initial risk assessment	2	4	3	3.13	0.64	0.21	004 proposed use of risk register instead
3	Decide of procurement method and payment options	2	4	3	2.89	0.60	0.21	006 good to make decision for procurement route early to benefit different types of clients 008 client experience and availability of expertise
4	Identify risks of project (contractual and non-contractual)	2	4	3	3.00	0.76	0.25	004 write all identified risks as risk events, 007 considers activity 2, and 4 to be out of sequence 4 to come earlier
5	Conduct qualitative risk analysis	2	5	3	3.38	0.92	0.27	003 not clear enough
6	Conduct quantitative risk analysis	3	4	3	3.25	0.46	0.14	004 use of risk matrix for likelihood X impact; instead of what I have for likelihood to use likelihood -1: <1%, Likelihood 2: 1-5%, Likelihood 3:5-10%, likelihood 4: 10-25%, likelihood 5: 25-50% and so on for impact use impact 1:<1% of budget; impact 3: 5-10% of budget, impact 4: 10-25% of budget, impact 5 : > 25% of budget
7	Decide on treatment options for identified risks	2	4	3	3.22	0.67	0.21	
8	Verification of procurement strategy	2	4	3	3.00	0.50	0.17	008 probably a party external to the client would give input
9	Request (decide on contract form and check if initial procurement mode is still viable	2	4	3	3.00	0.50	0.17	
10	Authoring (edit existing form or draft new contract)	3	4	3	3.13	0.35	0.11	

APPENDIX 11B Adequacy of decisions/activities at each stage

Adequacy of decisions/activities at each stage Continued 19B

No.	Item	Min Value	Max Value	Mode	Mean	S.D	CV	Comments from round 1 questionnaire
11	Negotiation (among design team)	3	4	3	3.13	0.35	0.11	004 rename as Review and revision to scope & specification
12	Approval (of final document by relevant person(s)	2	4	3	3.00	0.50	0.17	004 to include list of documents to be approved
13	Tendering (adjudication and considering of risk concerns from tenders)	2	4	3	3.00	0.50	0.17	004 Expand to 4 tasks to include 1. Tender posting and questions 2. Risk based tender evaluation 3. Selection proponent 4. clarification and negotiation 006 consider loop from 13 back to 12 if tender(s) is not acceptable 008 health and safety issues
14	Signing contract (final negotiation of risk liability)	3	4	3	3.00	0.53	0.18	008 authority to sign (presence of personnel)
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)	3	4	3	3.25	0.46	0.14	
16	Compliance (reporting and auditing of risks)	3	4	3	3.38	0.52	0.15	
17	Renewal (identification of l lessons learnt and changes for future practice and considerations for model update)	3	4	3	3.38	0.52	0.15	004 retitle renewal to lessons learnt

Appendix 11C Adequacy of Resources and requirements

No.	Step	Min	Max	Mode	Mean	S.D	C.V	Comments from Round 1
1	Decide on nature of building project	3	3	3	3	0	0	
2	Initial risk assessment	3	4	3	3.22	0.44	0.14	
3	Decide of procurement method and payment options	2	4	3	3.00	0.50	0.17	
4	Identify risks of project (contractual and non-contractual	2	4	3	3.00	0.50	0.17	
5	Conduct qualitative risk analysis	3	4	3	3.11	0.33	0.11	
6	Conduct quantitative risk analysis	2	4	3	3.00	0.50	0.17	
7	Decide on treatment options for identified risks	2	4	3	3.11	0.60	0.19	
8	Verification of procurement strategy	3	4	3	3.11	0.33	0.11	
9	Request (decide on contract form and check if initial procurement mode is still viable	3	4	3	3.11	0.33	0.11	
10	Authoring (edit existing form or draft new contract)	3	4	3	3.11	0.33	0.11	
11	Negotiation (among design team)	2	4	3	2.89	0.60	0.21	003 not clear what is to be negotiated
12	Approval (of final document by relevant person(s)	2	4	3	2.89	0.60	0.21	003 client has a review function here
13	Tendering (adjudication and considering of risk concerns from tenders)	2	4	3	3.00	0.50	0.17	
14	Signing contract (final negotiation of risk liability)	2	4	3	3.00	0.50	0.17	
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)	2	4	3	3.00	0.50	0.17	003 need for an integrated risk management plan by client/contractor/consultant
16	Compliance (reporting and auditing of risks)	2	4	3	3.11	0.60	0.19	
17	Renewal (identification of learns lessons learnt and changes for future practice and considerations for model update)	2	4	3	3.00	0.50	0.17	003 system is needed to capture knowledge; lessons learnt 009 be clear on who is involved in the process

