RISK MANAGEMENT IN THE PROCUREMENT OF COMMUNITY-BASED CONSTRUCTION PROJECTS IN ZAMBIA

By

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Declaration

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APPROVAL

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Abstract

The need to improve the socio-economic well being of the citizenry has placed huge challenges on the provision of better social infrastructure in developing countries like Zambia. To help with meeting the challenges, inputs from local communities have been incorporated in infrastructure development in Zambia. This arrangement minimizes construction costs compared to conventional construction modes and also instills a sense of responsibility in the community. However, the involvement of local communities in construction introduces a number of risks during the execution of the projects as the community may not be conversant with construction and the procedures involved in the procurement process. The consequences of not assessing and managing construction risks are that projects may experience time and cost overruns and lead to poor quality structures. This research sought to propose improvements in the management of community-based projects by identifying the risks involved at every stage in the procurement of the projects, analyzing them and developing a risk management model that would improve the implementation of the projects.

The methodology employed in this research included desk study, which involved literature review of studies and works done in the field of construction risk management. Group brainstorming sessions with PMCs were conducted to identify potential risks. A questionnaire survey that sought to validate the findings from the brainstorming sessions and also to collect data relating to probability and impact of the identified risks on project objectives was carried out. The risks identified in the study were classified in six categories namely: project initiation; community contribution and participation; budget and finance; skilled labour; materials procurement; and technical supervision and quality control. A risk management model that could be used in the implementation of community-based projects was developed at the end of the study and validated. The main limitation of the study was that data from other types of construction other than school infrastructure could not be collected.

Dedication

This piece of work is dedicated to my wife Etambuyu Mwangala Nawa who continued to encourage me throughout the study period and to my sons, Kabuku and Wamundila.

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List of Abbreviations

CSO	Central Statistics Office
SRP	Social Recovery Project
MPU	Micro-Projects Unit
NCDP	National Commission for Development Planning
ESSP	Education Sector Support Programme
FINNIDA	Finnish International Development Agency
ZEPIU	Zambia Education Projects Implementation Unit
OPEC	Oil Producing and Exporting Countries
OPSUP	OPEC Primary Schools Upgrading Programme
PMC	Project Management Committee
ZAMSIF	Zambia Social Investment Fund
HIPC	Highly Indebted Poor Countries
PRP	Poverty Reduction Programme
IMF	International Monetary Fund
MOE-SIS	Ministry of Education School Infrastructure Section
HRBS	Hierarchical Risk Breakdown Structure
RMM	Risk Management Model
PERT	Project Evaluation and Review Technique
MCS	Monte Carlo Simulation
JRAP	Judgemental Risk Analysis Process
PRM	Project Risk Management
BOT	Build-Operate-Transfer
DCI	Development Cooperation Ireland
MOE	Ministry of Education
SCN	Save the Children Norway
AHP	Analytical Hierarchy Process
SPSS	Statistical Package for Social Sciences
DEBS	District Education Board Secretary
PEO	Provincial Education Officer
NGO	Non-Governmental Organization

Preface

This dissertation presents work carried out in a study titled "Risk management in the procurement of community-based construction projects in Zambia". The dissertation is divided in seven chapters. In Chapter One, community-based construction is explained and the statement of the problem is given. The justification of the study is also outlined. The literature on risk management is outlined and reviewed in Chapter Two. Research methods and methodologies relating to risk management studies and those used in this study are discussed in Chapter Three. In Chapter Four, the data collected during the study is analysed to identify risks and determine their probability and impact on project objectives. The results of the analysis are discussed in Chapter Five and thereafter, Chapter Six presents the risk management model developed and its validation. The last Chapter, which is Chapter Seven draws conclusions on the study and offers recommendations.

CHAPTER ONE: INTRODUCTION

1.1 Background

Zambia, located in Southern Africa and with an area of 752,614 km^2, is a highly urbanized country with more than 50 percent of the approximately 10 million people living in urban or peri-urban areas and an estimated per capita income of US $134.00 (CSO, 1999 and CSO, 2000).

At independence, the population of Zambia was slightly above 4 million people. By the early nineties, the population had more than doubled thereby putting a lot of pressure on the few socio-economic service infrastructure such as schools and hospitals that did not proportionately increase in relation to the population growth due to unfavourable economic factors. There was, therefore, need for the government to construct more schools, health centers and other infrastructure such as roads and bridges. Construction of infrastructure using conventional ways of contracting proved to be too costly, given the economic recession that had befallen the country.

In order to minimize costs of construction in view of scarce resources and to instill a sense of ownership after the projects were commissioned, the communities were required to participate in the procurement process by contributing 25 percent of the cost of the project in terms of local labour and materials such as burnt bricks, crushed stones, river sand, building sand and timber.

Since the early 1990s, there has been a considerable amount of donor support to the government of Zambia in the area of infrastructure development to improve the socio-economic well being of the people. This was in addition to the funds allocated from government sources for rehabilitation and new construction. In 1991 the government established the Social Recovery Project (SRP) of the Micro-Projects Unit (MPU) under the National Commission for Development Planning (NCDP). Donor funds were channeled through the SRP which was tasked to identify and work with communities to initiate development projects in needy areas. The community-based projects include construction of schools and health centers among others. In the Ministry of Education, for example, the Education Sector Support Programme (ESSP) supported by Finnish International Development Agency (FINNIDA) funded construction of selected schools using the community-based mode. The period of implementation for the ESSP programme was from 1992 to 2003 and the total budget was USD 6 million. In addition, the Zambia Education Projects Implementation Unit (ZEPIU) constructed a number of schools using the community-based mode under the OPEC Primary Schools Upgrading Programme (OPSUP) with support from Oil Producing and Exporting Countries (OPEC). The OPSUP programme was also implemented between 1992 and 2003 with a total budget of USD 10 million.

Once a project was initiated, a series of sensitization meetings would be held with the communities, and depending on the targets for the project, labour and materials that made up the 25 percent contribution would be estimated. A project management committee (PMC) would be formed to spearhead the provision of up-front materials and to carry out the general management of the project including recruitment of skilled labour and procurement of materials among other duties. Once the material contribution was in place, the technical team from the MPU or any other implementing agency would carry out a field appraisal of the project followed by a desk appraisal and make recommendation to the Head Office for approval. The construction work would commence immediately the project was approved. The skilled manpower would be engaged and these would be assisted by the local labour from the community. A district technical team would monitor and supervise the project to ensure conformity to project guidelines up to handover stage. In the case of projects directly under the Ministry of Education, the provincial building officers assisted by district building officers would supervise the projects.

In 2001 the SRP came to an end and since then, the Zambia Social Investment Fund (ZAMSIF), receiving support from various donors, has been funding most of the donor-supported community construction projects. Under the Education Sector Investment Programme (SECTOR PLAN) of the Ministry of Education (for the period 2003 to

2007), a number of schools were constructed using the community-based mode. In 2003, the total budget for infrastructure development for basic schools alone was ZMK 126 billion of which 23% was for rehabilitation works. In addition, a number of projects have been funded through the Highly Indebted Poor Countries (HIPC) Initiative and the Poverty Reduction Programme (PRP). The procurement procedures are the same as described above with minor variations.

On 8th April 2005, the World Bank and the International Monetary Fund (IMF) endorsed and approved Zambia's reaching the Completion Point under the Heavily Indebted Poor Countries (HIPC) Initiative (MOFNP, 2005). This means that the creditors will now fully commit themselves to debt relief by canceling more than half the debt for the country as promised at decision point. Given the reduced debt service payments, more resources will now be channeled towards vital social services and economic infrastructure, thereby benefiting the common Zambian. It is therefore imperative that such resources are put to good use by devising better methods of managing construction projects.

To date a number of projects have been completed under the community-based mode of delivery. However, the execution of some of the projects was not managed properly thereby compromising the quality and durability of the structures constructed. In construction management the procurement process follows a sequence of clearly defined stages and these are prone to a number of risks. The following are examples of problems that were encountered in the implementation of some community based construction works:

- the budget and financing arrangements for some projects affected the implementation schedules and created cash flow problems. This frustrated community participation and brought about delayed implementation;
- the community contribution of materials also posed risks in that the aspect of quality control and adherence to standard specifications did not exist. For example, the sizes of bricks and crushed stones did not conform to the standards and grading requirements in engineering practice;

- in many cases, the designs for the buildings were standardized such that the same design, for instance of a clinic, was used throughout the country without due consideration for geo-technical conditions for the specific construction sites. It was rare that soil investigations and testing were done to determine the bearing capacities of the soils thereby increasing the risk of structural failures of foundations;
- many a time, construction schedules for community projects did not exist and this made it difficult for project teams to track the progress and control the implementation of the projects. In construction management lack of a construction schedule is a serious omission that may lead to uncoordinated site activities and delays in project delivery;
- the design of the buildings and the building drawings produced were quite often done in accordance with the standard architectural and engineering practice. Some communities involved in the construction activities could not fully interpret the drawings and other documentation thereby increasing the risk of producing poor quality work. The planning of the project and the technical specifications must be clearly spelt out in a manner that the PMCs can understand them to avoid endogenous risks;
- the engagement of a contractor or skilled labour was a source of risk that impacted negatively on the pace of implementation and quality of work. It is therefore imperative that well thought out guidelines for the engagement of contractors are put in place to avoid cases of poor workmanship and improve the quality of the final product; and
- procurement of construction materials also posed risks that threatened the smooth implementation of projects. Delays in the process and quality of the materials impacted negatively on the final product.

This research seeks to propose improvements in the management of the projects by identifying the risks involved at every stage in the procurement of the community projects, analyzing and mitigating them so as to minimize the costs, improve the quality and reduce the completion time.

1.2 Statement of the problem

The government of the republic of Zambia with the assistance of co-operating partners has spent and continues to spend colossal amounts of money on infrastructure development to improve the socio-economic life of the citizens. Some of the structures developed are of poor quality that cannot stand the test of time and require rehabilitation at an early stage. For example, a classroom block at *Ngambwa* Basic School in *Itezhi-tezhi* district developed serious structural cracks within ten years of its construction such that it could no longer be used for teaching and learning. Investigations revealed that the thickness of the foundation footing for the building was less than 100mm instead of the specified 200mm and was placed at less than 300mm below the ground level contrary to a minimum 600mm requirement in general engineering practice in Zambia.

Most of the donor assistance to the Zambian government and indeed other developing countries is through loans and failure to use them properly will not only mean a waste of resources, but a disservice to future generations who will end up paying for abortive work. In addition, government is spending a lot of scarce resources to rehabilitate and repair poorly constructed buildings.

1.3 Aim of the research

The aim of the research is to develop a Risk Management Model (RMM) to be used or adopted by the community and other stakeholders in the procurement of community-based construction projects in Zambia in order to improve their implementation. Improved implementation can be construed to be improved delivery time, cost-effectiveness and improved quality.

1.4 Objectives

To achieve the above aim, the following are the objectives:

i. identify all possible construction management risks that are associated with community-based construction projects from initiation to commissioning stage;

ii. determine the probability and likelihood of occurrence of the identified risks;

iii. rank the risks according to severity on project objectives;

iv. determine the impact and consequences on project targets of risks with medium or high probability. The targets being completion of projects within budget, expected quality achievement and timely completion; and

v. develop responses for mitigating, controlling and monitoring the risks with negative effects on the project targets so as to minimize costs, improve quality and efficiency of project delivery.

1.5 Research questions

i. What problems do communities face in the initiation stage of community-based projects that might have an effect on the implementation and final product?

ii. How do communities tackle issues of technical specifications, such as quality of construction materials, and quality control during execution of the works?

iii. What measures are put in place to ensure transparency and accountability in the management of community-based project funds and how does this affect the implementation schedule of the projects?

iv. What criteria are used in the recruitment of skilled manpower to ensure the engagement of competent personnel?

v. What are the major problems encountered in the procurement and transportation of materials and how is their quality assured?

vi. What technical and management problems are encountered during the implementation of community-based projects?

1.6 Justification of the research

Most of the projects currently being undertaken by the Government of Zambia are community-based. For example 75 percent of schools constructed under the Ministry of Education since 1999 to date are executed using the community- based approach (Nthele 2005). There is, therefore, need to improve on the management of such projects to improve the quality of the products, minimize costs and improve the efficiency of implementation up to commissioning stage and beyond. In 2004 alone, the Ministry of Education needed more than K4 billion for the repair of blown-off roofs on classroom blocks country-wide (MOE-SIS, 2004). Most of the buildings under repair were constructed in the past ten years using community-based mode of construction. The 2004 estimate for constructing a 1x3 classroom block was ZMK 153 million and the cost for repairing blown off roofs shown in Table 1.1 ranged from 13% to 40% of new construction.

Table 1.1 Cost Estimates for blown off roofs for selected school infrastructure.

Item	**Province**	**District**	**Name of School**	**Description of Work**	**Estimated Amount (K)**
1	Luapula	Mansa	Chilila Basic	Repair of blown off roof & reconstruction of classroom block	30,000,000.00
2	North-Western	Kasempa	Katenda Basic	Reconstruction of collapsed classroom block	23,896,000.00
3	Central	Mumbwa	Chikanda Basic	Repair of blown off roof on classroom	20,000,000.00
4	Eastern	Katete	Kagoro Basic	Repair of blown off roof on classrooms	40,000,000.00
5	Copperbelt	Masaiti	Chilese Basic	Repair of blown off roof on classroom	26,000,000.00
6	Western	Sesheke	Mwanalulenga Basic	Repair of blown off roof & reconstruction of classroom block	40,000,000.00
7	Southern	Gwembe	St Patrick Basic	Repair of blown off roof & reconstruction of classroom block	59,959,625.00
8	Northern	Chinsali	Kasangala Basic	Repair of blown off roof on classroom	25,000,000.00
				Total for 8 schools	**264,855,625.00**

Source: MOE-SIS, 2004

Undoubtedly, the picture portrayed above may also exist in other sectors of the economy where infrastructure projects are implemented under the community- based approach. However, it was not possible to obtain data for other types of infrastructure at the time of the research. This was due to the fact that ZAMSIF that funded other types of infrastructure such as health centers was winding up construction activities.

The Risk Management Model that will be developed during the course of this study will assist in the management of community-based construction projects in order to improve their implementation.

Construction, like any other business venture, is affected by a number of risks and it is therefore imperative that risk management techniques are applied in all its activities. The research will help to identify, analyze, mitigate, control and monitor the many risks associated with the procurement of community-based projects to improve the project delivery process.

1.7 Dissertation layout

This dissertation comprises seven chapters: introduction; literature review; research methodology; data analysis; discussion of results; risk management model and validation; and conclusions.

Chapter 1 gives a background to the study reported in the dissertation. It outlines the statement of the problem, the aim and objectives of the study. The chapter also presents the research questions and justification for the study.

Chapter 2 provides a review of literature pertaining to previous studies and publications in the field of project risk management. The chapter gives definitions of terminologies and classifications of risks in construction. It also presents risk identification techniques and main ways of risk reduction and control.

Chapter 3 discusses the research methods and methodologies in detail and how they are applied in this study. Different types of research methods are explained and a summary of the research process is outlined. Data collection techniques are also explained and a list of sample projects for brainstorming sessions is also presented.

Chapter 4 presents the data collected from both the brainstorming sessions and questionnaire surveys and its analysis. The analysis identifies the risks by category and also determines the probability and impact of the significant risks.

Chapter 5 discusses the significant risks by category and their likely effect on the project implementation process and most importantly on the project objectives of completing the project on time, within budget and with good quality.

Chapter 6 outlines and explains the risk management model developed in the study. It also presents the validation of the model through a questionnaire survey.

Chapter 7 presents the conclusions and recommendations drawn from the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The previous chapter gave a background to the study, definition of key terms, statement of the problem and the justification for the study. In addition, the objectives of the research were also outlined. In this chapter, literature pertaining to studies and publications in the field of project risk management is reviewed. The review is presented in two parts, namely, definitions and classifications, and lastly risk management studies.

The definitions and classifications assisted the researcher to appreciate the concepts applicable in the field of risk management in general and classification of some risks obtaining in construction projects. The review of risk management studies and publications helped the researcher to understand the risk management techniques and their applications in different project situations.

2.2 Definitions and Classifications

2.2.1 Definition of Risk

There are a number of definitions of risk obtained from the literature; however, the choice of any depends on the applicable situation. According to Hertz and Thomas (1983), risk is uncertainty and the result of uncertainty. It refers to the absence of predictability about the structure, results or consequences in a planning or implementation process. It is therefore imperative that risk analysis, which involves estimating the probabilities, needed as input data for the evaluation of decision alternatives (Lifson and Shaifer 1982), is carried out. Symbolically, the definition of risk can be expressed as:

Risk = Uncertainty + Damage (Jannadi and Almishari, 2003)

2.2.2 Definition of procurement

Procurement in the context of construction management is incorporated in all procedures and processes from conception to commissioning of a construction project. The processes include appraisal, planning, designing, estimating, scheduling, material procurement, implementation and commissioning.

2.2.3 Definition of community-based construction project

A community-based construction project is a non-conventional one where the community in the locality of a construction project volunteers to actively participate in the processes of implementing the project from initiation to commissioning.

Construction projects undertaken the world over are subject to tight constraints and uncertainties that may constitute risks that threaten their smooth implementation (Teale 2003). Community-based construction projects are no exception. Construction managers or project teams are tasked with the responsibility to deliver the project on time, within budget and of good quality. One way to achieve project objectives is by identifying and planning for the unexpected or unanticipated risks.

All potential risks that may be obtained in community-based construction projects should therefore be identified, classified and analysed to determine the probability of occurrence and impact on project objectives should they occur. Thereafter, risk reduction measures that may include avoidance, transference, acceptance and mitigation are put in place.

2.2.4 Definition of Risk Management

The means by which uncertainty is systematically managed to increase the likelihood of meeting project objectives is risk management. It is neither an insurance system nor a magical risk elimination method. It only aims to identify the potential risks as early as possible and manage them for the prevention of negative effects of the risks to the project objectives (Ökmen Ö, 2002), (Verzuh, 1999).

2.2.5 Risk management

Risk management which is an on going process due to the dynamic nature of many risks, follows three main steps that may be repeated throughout the life cycle of a project (del Caño and de la Cruz 2002, Verzuh 1999):

- *Risk Identification–* Identifying all the risks that might impact the project, documenting them and their characteristics;
- *Response Development–* Defining the risks, including their potential negative impacts, assigning a probability to each risk and developing a strategy to reduce the possible damage; and
- *Control–* Implementing the risk strategy and continuing to monitor the project for secondary risks.

Before the application of risk assessment techniques, it is vital that all potential risks are identified and documented together with their characteristics. Risks may or may not adversely affect the project. Some risks are no more than pebbles in a pond; causing a ripple that quickly subsides while others are like underwater earthquakes (Tsunamis) (Verzuh, 1999) causing damage with serious consequences on completion time, cost and quality. However, all risk events and their consequences should be identified. The following paragraphs outline some of the techniques used in the risk identification process.

2.2.5.1 Risk identification

Risk identification involves skill, experience and a thorough knowledge of project management techniques. There are four techniques that may be employed in the process of identifying risks (Verzuh 1999), namely:

- asking the stakeholders;
- making a list of possible risks (risk profile);
- learning from past, similar projects; and
- focusing on the risks in the schedule and budget.

In view of the above, the process should include project team members, stakeholders, subject matter experts, users, and anyone else who would provide information.

a. Asking the stakeholders

There are several techniques used in gathering information from stakeholders (del Caño and de la Cruz 2002). These include the methods outlined below.

i. Brainstorming

Brainstorming is probably the most often used technique in risk identification. This involves getting subject matter experts, project team members, risk management team members and anyone else who might benefit the process in one place and asking them to start identifying possible risk events (Heldman 2004). Brainstorming is therefore done in the form of group discussions with stakeholders and other interest groups.

ii. Delphi technique

The Delphi technique is a lot like brainstorming, except that the people participating in the meeting do not necessarily know each other. In fact, the people participating in this technique do not all have to be located in the same place and can participate anonymously. E-mail could be used to facilitate the Delphi technique very easily. The experts could be asked via a questionnaire to identify potential risks. They in turn send their responses back to the facilitator of the process. All the responses are organised by content and sent back to the Delphi members for further input, addition or comments. The participants then send their comments back one more time, and a final list of risks is compiled by the facilitator (Heldman 2004).

The Delphi technique is a great tool that allows consensus to be reached very quickly. It also helps prevent one person from unduly influencing the others in the group and thus prevents bias in the outcome because the participants are usually anonymous and don't necessarily know how others responded.

iii. Interviews

Interviews are question-and-answer sessions held with others, including project managers, subject matter experts, customers, the management team, project team members and users. The individuals identify possible risks based on their past experiences with similar projects (Heldman 2004).

b. Making a list of possible risks (a risk profile)

A risk profile is a list of questions that address traditional areas of uncertainty on projects. These questions may be gathered and refined from previous, similar projects. Creating a risk profile is an ongoing process. The following are some examples of risk profile questions according to categories (Verzuh 1999; Heldman 2004):

i. Project Team

- How many people are on the team?
- What percentage of the team is fully dedicated to the project?
- Which team members will spend 20 percent or less of their time working on the project?
- What is the experience level of the team?
- Have team members worked together before?
- Is the team spread out geographically?

ii. Organisation

- Is there a resource conflict due to multiple projects occurring at the same time?
- Are the scope, time and cost objectives realistic given the organization's resources and structure?
- Is there a problem of lack of funding or diverting funds from the project to other projects?

iii. Technology

- Will there be technology that is new to the project implementation team?

- Will there be technology that is new to the users?
- Is there any new or leading-edge technology in the project?

iv. External

- Are there new laws or regulations that might affect the project implementation?
- Are there any labour issues impacting negatively on the smooth running of the project?
- Is the weather favourable for the project execution or not?
- How is the foreign policy of the donor countries affecting implementation of the project?

c. Learning from past, similar projects

Historical information continues to be the best forecaster of the future. This input refers to previous project experiences compiled from project files, published information such as commercial data bases and academic research that might exist in particular application areas. A project manager will do well to investigate what happened on similar projects in the past. Some useful risk-related information already written down that could be tapped into include the following (Verzuh 1999):

- planned and actual performance records that indicate how accurate the cost and schedule estimates were;
- problem logs that portray the unexpected challenges and relate how they were overcome;
- post project reviews that generate the lessons learnt from the project. These lessons may be critical to the success of a project despite the fact that often times they are ignored; and
- client satisfaction records could be referred to for pit falls and successes of previous similar projects, particularly those that generated either glowing praise or a multitude of complaints from stakeholders.

It is important for project managers to organise project documentation in such a way that it will be easy to make reference to them long after the project has been completed.

d. Focusing on the risks in the schedule and budget

As part of the planning process, each task will need a cost and schedule estimate. Some tasks may be difficult to estimate and this usually means that there is some uncertainty associated with them. In such cases there is need to identify and document certain assumptions that might be used in the management or further identification of risks. Such assumptions should be accurate, complete and consistent. In some cases, there is need to carry out an assumptions analysis to validate the assumptions (Heldman 2004).

At the end of the risk identification process and the qualitative analysis to determine their likelihood and impact, a prioritized risk register and other documents are produced.
The risks that will be ranked highly or in the middle of the risk register will be considered critical and will be subjected to quantitative analysis. This analysis evaluates the impacts of risks and quantifies the risk exposure of the project by assigning numeric probabilities to each risk and the combined impact on project objectives.

2.2.5.2 Response development

As stated earlier, not every risk will jeopardize a project. Therefore project managers must know how to discern the magnitude of a risk, develop potential responses to enhance and take advantage of opportunities and to mitigate the threats (del Caño and de la Cruz 2002). The strategy so developed is called response development and it has the following components:

- risk definition – a brief description of a risk including its negative impacts;
- risk probability – the likelihood of the risk event occurring; and
- risk reduction – the strategy to reduce possible damage based on severity and probability of the risk.

a. Risk definition

A risk definition is a concise statement describing the situation that is causing concern or uncertainty and the possible negative outcomes that may be caused by the condition. A good description of risk is essential to understanding it and a clearly defined risk will make it easier to predict the impact of the risk event (Verzuh 1999).

When a risk becomes a problem it leads to a system's malfunction. A system in this context represents a task, work package, or a project. A risk or problem acts as a disturbance which affects the normal functional behaviour of a system. The assumption considered here is that risk factors influence the severity of risks, which in turn cause changes in the system's performance measures, which are duration, cost, quality and safety (Tah and Carr, 2000).

All the risks that will be categorized as critical will be clearly described and defined for understanding and predictability of impact on the project objectives.

b. Risk probability

It is important for the project manager to know the likelihood and impact of risk events on the project so as to devise effective and less costly responses for managing them. There are two methods used in the assessment of risks to determine their probability and impact on the project, qualitative risk analysis and quantitative risk analysis (Heldman, 2004).

i. Qualitative risk analysis

Qualitative risk analysis involves determining what consequences the identified risks will have on the project objectives and the probability they will occur. It also puts the risks in priority order according to their effect on project objectives and allows one to evaluate the consequences.