Appendix 12A Adequacy of illustrations and forms developed- **Delphi Round 2 Responses**

Step	Item	Comments from round 1 questionnaire	Comments from round 2 questionnaire
1	The initial risk assessment form is adequately formulated	003 consider consultant and contractors risk 005 forms to stand alone and not depend on any other documents. Consider site information. 006 consider environmental risks 009 add environmental risks	005 form to stand alone; environmental risks covered by consultant/contractor risks 003 No comment 008 I support the comments made 004 Agree with 005 and 006/009. Do not agree with 003 007 Agree on detail needed 002 comment are valid but project objectives should be paramount 009 add EIA 006 agree with 005 and 006
2	The risks for building works adequately identified	006 consider separating risk at each stage of the project design, tender construction 009 separate risks depending on phase of the project	005 risks for building works adequately identified 003 No comment 008 I agree with the comments made 007 risks should not be separated for project phase 002 consider work breakdown structure approach 009 disagree with separation of risk 006 disagree with 006
3	The form for risk identification is adequately formulated	005 not satisfied with classification under nature of project 008 where are risks related to client knowledge, complexity, project duration, project team, specification	005 nature of risk concern without recommendation 003 No comment 008 I agree that the range of risks needs to be expanded 007 Fully agree that client knowledge risk and complexity are concerns 002 initial formulation is fine key is to be cognisant of the evolving external environment 009 adequately illustrated 006 classification is fine
4	The qualitative assessment sheet is adequately formulated	003 assess in terms of probability and impact 006 consider use of risk matrix	005 qualitative assessment sheet adequately formulated 003 no change 008 Nothing to add 004 Do not agree any of these are necessary for qualitative risk assessment 007 Agree 002 adequate as perception, likelihood and consequence are taken into account 009 Not necessary in qualitative risk assessment 006 this is qualitative risk assessment
5	The quantitative assessment sheet is adequately formulated	005 under risk rating indicate like hood x relative impact	005 include under risk rating 003 no change 008 Nothing to add 004 Strongly disagree. Multiplying likelihood by impact gives an expected value, which should not be used to assess risk as it 009 no change ignores the increasing disutility of loss 007agree 002 adequate as perception, likelihood and consequence are taken into account Hr covered as far as I know
8	The contract selection process adequately is illustrated	003 why are items under consideration different for public and private sector	005 contract selection process adequately illustrated 003 no change 008 Nothing to add 007 fair question 002 The contract selection process is adequately illustrated 009 These types of clients have different goals private sector is profit oriented 006 clients have different aims

Appendix 12B Adequacy of decisions/activities at each stage

Step	Item	Comments from round 1 questionnaire	Comments from round 2 questionnaire
1	Decide on nature of building project	007 use of the word nature in step 1 is considered too broad 008 what about client requirements/ project objectives	005 Use type 003 no change 008 I support the comments made 007 The type of the project has to be specified in terms of the principle 3 constructed domains - infrastructure / commercial / residential shown with subdivisions 002 part of strategic planning 009 indifferent 006 type could be used
2	Initial risk assessment	004 proposed use of risk register instead	002 could be used but proposed is also acceptable 009 disagree 006 disagree
3	Decide of procurement method and payment options	006 good to make decision for procurement route early to benefit different types of clients 008 client experience and availability of expertise	005 Procurement methods ok. 003 no change 008 Nothing to add 007 Early selection of procurement system is fine with a clear understanding of the risks 002 There also needs to be some form of flexible across the project life cycle as the conditions within the environment might change. 009 From the decision to build the procurement method should flow to guide who identifies initial risks considering some clients may not be knowledgeable 006 agree with 006
4	Identify risks of project (contractual and non-contractual)	004 write all identified risks as risk events, 007 considers activity 2, and 4 to be out of sequence 4 to come earlier	008 to be immediately after decide to build 007emphasis is on early risk assessment 002 risk identification is an iterative process in this model 009 should have 3 then 2, 4 and others follow 006 Classification is fine under nature of project 004 Agree with 007
5	Conduct qualitative risk analysis	003 not clear enough	005 This is clear for me 003 no change 008 Agree 007 agree with statement 002 There exist a number of qualitative techniques. Some criteria and justification of the method to be selected should be included here or reference made to. 009 disagree 006 no change
6	Conduct quantitative risk analysis	004 use of risk matrix for likelihood X impact; instead of what I have for likelihood to use likelihood -1: <1%, Likelihood 2: 1-5%, Likelihood 3:5-10%, likelihood 4: 10-25%, likelihood 5: 25-50% and so on for impact use impact 1:<1% of budget; impact 3: 5-10% of budget, impact 4: 10-25% of budget, impact 5 : > 25% of budget	005 Initial quantitative risk analysis ok 003 no change 008 nothing to add 007 To a certain degree yes – however these types of the systems tend to give the impression of a more systematic, mechanistic process than is actually the case. 009 Agree 007 consider