The tools and techniques of the qualitative risk analysis process (Heldman, 2004) include:

- risk probability and impact;
- probability/impact risk rating matrix;
- project assumptions testing; and
- data precision ranking.

ii. Quantitative risk analysis

Quantitative risk analysis is applied to those risks that are ranked highly or intermediately in the risk register after the qualitative analysis. The analysis evaluates the impacts of risks and quantifies the risk exposure of the project by assigning numeric probabilities to each risk and their impacts on project objectives. This may be accomplished by using either the Analytical Hierarchy Process or the Monte Carlo Analysis techniques. In this study, the Expert Choice software package based on the Analytic Hierarchy Process will be used in the analysis and model building.

The purpose of the quantitative risk analysis (Heldman, 2004) is to perform the following:

- determine the probability of achieving project objectives;
- quantify the risk exposure for the project and determine the size of cost and schedule contingency reserves;
- identify risks that need the most attention by quantifying their contribution to overall project risk; and
- identify realistic and achievable schedule, cost or scope targets.

The tools and techniques of quantitative risk analysis include the following:

- sensitivity analysis;
- decision tree analysis and
- simulation.

c. Risk reduction

Risk reduction is one of the methods or strategies used to control the negative effects of risks if they occur. There are four main ways of reducing risks and these include transference, avoidance or elimination, mitigation and acceptance (Choi et al., 2004). Another approach for managing risks is "risk finance" which includes retention through self-insurance and funding, risk transfers that are not considered as risk control devices such as contractual transfer and commercial insurance (Nishjima 1993).

It is important to note that specific responses to risks can cause secondary risks that would not exist in other cases. For example, a turnkey contract at a fixed price will reduce the risk of cost overruns for the owner, but quality risks may arise (del Caño and de la Cruz 2002).

d. Control

The last step of risk management is control. This involves implementation of the risk management strategy and continuing monitoring the project for secondary risks. One way of controlling risks in construction projects is to develop reliable project estimates and schedules (Öztaş and Ökmen, 2004).

In order to reduce the negative effects of the critical risks, there is need to produce a risk management plan to outline a process for the ongoing management of risk during the life of the project. Figure 2.1 shows an example of a risk management process chart:

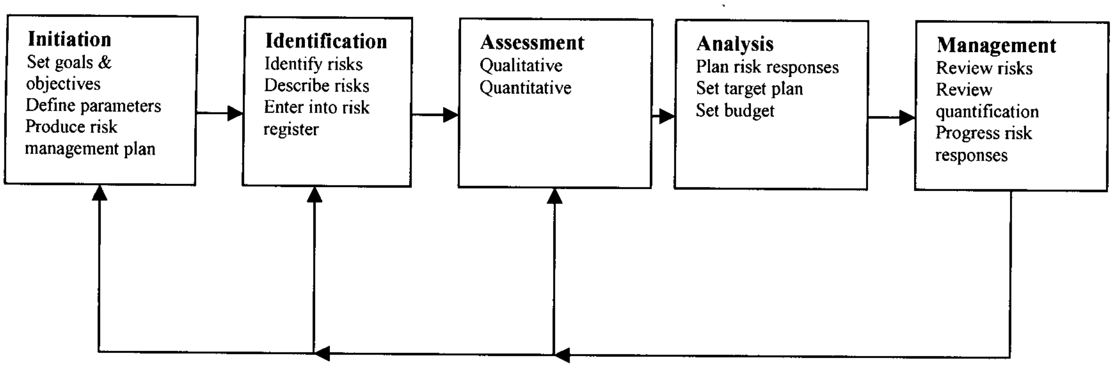

Figure 2.1: Risk management process chart

2.2.6 Risk classification

According to Tah and Carr (2000), risk classification is an important step in the risk assessment process, as it attempts to structure the diverse risks that may affect construction projects, including community-based ones. There are different ways of classifying risks suggested in the literature. Tah *et al.* (1993) used a risk-breakdown structure to classify risks according to their origin and the location of their impact on the project. Cooper and Chapman (1987) classified risks according to their nature and magnitude, grouping them into two major groupings of primary and secondary risks. Perry and Hayes (1985) gave an extensive list of factors gathered from different sources and classified in terms of risks retainable by contractors, consultants and clients. Wirba *et al.* (1996) adopted a synergistic combination of the approach of Tah *et al.* and that of Cooper and Chapman, where the former was used to classify all risks exhaustively and the latter used to segregate risks into primary and secondary categories.

Some examples of risk classifications obtained from literature are given below.

Nasir et al. (2003) classified risks into the following categories according to their source:

a. Environmental

- history of an earthquake causing damage;
- season that may affect the schedule;
- history of precipitation; and
- effect of humidity on the progress of work.

b. Geotechnical

- archeological survey done;
- geotechnical history of area;
- experience of consultants in similar area and project scale; and
- unknown conditions that may result in delay.

c. Labour

- labour affiliation to union;
- risk of labour disputes;
- availability of labour;
- prevalent wage rates of skilled and unskilled labour;
- competency level of labour;
- risk that labour may delay progress;
- risk to injury due to poor site safety; and

- general labour output.

d. **Owner/Client**

- type of owner;
- financial stability of owner with respect to the project;
- efficiency of decision making by the owner; and
- progress payments at time specified in contract.

e. **Design**

- are design and construction running concurrently?
- experience of design group in type and size of project;
- a multifunctional building may be more complex;
- the degree to which project scope is defined;
- design requiring unique details for various components;
- degree of design specification completeness;
- design quality in terms of design review or rework; and
- risk that design changes will affect work progress.

f. **Condition of area site**

- site location;
- significant demolition, rehabilitation, in operating facility;
- other site activity outside of construction;
- traffic may affect movement of people, materials on site;
- is movement of equipment, people, and materials affected?
- permits and approvals including traffic diversions;
- is intense security required in the area?
- are work time restrictions in place?

g. **Political**

- standpoint of the local residents toward the project;

- is a strong influential group against the project?
- any current public inquiries related to project?
- the chance of delay by parties outside the contract; and
- chance of project stopped or abandoned entirely.

h. Contractor

- will the contractors be pre-qualified?
- contractor's experience and ability including staff profiles;
- will new construction methods be used?
- risk of defects that necessitate rework;
- the chance of frequent reworks needed; and
- risk of many short breaks affecting productivity.

i. Contractor non-labour resources

- is vendor bonded to supply items for a specified time?
- are critical equipment or materials being imported?
- condition of contractor's equipment;
- chances of theft of equipment and tools affecting work;
- risk of damage to equipment by mishandling, low skill;
- the chance of equipment failure; and
- the chance of nonavailability of equipment.

j. Material

- level of reliance on just in time material delivery;
- is material yard secured to avoid sabotage or theft?
- chance of sabotage of material by anyone;
- status of fabricated or raw material procurement; and
- the chance of nonavailability of material.

According to Fang *et al.* (2004) the following were some of the factors that could be used in the classification and assessment of risks affecting the tendering and execution of building projects in China:

- owner type;
- source of project financing;
- existence or lack of past cooperation between contractors and owners;
- intensity of competition during tendering;
- reasonableness of the bid price; and
- the degree of support from the contracting company to its projects.

Construction risks can also be classified according to their possible sources (Heldman, 2004) as follows:

- budgets/funding;
- schedules;
- project targets and requirements change;
- project plan;
- project management processes;
- technical issues;
- personnel issues:
- hardware;
- contractual issues;
- political concerns;
- business risks;
- legal risks; and
- environmental risks.

According to Baker *et al.* (1999), there were six types of risks obtaining in the construction industry and there were many and varied examples of risks within each of the six types. The following are the six types of risks in order of importance:

- financial;
- technical;

- time;
- operational;
- environmental; and
- political.

2.3 Risk management studies

The concept of risk analysis and management has received a good share of recognition in the last four decades, with regard to its application in the construction industry. To date a number of studies in the field of risk assessment and management have been carried out. It is worth noting that of all the literature cited, none is specifically addressing construction risks associated with the procurement of community-based projects. The reason for that could be that this is a new concept that is being practiced in some developing countries. It is therefore necessary to assess the risks in this mode of construction and find out if there are similarities with those obtaining in conventional construction.

A paper by Baker et al (1999) investigates how variations in the use of risk management practices (identification, analysis, evaluation, response and monitoring) depend on numerous factors such as the industry sector. A questionnaire survey method was used to obtain information from over 100 companies within the construction industry and oil and gas operators in the United Kingdom. The information elicited from the respondents included the following: size and range of activities of the company; the techniques of risk analysis used; company's policy on responding to risk; identifying specific risks encountered during any particular project. The conclusions of the study were that:

- the most successful qualitative techniques in risk assessment are personal and corporate experience and engineering judgement;
- the principal quantitative techniques are expected monetary value, expected net present value, sensitivity analysis, and decision analysis; and
- risk reduction (through staff training and education and the improvement of working conditions) is the most popular method of responding to risk.

Choi et al (2002) presented a study whose aim was to demonstrate the modified risk assessment procedure and the software system model with pre-postprocessors for the risk assessment of subway construction projects. A survey was conducted through e-mail and interviews with more than 100 members of staff from engineering/construction firms. The study presented a risk assessment procedure and associated tools including a risk analysis software system for underground projects. The proposed methodology could be applied where assessment of risks incorporates experts' experiences and subjective judgements.

A paper by Tah and Carr (1999) discussed the development of a formal model for qualitative risk assessment using a hierarchical risk breakdown structure (HRBS) representation. A common language for describing risks in terms of likelihood and impacts so as to achieve consistent quantification was presented. Quantification of the likelihood of risk events occurring, the level of dependence between risks and the severity of risk events was done using linguistic variables and fuzzy logic.

The four steps followed in the application of the fuzzy risk assessment model were:

- identification of the risk sources by the stake holders;
- subjective assessment of the likelihood of occurrence and severity of the individual risk factors;
- computing the severity of each risk due to the effects of the risk factors which have been assessed in the second step; and
- computing the changes induced in the performance measures of the work packages by the individual risks.

The study suggested the use of a Hierarchical Risk Breakdown Structure (HRBS) to facilitate risk identification and classification. A common language grounded in the classification of risks and actions, and based on the HRBS, was developed for describing risks, likelihood and impacts in order to achieve consistent quantification. The relationships between risk factors, risks and their consequences were developed and represented on cause and effect diagrams.

In another paper, Nair et al (2002) presented a comprehensive construction schedule risk model to provide suggestions for the upper and lower activity duration limits based on project characteristics for the purpose of stochastic schedule analysis (Programme Evaluation and Review Technique (PERT) or Monte Carlo (MC) simulation). The methodology employed included identification of risk variables through literature review, procedure manuals and questionnaire surveys. In addition, interviews and brainstorming sessions with experts/practitioners were carried out. The success of any project is usually measured against two basic factors, the schedule and budget. Construction planning and scheduling is a logical analysis of a construction project together with a thorough knowledge of construction methods, materials and practices (Fisk 1997). Most schedules are developed in a deterministic manner, i.e. activity durations are given as a single value, usually the most likely duration. The assumption is that the duration is known with some certainty. However, the schedule often contains significant uncertainty, especially for non-routine or risky projects. It is important therefore to determine the lower and upper activity duration limits.

Fang et al (2004) presented a paper that evaluates the importance of various risks encountered by Chinese contractors when contracting for projects in Chinese markets using an importance evaluation index. Questionnaire surveys and case studies were employed. Respondents were drawn from top managerial personnel of special-class and first-class contractors within the Chinese borders. The research showed that the main risks encountered by Chinese contractors in domestic markets included owner's irregular behaviour and government departments' interference in the construction markets.
The research results provided valuable data enabling both local and international contractors gain a better understanding of the potential risks in the Chinese construction market environment.

Table 2.1 shows content analysis of reviewed literature in this study.

Table 2.1: Content analysis of reviewed literature

AUTHOR	OBJECTIVES	METHODOLOGY	CONCLUSIONS/COMMENTS
Yang and Chang, 2005.	To present a chance-constrained programming model to solve the limited resource allocation problem under uncertain supply conditions of resources and funding.	• Review of existing approaches in scheduling scarce resources. • Description of the operation system of repetitive construction projects. • Discussion of an existing deterministic optimisation model with the objective of maximising the system production rate as well as the project completion time. • Enhancement of the deterministic model to a chance-constrained programming formulation. • Conversion of the chance-constrained programming problem to a deterministic equivalent, which is then solved by common linear programming techniques. • Application of the proposed model to a project of 100 housing units to demonstrate how it can assist project managers in project acceleration and risk management.	The paper has shown that the proposed model is useful in the following aspects: • Determining the acceleration strategy. • Setting the technical bounds of individual activity production rates. • Evaluating the impact of different levels of uncertainty on the project duration. The amount of resources and funding for any construction project are subject to certain limits. Their supply conditions may also be exposed to uncertainty in today's dynamic and complex business environment. It is therefore imperative that such uncertainty requires caution and should be incorporated into the decision-making process. The chance-constrained programming model is developed to deal with the above scenario and manage the risks.
Mahdi and Alreshaid, 2005	Selection of a project delivery method based on high degree of technical factors and low construction costs.	A multi-criterion decision making methodology using the analytical hierarchy process. The relative importance of the technical factors affecting the selection are analysed to establish their relative importance.	The study analysed the factors that may be used in the selection of a project delivery method to be used by the client in the assignment of design and construction performance risks to other parties.

Table 2.1 continued........

AUTHOR	OBJECTIVES	METHODOLOGY	CONCLUSIONS/COMMENTS
Öztaş and Ökmen, 2005.	Firstly to propose a time schedule risk analysis methodology that is applicable on construction projects. The methodology called Judgemental Risk Analysis Process (JRAP) is a different approach to the analysis stage of risk management systems. Secondly to illustrate the application of the JRAP using a construction project data.	The methodology is mainly based on Monte Carlo Simulations (MCS) and an equation that is proposed in the study. The equation enables the planner to observe the variation in the activity durations during the MCS. The simulated values regarding the activity durations are utilised in the spreadsheet risk model through arithmetic formulas that are produced according to the logical relationships between the activities of the time schedule network.	The general concluding remark for the paper is that JRAP is a practical risk analysis methodology in the overall risk management framework and also contributes to the dynamism of the risk management system through its stochastic characteristics. The proposed risk analysis method qualifies to be 'judgemental' in that the lack of historical data related to the activities of the time schedule network does not interfere with performing risk analysis on the network, i.e. engineering judgement, experience and intuition of the planner have all been utilised through JRAP. As a matter of fact, such an analysis strategy would create additional risks due to the subjective data used.
Fang et al, 2004.	To identify risk factors that induce major risk events in Chinese construction markets and by using statistical method, devise a model for assessing the risk of undertaking contracted projects in order to help contractors make better tender decisions and project selection.	Design of questionnaires, questionnaire investigation and use of logistic regression. Identification of risk factors through questionnaire surveys and interviews with top project management staff. The questionnaires involved a number of variables with different properties, including nominal variables, ordinal variables, as well as scale variables. Most questions in the study were designed as dichotomy variables with a "Yes" or "No" answer, or directly supplied with different types of choice. With regard to the ordinal variable, the general answer is "very high", "relatively high", "average", and "relatively low" or "full support", "moderate support", and "insufficient support".	The findings show that six factors, namely, owner type, source of project funds, existence of cooperation between contractors and owners, bidding competition intensity, reasonableness of bid price and degree of support from the contracting company to its projects, can to a certain extent be used to assess the risks of tendering for contracted projects.
Fang et al, 2004.	To evaluate the importance of various risks encountered by Chinese contractors when contracting for projects in Chinese markets using an importance evaluation index.	Questionnaire surveys and case studies. Respondents were drawn from top managerial personnel of special-class and first-class contractors within the Chinese borders	The research shows that the main risks encountered by Chinese contractors in domestic markets include owner's irregular behaviour and government departments' interference in the construction markets. The research results provides valuable data enabling both local and international contractors gain a better understanding of the potential risks in the Chinese construction market environment.

Table 2.1 continued.........

AUTHOR	OBJECTIVES	METHODOLOGY	CONCLUSIONS/COMMENTS
Warszawski and Sacks, 2004.	To develop a straightforward method for the assessment of risk in building construction investment projects, without the drawbacks of sensitivity analysis, yet employing similar levels of input information and resource management.	The methodology adopted was as follows: 1. Review of the accepted profitability measure of a project based on its discounted cash flow, using deterministic "most likely" estimates of its parameters. 2. Examination of the behaviour of the cash flow parameters as random variables and the effect of their variability on the risk of the total project. Two cases were examined: ✓ When the risks inherent in different activities are assumed independent of each other. ✓ When interdependence is assumed to exist.	A practical and transparent multifactor method comparable to the conventional sensitivity analysis method has been developed, implemented and tested in this study. It enables a project owner or developer to: 1. Assess the economic risk associated with their project very quickly and with relatively little input information and; 2. Identify the ways in which he/she can intervene to mitigate the risks and assess the effectiveness of such interventions. The advantages of the multifactor-method are as follows: • All significant risk factors are handled simultaneously, rather than in isolation; • It assumes a normal (and can use any other) probability distribution for each risk factor over its range of variation, rather than simple linear variation; • It accounts for dependencies between the risk factors in a straight forward manner; and • It allows for easy evaluation of the tradeoffs between the cost and the risk inherent in a project.

Table 2.1 continued.........

AUTHOR	OBJECTIVES	METHODOLOGY	CONCLUSIONS/COMMENTS
Lyons and Skitmore, 2004.	To obtain feedback from practitioners on the following aspects of risk management: • Perceived risk tolerances of individuals and companies. • Frequency of use of risk management. • Factors limiting the implementation of risk management. • Risk management techniques used. • Risk management usage in each of the project life cycle phases. • The recording and use of historical risk data.	A small pilot study was carried out after which a final version of a questionnaire was developed and comprised four sections, namely: • Background information. • Risk management training. • Use of risk management techniques and limiting factors. • Organisational experience with regard to application of risk management. The survey questionnaire was administered to a random sample of 200 organisations involved in the Queens land engineering construction industry. The survey sample comprised owners, property developers, consultants (project managers, quantity surveyors and engineers) and contractors.	The results of the study indicated the following: • The use of risk management is moderate to high, with very few differences between the types, sizes and risk tolerances of the organisations, and experience and risk tolerance of the individual respondents; • Risk management usage in the execution and planning stages of the project life cycle is higher than in the conceptual or termination phases; • Risk identification and risk assessment are the most used risk management elements ahead of risk response and risk documentation; • Brainstorming is the most common risk identification technique used; • Qualitative methods of risk assessment are used frequently; • Risk reduction is the most frequently used risk response method, with the use of contingencies and contractual transfer preferred over insurance; and • Project teams are the most frequently used for risk analysis ahead of in-house specialists and consultant.
Olsen and Osmondsen, 2004	Sharing of endogenous risks (risks influenced by planning and specification activities) in construction.	Case study of Norwegian offshore development projects.	Careful project planning and detailed engineering activities can reduce the risk of construction projects, since they involve time costs. Therefore, procurement risk management can be perceived as a trade-off between time costs and incentive costs that can be shared between the client and the contractor.
Choi et al, 2004	To demonstrate the modified risk assessment procedure and the software (S/W) system model with pre-postprocessors for the risk assessment of subway construction projects.	A survey was conducted through e-mail or interviews with more than 100 members of staff from engineering/construction firms.	The study presented a risk assessment procedure and associated tools including a risk analysis software system for underground projects. The proposed methodology could be applied where assessment of risks incorporates experts' experiences and subjective judgements. In this study, developed tools such as survey sheets and detailed check lists may be employed.

Table 2.1 continued.........

AUTHOR	OBJECTIVES	METHODOLOGY	CONCLUSIONS/COMMENTS
Nasir et al, 2003	To develop a comprehensive construction schedule risk model to provide suggestions for the upper and lower activity duration limits based on project characteristics for the purpose of stochastic schedule analysis (PERT or MC simulation).	Identification of risk variables through literature review, procedure manuals, questionnaire surveys, interviews and brainstorming sessions of experts/practitioners.	The paper concluded that most schedules are developed in a deterministic manner, i.e. activity durations are given as a single value, usually the most likely duration. The assumption is that the duration is known with some certainty. However, the schedule often contains significant uncertainty, especially for nonroutine or risky projects. It is important therefore to determine the lower and upper activity duration limits.
Leopoulos et al, 2003.	To show that project-based companies who participate in competitive bids should consider risk as an integral part of all factors that interfere in their estimations and should therefore direct their bidding effort accordingly. Risk management should be integrated in the bidding process.	Data was collected from 20, same nature projects of a major member of the Greek construction industry and analysed to assess the loss caused by unmanaged risks. The results were presented in this study.	The results strongly suggested that project based industries should integrate the strategy of risk management in the bidding process in order to invest in successful bids and projects.
Rahman and Kumaraswamy, 2002.	To examine the attitudes of contracting parties and the co-operative relationships among the project participants in light of transaction cost economics (TCE) and relational contracting (RC) to improve project delivery through joint risk management (JRM) at the post-contract stage.	Questionnaire survey based in Hong Kong and case study in mainland China (triangulation-type verification). There were 47 responses from the questionnaire survey that gave perceptions on the following: • Present risk allocation; • Preferred allocation, including an option for JRM, in conventional construction contracts. The information for the case study was collected through a 5-day stay at the project site and by interviewing key personnel from both the employer and the contractors. Two conceptual models (frameworks) were formulated for the improvement of the construction process.	Appropriate contract conditions help to meet the specific requirements and objectives of a project. Contract conditions are expected to be clear in order to define the rights and duties of project participants and to allocate risks (or future uncertainties) to the different contracting parties. Contract conditions are also expected to be equitable, so as to allocate the risks in a fair way, apart from merely following the principle of assigning the risks to those best equipped to deal with them. A totally comprehensive contract is impossible to achieve for the following reasons: ▪ Not all information required to handle future uncertainties properly are discernable, and not all risks are identifiable and quantifiable at the planning stage. ▪ Not all the risks are manageable by a single contracting party, and may ideally require more than one contracting party to handle. In view of the above and in order to properly address the uncertainties in the construction process, the following need to be done: ▪ Joint and dynamic risk management under the umbrella of flexible contract conditions with provisions for amicable adjustment processes and rapid coordinated multi-party responses to emerging problem scenarios. ▪ A veritable 'cultural revolution' in terms of project culture. Diverse interests of contracting parties need to be addressed through better relationships, co-operative teamwork and proper restoration techniques, as and when anticipated risks occur.

Table 2.1 continued........

AUTHOR	OBJECTIVES	METHODOLOGY	CONCLUSIONS/COMMENTS
del Caño and de la Cruz, 2002.	To stimulate reflection on ways to develop the Project Risk Management (PRM) tasks in different environments (projects, companies and so on). To present a flexible methodology to be adapted to the project and organisation circumstances.	An integrated methodology based on a hierarchically structured, flexible and generic PRM process. Consideration of project circumstances, especially those related to the level of risk management maturity of the organisation undertaking the project, the relative project size and the project complexity. Design and administration of questionnaire to determine complexity of projects. Four phases of PRM process are followed, namely initiation, balancing, Maintenance and learning.	The article defined a generic PRM process to be undertaken by organisations with the highest level of risk management maturity in the largest and most complex construction projects where a specific risk management team is set up. In smaller projects and low maturity organisations, the PRM processes could still be performed by the project management teams.
Shen et al, 2001.	To identify risks associated with Sino-foreign joint ventures in the Chinese construction industry and examine their relative significance. In addition, to establish a risk significance index, from which the most significance risks are highlighted.	A questionnaire survey was conducted. Questionnaires were distributed to 185 professionals and 54 effective replies were received from firms based in Hong Kong and mainland China. The respondents were from consultants, designers and project managers with good experience working on behalf of foreign partners in various joint ventures. Respondents were requested to analyse the relative significance of the risks already identified and highlight the major risks. Two attributes were to be considered for each risk: • The probability level of the risk occurrence and; • The degree of impact or the level of loss if the risk occurs.	The survey systematically examined the major risks affecting the Sino-foreign construction joint ventures. The risk significance index developed, together with the real risk cases cited, provided an effective insight and clear picture of the risk profile involved in the joint venture businesses in Chinese construction. The proper understanding of this risk profile is essential in order for joint venture to take proper risk management strategies.
Han and Diekmann, 2001.	To introduce a formal procedure for international market entry decisions, or more simply go/no-go decisions for traditional competitive public sector projects, which are either financed by governments or funded by international agencies. The paper also focuses on the following three questions: • What are the essential risks associated with international construction projects? • What are the current approaches used to make go/no-go decisions for international projects? • What is the most appropriate approach for risk-based go/no-go decision formalism?	The paper describes a risk-based, analytical methodology for go/no-go decisions considering shortcomings of existing tools.	There are two distinct types of decision-making theories; the normative decision theory and the descriptive cognitive theory. Normative decision theory attempts to analyse decision tasks to prescribe the optimal way to behave, whereas the descriptive decision theory attempts to describe how decisions are actually made. Based on the normative decision theory, a risk-based go/no-go decision model is created.

Table 2.1 continued.............