Appendix 12C Adequacy of Resources and requirements

Step	Item	Comments from round 1 questionnaire	Comments from round 2 questionnaire
8	Verification of procurement strategy	008 probably a party external to the client would give input	005 Can be considered 003 no change 008 Nothing to add 007 Maybe. Most procurement strategies are extensively developed in close collaboration with a 'preferred' member of the delivery team – either an architect, engineer, QS or contractor as a rule. 002 agreed 009 Parameters for verification could help 006 To be considered when expertise are inadequate
11	Negotiation (among design team)	004 rename as Review and revision to scope & specification	005 Negotiation is the term commonly used 003 no change 008 nothing to add 007 Makes sense 002 agreed could this be project scope, budget, responsibilities or what exactly 009 disagree 006 disagree
12	Approval (of final document by relevant person(s)	004 to include list of documents to be approved	005 List of documents can be included 003 no change 008 agree but documents are dependent on procurement method used 007 good suggestion 002 agreed 009 Really dependent on project 006 agree
13	Tendering (adjudication and considering of risk concerns from tenders)	004 Expand to 4 tasks to include 1. Tender posting and questions 2. Risk based tender evaluation 3. Selection proponent 4. clarification and negotiation 006 consider loop from 13 back to 12 if tender(s) is not acceptable 008 health and safety issues	005 cannot follow 003 no change 008 agree with 008 004 Agree with 006 007 All decent suggestions. Agree. 002 Clarity required in terms of the specific risks arising 009 Agree with 004 and 006 006 agree with 004 and 006
14	Signing contract (final negotiation of risk liability)	008 authority to sign (presence of personnel)	005 ok 003 no change 008 I agree that there should be a resolution giving authority to the signee 007 sensible provision 002 agreed 009 agree
17	Renewal (identification of l lessons learnt and changes for future practice and considerations for model update)	004 retitle renewal to lessons learnt	005 Agreed. Use lessons learnt 003 no change 008 nothing to add 007 Fully agree – though you may wish to consider 'knowledge management protocol' or similar. 002 Renewal is fine although the 'Post project reviews' also might be another option. The 'outcome' of that stage is correctly identified (renewal) 009 Covers much more that lessons learnt maintain 006 indifferent

12C Adequacy of Resources and requirements Continued			
No.	**Step**	**Comments from Experts Round 1 questionnaire**	**Comments from experts -Round 2**
11	Negotiation (among design team)	003 not clear what is to be negotiated	003 no change 008 nothing to add 007Agree 002 agree 009 Consider the design, estimates sum against budget, availability of materials chosen 006 Process map explains
12	Approval (of final document by relevant person(s)	003 client has a review function here	003 no change 008 nothing to add 007Agree 002 Agree 009 Client and all consultants to be involved 006 agree
15	Obligation Phase (continued risk identification, analysis, monitoring and reporting of contractual and non-contractual risks)	003 need for an integrated risk management plan by client/contractor/consultants	005 Is integrated risk management plan by client/contractor/consultants possible? A lot of thought needs to go into this 003 no change 008 agree 007 This feeds from a more complete pre- procurement selection process. 002 One mechanism for enhancing this integrated risk management plan is through formalised enterprise risk management (ERM) 009 risk management plan is needed. However what happens if there is fundamental breach leading to termination in the obligation phase consider alternatives 006 agree
17	Renewal (identification of learns lessons learnt and changes for future practice and considerations for model update)	003 system is needed to capture knowledge; lessons learnt 009 be clear on who is involved in the process	005 Lessons learnt are easily captured by organisations with a deliberate knowledge management system 003 no change 008 nothing to add 007 consider knowledge management protocol 002 System needs to be aware of the barriers to the capture of lessons learned. This will influence the future identification as well as future practice 009 Initial provisions are in order 006 not sure