AUTHOR	OBJECTIVES	METHODOLOGY	CONCLUSIONS/COMMENTS
Xu and Tiong, 2001.	To develop a new approach for the risk assessment of contractors' pricing strategies by using quantities as random variables. The approach enables the contractor to find the global optimal pricing through the stochastic programming model.	Since quantities are random variables in cost estimating (Powell and Soulsby, 1990; Touran, 1993), the expected value model, which is one of the methodologies used to solve stochastic programming problems, is particularly suitable and is used to determine the optimal pricing and to quantify its risk. In other words, the risks caused by contractors' pricing strategies are assessed in a quantitative manner. A real case analysis using the approach is also demonstrated.	The paper concluded that pricing strategies are feasible in theory and common in the construction industry. Like any other strategy, they have both pros and cons. The contractor can either increase profit or be exposed to greater risks. It is therefore essential for the contractor to be fully aware of the risks before employing any pricing policy. The risk assessment approach reduces the possibilities of cash flow shortfall or bankruptcy and avoids legal expenses or any other losses caused by a contractor's financial default.
Tah and Carr, 2000.	To develop a formal model for qualitative risk assessment using a hierarchical risk breakdown structure (HRBS) representation. Presentation of a common language for describing risks which includes terms for quantifying likelihood and impacts so as to achieve consistent quantification.	Quantification of the likelihood of risk events occurring, the level of dependence between risks and the severity of risk events using linguistic variables and fuzzy logic. Four steps followed in the application of the fuzzy risk assessment model: ▪ The first step is the identification of the risk sources by the stake holders. ▪ The second step involves the subjective assessment of the likelihood of occurrence and severity of the individual risk factors. ▪ The third step involves computing the severity of each risk due to the effects of the risk factors which have been assessed in the second step. ▪ The fourth step involves computing the changes induced in the performance measures of the work packages by the individual risks.	In this study, a hierarchical risk breakdown structure has been suggested to facilitate risk identification and classification. A common language grounded in the classification of risks and actions, and based on the HRBS, has been developed for describing risks, likelihood and impacts in order to achieve consistent quantification. The relationships between risk factors, risks and their consequences have been developed and are represented on cause and effect diagrams.

Table 2.1 continued.............

AUTHOR	OBJECTIVES	METHODOLOGY	CONCLUSIONS/COMMENTS
Wang et al, 2000.	To identify, analyse and manage risks associated with build-operate-transfer (BOT) projects, with emphasis on power projects in china. The objectives of the paper were as follows: • to identify the unique or critical risks associated with China's BOT projects; • to examine the adequacy of key contract clauses used in Laibin B's concession agreement (CA) to address the risks; and • to propose improvements to the contract clauses.	The methodology developed in the study included the following: • a literature review to identify an initial list of unique or critical risks associated with BOT projects and mitigating measures for the risks; • unstructured interviews and discussions to verify the risks and mitigation measures identified in the literature review. • an international survey to evaluate the criticality of the risks and the adequacy of the key contract clauses in the Laibin B's CA; and • case studies to provide additional insight concerning contract clauses in China's BOT infrastructure projects.	The paper generally concluded that the contract language and the provisions in the concession agreement (CA) conformed to international practice. It also concluded that the clauses were relatively adequate in addressing the sponsors' and lenders' concerns towards foreign exchange and revenue risks in China. However, there were areas for improvement, especially in the area of foreign exchange approvals and tariff adjustments.
Baker et al, 1999.	To investigate the dependency on numerous factors, such as the industry sector, of the variations in the use of risk management practices (identification, analysis, evaluation, response and monitoring).	Questionnaire surveys of over 100 companies within the construction industry and oil and gas operators in the United Kingdom. The information elicited from the respondents included the following: size and range of activities of the company; the techniques of risk analysis currently used; company's policy on responding to risk; identifying specific risks encountered during any particular project.	The paper concluded as follows: • The most successful qualitative techniques in risk assessment are personal and corporate experience and engineering judgement. • The principal quantitative techniques are expected monetary value, expected net present value, sensitivity analysis, and decision analysis. Risk reduction (through staff training and education and the improvement of working conditions) is the most popular method of responding to risk.

2.4 Summary

Definitions and concepts applicable in the field of risk management in general and classification of some risks obtaining in construction projects were outlined in this chapter.

Risk management has been defined as "an on going process of identifying risks, developing responses through risk definition, risk probability assessment and risk reduction strategy formulation; and finally risk control through continuous monitoring of the project".

Key terminologies used in risk management such as risk identification, risk probability assessment, risk reduction and control have been defined. Techniques used in the risk identification and probability assessment have also been discussed. These include asking stakeholders, learning from past, similar projects, qualitative analysis and quantitative analysis.

Four main ways of reducing risks were also outlined in this chapter and these included transference, avoidance or elimination, mitigation and acceptance.

In chapter 3 that follows, research methods, general terminologies and those that may be applicable in the field of risk management are outlined.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

In the previous chapter, literature pertaining to risk management and how it was applied to different types of projects was reviewed. Further, the literature relating to research methodologies employed in similar studies was also outlined. The review of the available methodologies assisted the researcher to have an overview of the available research methodologies from which a suitable one for the study was chosen.

In this chapter, the research methods and methodologies, and how they were applied in this study are discussed in detail. Different types of research methods are explained and a summary of the research process outlined. Data collection techniques are also explained and a list of sample projects for brainstorming sessions is also presented.

After consideration of the research topic and factors affecting the choice of research methodology as outlined in the literature review, both qualitative and quantitative research methods were applied in the study.

3.2 Research Methodologies

Research methodology is an approach a researcher uses to investigate a subject. Methodology refers to the philosophical basis on which the research is founded. The particular techniques used to collect data and information are termed methods (White, 2000).

A number of methodologies and methods have been developed over time. The most commonly used ones are experiments, surveys, case studies and examination of historical documents and records. Overall, qualitative and quantitative methods are identified as two main methodologies for research.

a. Qualitative research

In this approach data is usually collected in the form of descriptions. Although some of the data collection methods used, such as interviews are used in quantitative research, the difference is that in qualitative research non-mathematical procedures are employed when interpreting and explaining the research. This approach is used mainly to study the way organizations, groups and individuals behave and interact.

b. Quantitative research

In this type of research the results are given numerical values and the researcher uses mathematical and statistical treatment to help evaluate the results. Questionnaire and interview responses are given numerical values and would also be considered as quantitative research instruments.

In certain cases, a combination of qualitative and quantitative researches may be employed.

3.2.1 Experimental research method

Experiments are a fundamental part of scientific research. Although statisticians at agricultural institutes developed much of the theory of design and analysis of experiments, the methods are still useful in many other application areas.

Experimental research is usually conducted to examine the relationship between two or more variables (Bickman and Rog, 1998). In this method, an independent variable is systematically varied and the ensuing reactions or changes on the dependent variables are then measured and recorded. This approach is usually employed to determine the cause-effect relationships.

3.2.2 Survey method

A survey is a procedure in which information is collected systematically about a set of cases (human population, organizations, projects etc.). The sample units are selected from

a defined population/organisation and the aim is to construct a data set from which estimates can be made and conclusions reached about the population/organization.
Surveys are similar to experiments in that they both aim to collect data in a systematic way and to make inferences from the results. The difference between surveys and experiments is that the former are carried out under natural conditions. Surveys can either be qualitative or quantitative and data collecting techniques may include interviews and questionnaires.

The quality of data from a survey method largely depends on the size and the representativeness of the sample, the quality of interviewing and the type and clarity of questionnaires (Bickman and Rog, 1998). The overriding advantage of this method is that broader generalisations can be made from data collected from a representative sample.
The other advantage is that the method is less expensive. The disadvantages of this method include the fact that the questionnaires may not be responded to conclusively and provision of set responses may also limit gathering of additional information.

3.2.3 Historical research method

Historical information continues to be the best forecaster of the future. Historical research methodology relies on previous project experiences compiled from project files, published information such as commercial data bases and academic research that might exist in particular application area of interest to the researcher. Some useful risk-related information documented that could be useful to a researcher includes (Verzuh 1999):

- planned and actual performance records that indicate how accurate the cost and schedule estimates were;
- problem logs that portray the unexpected challenges and relate how they were overcome;
- post project reviews that generate the lessons learnt from the project. These lessons may be critical to the success of a project despite the fact that often times they are ignored; and

- client satisfaction records could be referred to for pit-falls and successes of previous similar projects, particularly those that generated either glowing praise or a multitude of complaints from stakeholders.

Historical research method may not give satisfactory results considering the fact that record-keeping by rural communities are known to be poor. It is therefore important for project management teams to organise project documentation in such a way that it will be easy to make reference to long after the projects have been completed.

3.2.4 Case study research method

A case can be an individual, a group, institution or community that can be studied as single or multiple cases depending on the focus of the research. A case study is one that investigates an individual, a group, institution or community to provide answers to specific research questions which seek a range of different kinds of evidence, evidence which is there in the case setting, and which has to be abstracted and collated to get the best answers to the research questions. One kind or source of evidence may not be sufficient or sufficiently valid on its own. The key characteristic of case study research is the use of multiple sources of evidence, each with its strengths and weaknesses (Gillham, 2000). One advantage of case study methodology is its flexibility and use of multiple techniques of data collection such as field observations, interviews, questionnaires, archival records, surveys and other documentation (Scholz and Tietje, 2002). One disadvantage is that the researcher has no control on the behaviour of the events (De vaus, 2001).

From the literature, there is no research method that can be presumed superior to the other in terms of results and objectivity, but rather the methods complement each other. A research method to be used in a particular study is arrived at after consideration of the advantages and disadvantages of each method and also dependant on factors such as:

- the research topic;
- the research questions;
- the research area/setting;

- expected sources of data; and existing situation as opposed to historical data.

3.2.5 Data Collection Techniques

Data collection techniques can be both qualitative and quantitative. These include brainstorming sessions, application of the Delphi technique, discussions with focus groups, and interviews with individuals and stakeholders, questionnaires and case studies. These techniques have been explained in detail in the previous chapter.

3.3 Research Design and Methodology

The research process followed in this study is illustrated in Figure 3.1 and involved literature review of publications in the field of project risk management this far. The review of literature fed into the formulation of the aims and objectives of the study, methodological approach, data collection and data analysis.

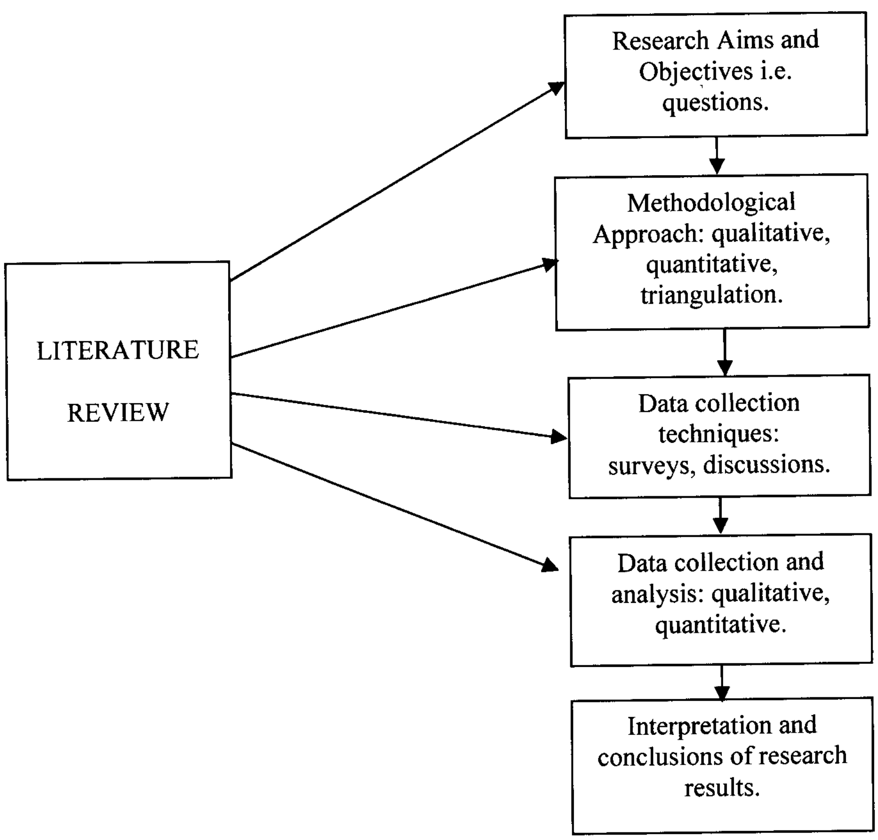

Figure 3.1: Summary of research process.

In this study two techniques for identifying risks were employed, namely asking the stakeholders and learning from past, similar projects. Brainstorming was applied in the form of group discussions with project management committees at community level to identify potential risks affecting their particular projects. Thereafter questionnaire surveys were carried out.

3.3.1 Qualitative data collection

Qualitative research methods that were descriptive and non-numerical were applied in the first phase of field research that involved identification and documentation of risks. The data collection methods used were brainstorming and interviewing focus groups such as project management committees and other stakeholders. Guiding questions for the brainstorming sessions with project management committees were developed and categorized into risk factors. The instrument was pilot-tested by carrying out brainstorming sessions with two PMC groups in Lusaka Province and by a few experts to ascertain ease of understanding. The responses were incorporated in the list of guiding questions and as a result the number of questions reduced from eleven to seven.

Nine sample units from each of the nine provinces of Zambia were selected using purposive sampling method. The sample units were either completed or on-going projects. The PMCs for the projects formed part of the respondents interviewed and discussed the potential risks for the projects. Table 3.1 shows the sample project units for the brainstorming sessions. A sample of the list of guiding questions for brainstorming sessions with project management committees is shown in Appendix B. A sample list of participants in the brainstorming sessions is also shown in Appendix C.

Table 3.1: List of Sample Projects

Project No.	Province	District	Name of Project	Type of Project	Budget in ZMK '000	Project Status	No. of PMC respondents
1	Central	Mkushi	Kasokota School	Construction of classroom block	153,000	Completed	16
2	Northern	Kaputa	Kaputa School	Rehabilitation of classroom block	22,000	Completed	14
3	North Western	Kasempa	Lufupa School	Construction of classroom block	153,000	On-going	13
4	Copperbelt	Ndola	Northrise School	Construction of classroom block	160,000	On-going	13
5	Luapula	Mansa	Lukangaba School	Construction of classroom block	153,000	On-going	15
6	Western	Kalabo	Namatindi School	Construction of houses	282,000	On-going	19
7	Lusaka	Chongwe	Chinyunyu School	Construction of houses	282,000	On-going	16
8	Southern	Namwala	Kabulamwanda School	Construction of laboratory	130,000	On-going	28
9	Eastern	Nyimba	Fumba School	Construction of classroom block and houses	210,000	On-going	18

3.3.2 Quantitative data collection

In the second stage of the data collection activity, quantitative methods were applied and data collection was done by way of questionnaire surveys to try and validate the findings from the brainstorming sessions. Questionnaires were pilot-tested by a few selected experts, prior to administration to a chosen sample. The possible responses to the questions in the questionnaire were coded for ease of analysis. The experts were drawn from organizations implementing community-based construction projects such as ZAMSIF, DCI, MOE, SCN-Zambia and ZEPIU.

A copy of the questionnaire is shown in Appendix D.

Both postal and self-administered questionnaires were employed. In other privileged cases, the questionnaires were sent by e-mail.

3.4 Summary

In this chapter, literature relating to research methodologies employed in similar studies was outlined. The review of the available methodologies assisted the researcher to have an overview of the available research methodologies from which a suitable one for the study was chosen.

The research methodology chosen for the study included both qualitative and quantitative research methods.

The methodology employed included desk study to come up with lists of risk variables identified from previous studies on risk management in construction projects. Thereafter, brainstorming sessions were conducted with PMCs to identify risks obtaining in community-based projects. A questionnaire survey was then carried out to validate the findings from the brainstorming sessions.

In the next chapter, different methods of data analysis, presentation of the data collected in the field study and its analysis were outlined.

CHAPTER FOUR: DATA ANALYSIS

4.1 Introduction

Different types of research methods and methodologies were reviewed in the previous chapter. Criteria for selection of a suitable research method and how they were applied to different research scenarios were also reviewed. Further, techniques used in the data collection process were outlined. In this chapter different methods of data analysis used to assist in the interpretation of the data collected in the field study were examined. In addition, data collected in the research was presented and analysed in this chapter.

4.2 Data Analysis Methods

Data analysis involved both qualitative and quantitative methods.

4.2.1 Qualitative risk analysis

Qualitative risk analysis involves determining what consequences the identified risks will have on the project objectives and the probability that they will occur. The analysis also puts the risks in priority order according to their effect on project objectives and allows one to evaluate the consequences. Qualitative methods are frequently used in the assessment of risks (Lyons and Skitmore, 2004).

Some of the tools and techniques of the qualitative risk analysis process include (Heldman, 2004):

- risk probability and impact; and
- probability/impact risk rating matrix.

4.2.2 Quantitative risk analysis

Quantitative risk analysis is applied to those risks that are ranked highly or intermediately in the risk register after the qualitative analysis. The analysis evaluates the impacts of risks and quantifies the risk exposure of the project by assigning numeric probabilities to each risk and their impacts on project objectives. This may be accomplished by using either the Analytical Hierarchy Process (AHP) or the Statistical Package for Social

Sciences (SPSS). In this study, the Statistical Package for Social Sciences (SPSS) was used in the analysis.

The purpose of the quantitative risk analysis is to (Heldman, 2004):

- determine the probability of achieving project objectives;
- quantify the risk exposure for the project and determine the size of cost and schedule contingency reserves;
- identify risks that need the most attention by quantifying their contribution to overall project risk; and
- identify realistic and achievable schedule, cost or scope targets.

The tools and techniques of quantitative risk analysis include the following:

- sensitivity analysis;
- decision tree analysis and
- simulation.

4.3 Data Presentation and Analysis

4.3.1 Data collected from Group Brainstorming Sessions

One of the objectives of this research was to identify risks obtained in community-based projects. According to Lyons and Skitmore (2004), brainstorming was the most common risk identification technique used in risk management. Therefore data collection by way of brainstorming sessions with nine project management committees, one in each of the nine provinces was carried out to achieve this objective. The sample units were selected randomly using purposive sampling method. It should be noted that the levels of education for the participants were low. The highest qualifications in construction were craft certificates in either carpentry or bricklaying held by the assistant building officers. The attendance for each of the meetings ranged from 13 to 28. It is worth noting that some participants were not actively involved in the deliberations. However, a number of risks were identified during the meetings.

It was not possible to collect data relating to the probability and impact of the identified risks, as this would have minimized participation, since the sessions would have taken too long (Teale, 2001). The average time period for each of the sessions was two hours. Therefore the sessions were confined to identification of risks.

The identified risks were classified in six categories based on the reviewed literature and in relation to the research topic. The categories were:

- project initiation;
- community contribution and participation;
- Budget and finance;
- skilled labour;
- material procurement; and
- technical supervision and quality control.

4.3.2 Analysis of risks identified from brainstorming sessions

Risks may or may not adversely affect a project (Verzuh, 1999). It is therefore important to identify the risks that would have a moderate or high probability of occurrence. In this study, a cut off percentage of 50% was considered for intermediate risks due to the fact that the education level of the participants was low and that some of them did not participate actively. Therefore, all risks that received affirmative responses of 50% or more of the brainstorming sessions were considered as moderate to high in terms of importance. The identified risks for each category were analysed to determine the percentage affirmative response by the nine group brainstorming sessions for each of the cited risks. This was one way to establish the priority order of the risks. A good description of a risk is essential to understanding it and a clearly defined risk would make it easier to predict impact of the event (Verzuh 1999). It was therefore prudent that identified risks were clearly defined.

4.3.2.1 Project initiation risks

Since the community initiated most community-based construction projects as beneficiaries, it was important that risks pertaining to project initiation were identified. Figure 4.1 shows a summary of the identified project initiation risks after analysis. The respective percentage responses by the nine brain storming sessions are indicated.

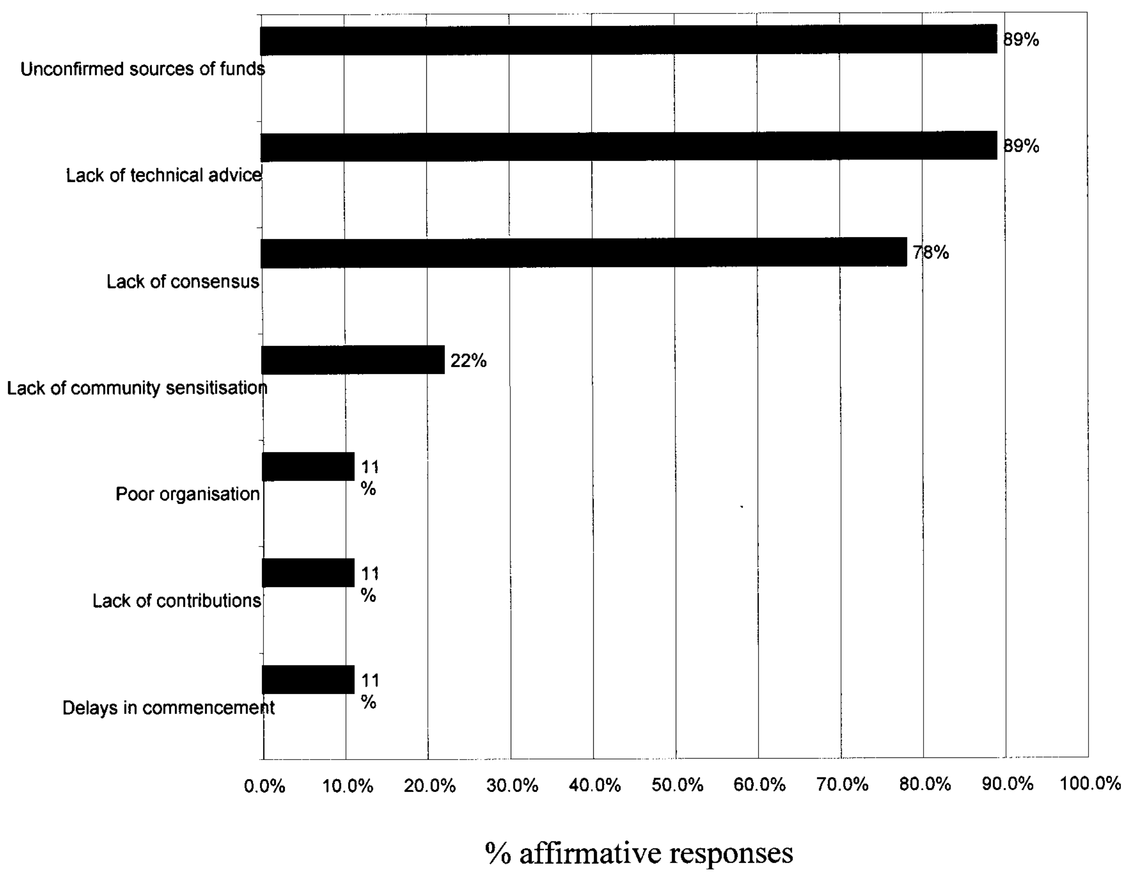

Figure 4.1: Identified project initiation risks

From Figure 4.1 the main identified project initiations risks were:

- unconfirmed sources of funds;
- lack of technical advice; and
- lack of consensus.

The risks identified during brainstorming sessions under the category of project initiation are described in Table 4.1.

Table 4.1: Description of project initiation risks

Item no.	Identified Risk	Description of Risk
1	Unconfirmed sources of funds	Unreliable or unconfirmed sources of funding discouraged participation and hindered full cooperation with regard to material contribution;
2	Lack of technical advice	Lack of clarity on the requirements for the project, led to acquisition and preparation of wrong materials not meeting the standard engineering specifications;
3	Lack of consensus	Community failing to reach consensus on need and type of project, led to some members not fully participating in the project.
4	Lack of community sensitization	Absence of sensitisation and motivation of the community led to slow rate of participation;
5	Poor organization	Communities poorly organized by village administration led to delays in arranging upfront materials and lack of full cooperation
6	Lack of contributions	For projects located in peri-urban areas composed of working class people, community contributions were difficult to organize. This led to delayed start-up;
7	Delays in commencement	Delayed commencement of project due to various factors led to collected materials such as sand to be washed away;

4.3.2.2 Community contribution and participation risks

As already stated elsewhere in this report, one of the major activities carried out by the beneficiary community for a project was to provide upfront locally available materials and unskilled labour. The materials may include crushed stones, river sand, building sand, sawn timber and burnt bricks in some cases. In the process of preparing upfront materials, a number of risks that could manifest were identified.

Figure 4.2 shows a summary of the identified community contribution and participation risks after analysis.

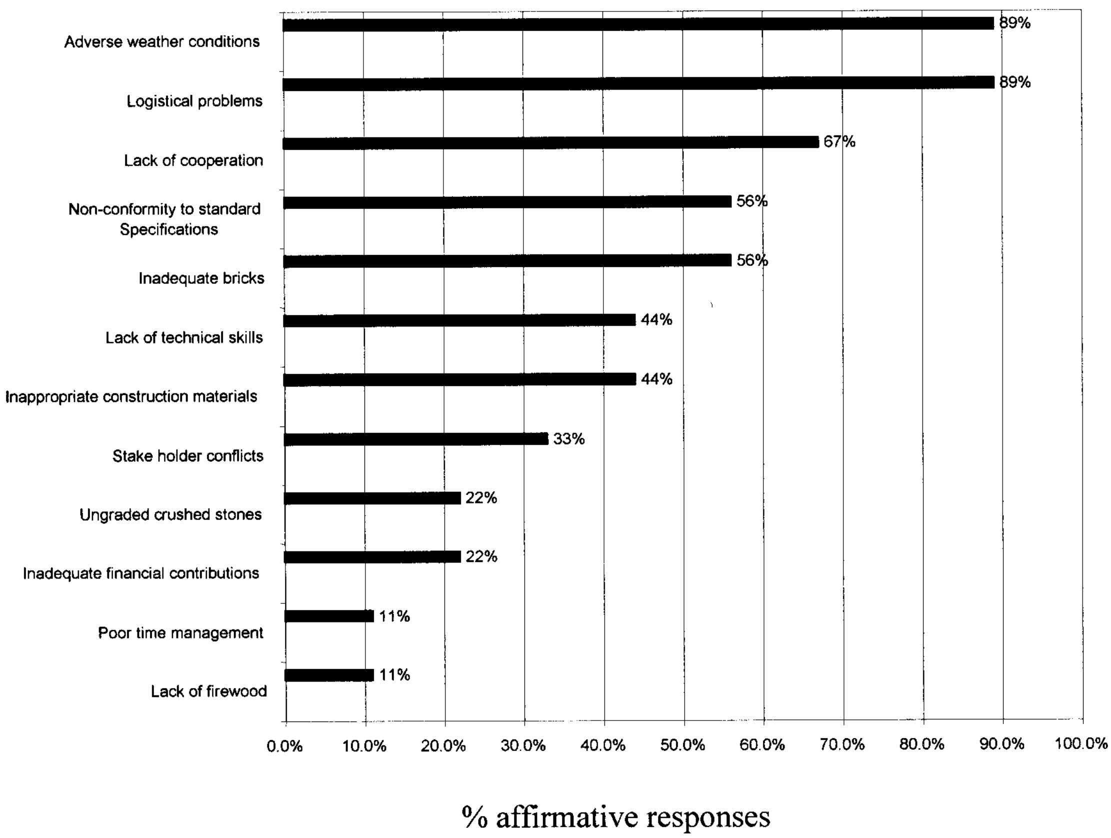

Figure 4.2: Identified community contribution and participation risks

From Figure 4.2 the major identified community contribution and participation risks were:

- adverse weather conditions;
- logistical problems;
- lack of cooperation;
- non-conformity to standard specification; and
- inadequate bricks.

The risks identified during brainstorming sessions under the category of community contribution and participation are described in Table 4.2.

Table 4.2: Description of community contribution and participation risks

Item no.	Identified Risk	Description of Risk
1	Adverse weather conditions	Heavy rainfall, flooding in the rainy season and other environmental conditions made it difficult to prepare materials for the project. This led to delayed implementation;
2	Logistical problems	Problems relating to transportation of materials in view of poor state of feeder roads posed difficulties in the mobilization of materials. This led to delayed implementation;
3	Lack of cooperation	Community members were unwilling to cooperate and contribute to the project due to government policy of free education. Some community members expected government to execute the project;.
4	Non-conformity to standard specification	Shapes and sizes of bricks varied due to lack of quality control measures at production. This led to poor quality brickwork;
5	Inadequate bricks	Bricks not moulded in adequate quantities in relation to the project targets. This led to delayed implementation;
6	Lack of technical skills	Lack of technical skill on the part of the community involved in the preparation of upfront materials such as moulded blocks/burnt bricks, aggregates and timber led to poor quality materials;
7	Inappropriate construction materials	Lack of suitable aggregates and other materials for construction. This led to poor workmanship and poor quality buildings;
8	Stakeholder conflicts	Conflicts among stake holders relating to their roles and participation. This led to delayed project start up;
9	Ungraded crushed stones	Manually crushed stones were not graded and were therefore of different sizes and shapes. This led to weak and poor quality concrete;
10	Inadequate financial contributions	Projects located in an urban setting, and therefore communities were required to contribute funds to purchase upfront materials. High unemployment levels led to inadequate financial contributions;
11	Poor time management	Failure by community members to apportion time between project, traditional and farming activities. This led to delays in the mobilization of materials;
12	Lack of firewood	Difficulties in collecting firewood for firing kilns to burn the moulded bricks. This led to delayed implementation.

4.3.2.3 Budget and finance risks

Financing is a major input in the implementation of any construction project and community-based construction projects are no exception. It was on this premise that risks associated with budgeting and financing of these projects were identified at group discussions. Figure 4.3 shows a summary of the identified budget/finance risks after analysis. The respective percentage responses by the nine brain storming sessions are indicated.

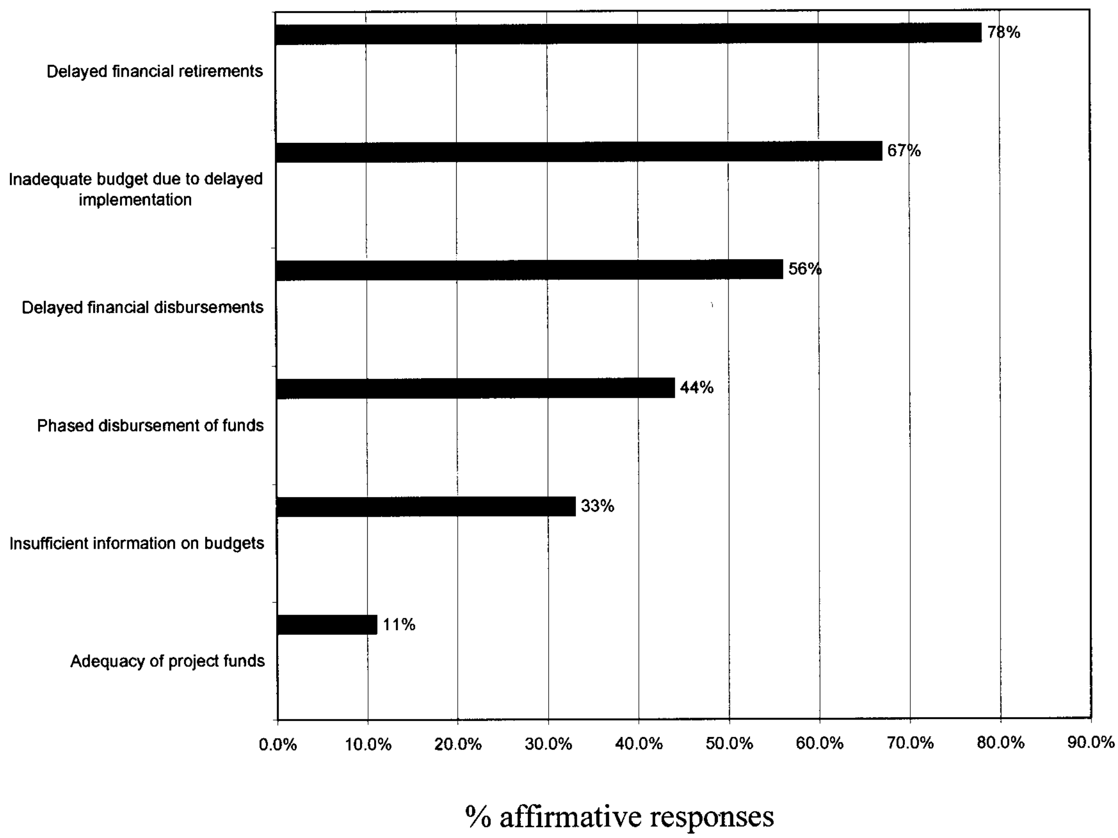

Figure 4.3: Identified budget and finance risks

From Figure 4.3 the major risks identified in the category of budget and finance were:

- delayed financial retirements;
- inadequate budget due to delayed implementation; and
- delayed financial disbursements.

The risks identified under the category of budget and finance are described in Table 4.3.

Table 4.3: Description of budget and finance risks

Item	Identified Risk	Description of Risk
1	Delayed financial retirements	The retirements for the funds done through the district education office were delayed. This led to delay in the release of more funds and consequent completion of the project;
2	Inadequate budget due to delayed implementation	Due to delayed implementation, the value of the budget was eroded and this led to a deficit and subsequent budget overrun.
3	Delayed financial disbursements	This led to delayed start-ups and phased purchases of materials and subsequent delayed implementation;
4	Phased disbursement of funds	Funds to the project were released in bits instead of lump sum due to poor estimations. This led to phased purchases of materials and subsequent delayed implementation;
5	Insufficient information on budgets	Community members did not participate in preparation of project budget;
6	Adequacy of project funds	Rehabilitation works not properly estimated. Budget figures arrived at through "guess work";

4.3.2.4 Skilled labour risks

As is the case in all construction projects, skilled labour plays a pivotal role in the implementation of community- based construction projects. It was therefore prudent that risks associated with this resource were identified during brain storming sessions.

Figure 4.4 shows a summary of the identified skilled labour risks after analysis. The respective percentage responses by the nine brain storming sessions are also shown.

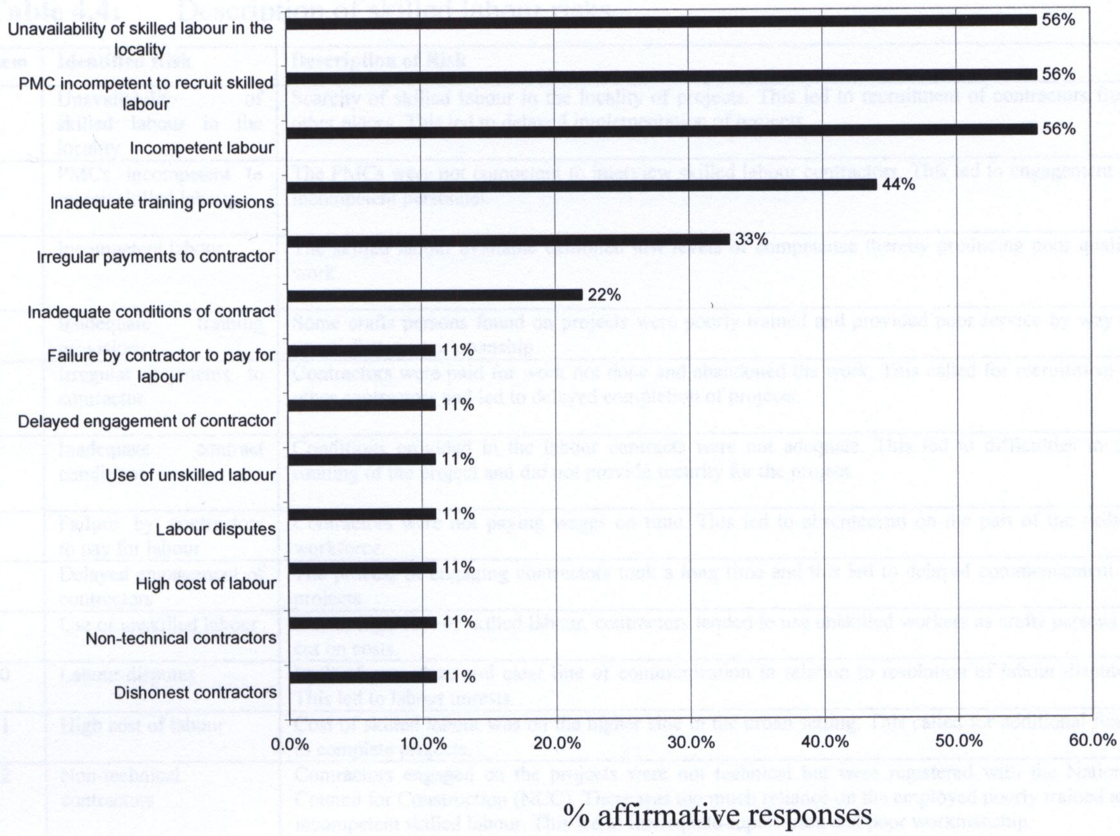

Figure 4.4: Identified skilled labour risks

From Figure 4.4 the risks of high significance under the category of skilled labour were:

- unavailability of skilled labour in the locality;
- PMCs incompetent to recruit skilled labour; and
- incompetent labour.

The risks identified under the category of skilled labour are described in Table 4.4.

Table 4.4: Description of skilled labour risks

Item	Identified Risk	Description of Risk
1	Unavailability of skilled labour in the locality	Scarcity of skilled labour in the locality of projects. This led to recruitment of contractors from other places. This led to delayed implementation of projects.
2	PMCs incompetent to recruit skilled labour	The PMCs were not competent to interview skilled labour contractors. This led to engagement of incompetent personnel.
3	Incompetent labour	The skilled labour available exhibited low levels of competence thereby producing poor quality work.
4	Inadequate training provisions	Some crafts persons found on projects were poorly trained and provided poor service by way of unsatisfactory workmanship.
5	Irregular payments to contractor	Contractors were paid for work not done and abandoned the work. This called for recruitment of other contractors and led to delayed completion of projects.
6	Inadequate contract conditions	Conditions provided in the labour contracts were not adequate. This led to difficulties in the running of the project and did not provide security for the project.
7	Failure by contractors to pay for labour	Contractors were not paying wages on time. This led to absenteeism on the part of the skilled workforce.
8	Delayed engagement of contractors	The process of engaging contractors took a long time and this led to delayed commencement of projects.
9	Use of unskilled labour	Due to high cost of skilled labour, contractors tended to use unskilled workers as crafts persons to cut on costs.
10	Labour disputes	Lack of procedure and clear line of communication in relation to resolution of labour disputes. This led to labour unrests.
11	High cost of labour	Cost of skilled labour was on the higher side in the urban setting. This called for additional funds to complete projects.
12	Non-technical contractors	Contractors engaged on the projects were not technical but were registered with the National Council for Construction (NCC). There was too much reliance on the employed poorly trained and incompetent skilled labour. This led to inadequate supervision and poor workmanship.
13	Dishonest contractors	Double dealing on the part of skilled labour contractors. Contractors had more than one job at any given time and failed to service them adequately. This led to delayed completion.

4.3.2.5 Materials procurement risks

Procurement of non-local materials (materials not available in locality of project) is an important aspect in the timely execution of construction projects. This was also true about community-based construction projects and it was therefore imperative that risks associated with this aspect of project implementation were identified. Figure 4.5 shows a summary of the identified material procurement risks after analysis. The respective percentage responses by the nine brain storming sessions are indicated.

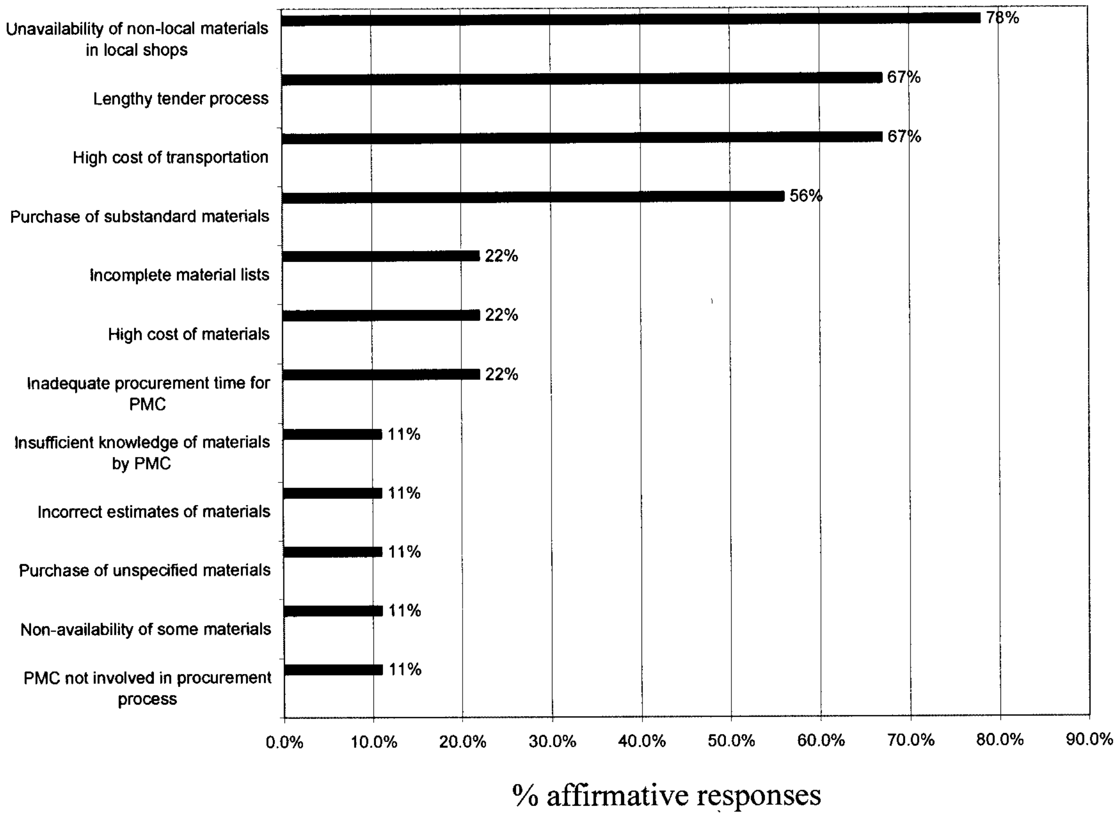

Figure 4.5: Identified materials procurement risks

From Figure 4.5, the major material procurement risks were:

- unavailability of non-local materials in local shops;
- lengthy tender processes;
- high transportation costs; and
- substandard materials purchased.

The risks identified during brainstorming sessions under the category of material procurement are described in Table 4.5.

Table 4.5: Description of materials procurement risks

Item no.	Identified Risk	Description of Risk
1	Unavailability of non-local materials in local shops	Non-local building materials were not available in the nearest local shops. This meant that materials could only be obtained in the provincial centers several kilometers away. This led to delayed implementation.
2	Lengthy tender process.	Materials were procured through a lengthy tender process by either the District Education Board Secretary (DEBS)' office or the Provincial Education Officer (PEO)'s office. This led to delayed implementation;
3	High cost of transportation	Materials were procured from hardware shops in the provincial center, several kilometers away. This led to high cost of transportation and subsequent cost overruns;
4	Purchase of substandard materials	Sub-standard materials such as doorframes and window frames were procured. In the absence of technical advice, the PMC purchased poor quality materials;
5	Incomplete materials list	Important materials missing from the procurement list. For example, materials for shuttering and making formwork were not included in the materials list. Given the long process of procurement, this led to delays in the project implementation.
6	High cost of materials	Due to the remoteness of the sources of building materials, the prices of most of them were on the higher side. This led to cost overruns;
7	Inadequate procurement time for PMCs	The PMC representatives were not given ample time to carry out the material procurement assignment. Only two nights of subsistence allowance were provided for;
8	Insufficient knowledge of materials by the PMC	PMC/Community did not have adequate knowledge of materials to be procured. This led to procurement of poor quality materials;
9	Incorrect estimates of materials	Poor material estimates led to either under procurement or over procurement of materials such as cement;
10	Purchase of unspecified materials	Some unspecified and sub-standard materials such as mortice locks were procured. This led to poor workmanship;
11	Non-availability of some materials	Materials quoted for by local suppliers were not available at the purchase stage. This meant delayed material delivery and subsequent delayed project completion;
12	PMCs not involved in procurement process	Materials were delivered to the site by the supplier without verification of the quality. This resulted in poor quality materials being used in the works;

4.3.2.6 Technical supervision and quality control risks

Quality is one of the three factors used to measure the success of any construction project including community-based ones. It was therefore important that risks that would impede the achievement of good quality work in community projects were identified. Figure 4.6 shows a summary of the identified technical supervision and quality control risks after analysis. The respective percentage responses by the nine brain storming sessions are indicated.

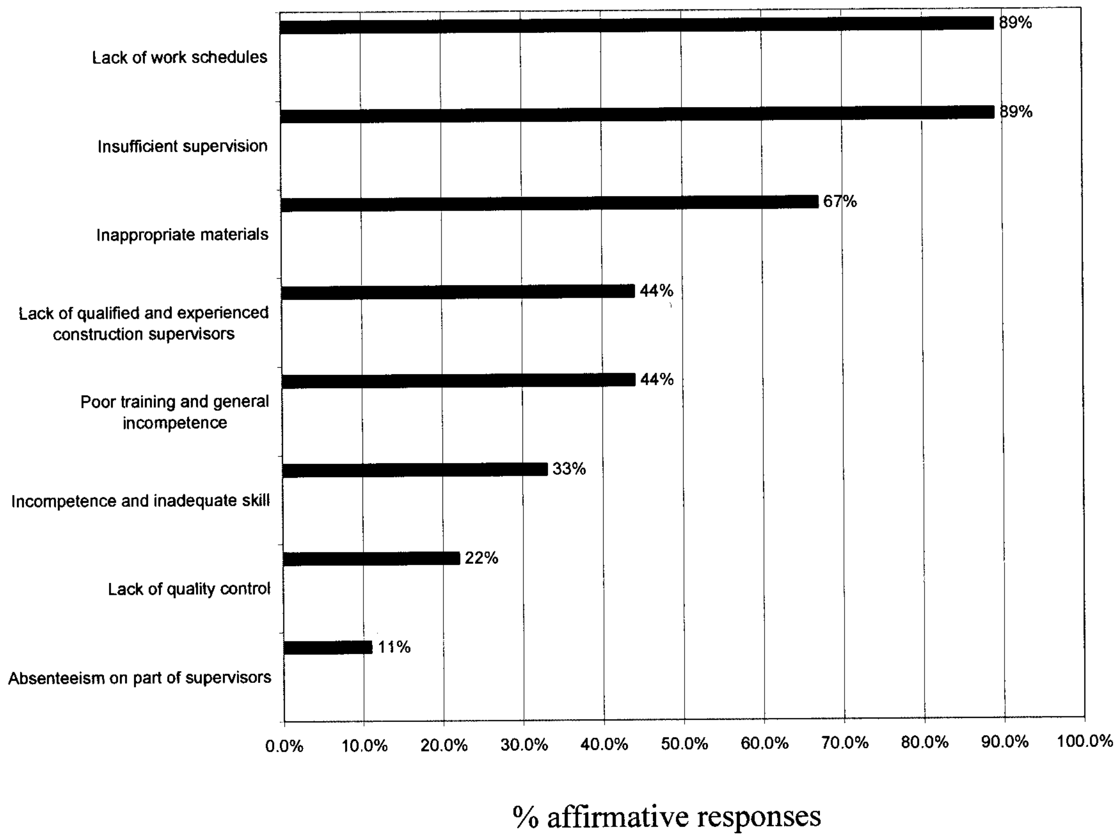

Figure 4.6: Identified technical supervision and quality control risks

From Figure 4.6, the major technical supervision and quality control risks were:

- lack of work schedules;
- insufficient supervision; and
- inappropriate materials.

The risks identified under the category of technical supervision and quality control are described in Table 4.6.

Table 4.6: Description of technical supervision and quality control risks

Item no.	Identified Risk	Description of Risk
1	Lack of work schedules	Absence of work schedule to assist in the planning and tracking of progress of implementation of the project. This caused delayed completion;
2	Insufficient supervision	Irregular supervision by technical officers led to poor work corrected late or not corrected at all;
3	Inappropriate materials.	The materials organized and arranged by the community were inappropriate for the work because they did not conform to standard engineering specifications;
4	Lack of qualified construction supervisors	This led to poor work done by the incompetent skilled labour who could not work without supervision.
5	Poor training and general incompetence	Due to poor training and lack of competence on the part of the crafts persons on the project, the resultant work was of poor quality;
6	Incompetence and inadequate skill	Lack of skill on the part of skilled labour led to their failure to interpret drawings resulting in poor work being done;
7	Lack of quality control	There were no quality control mechanisms employed with regard to mortar and concrete mixes;
8	Absenteeism on part of supervisors	Absenteeism on the part of site supervisors led to poor workmanship;

4.3.2.7 Summary of analysis of brainstorming session results

The analysis of data collected during the brainstorming sessions with project management committees (PMCs) was out lined in this section. The identified risks whose affirmative responses were more than 50% were considered to be moderate or high in terms of importance. Table 4.7 shows a summary of the identified risks, in order of severity.

Table 4.7: Summary of identified risks with more than 50% affirmative responses

Category	Identified risk
Project Initiation	• Unconfirmed sources of funds; • Lack of technical advice; and • Lack of consensus.
Community Contribution and Participation	• Adverse weather conditions; • Logistical problems; • Lack of cooperation; • Non-conformity to standard specification; and • Inadequate bricks.
Budget / Finances	• Delayed financial retirements; • Inadequate budget due to delayed implementation; and • Delayed financial disbursements.
Skilled Labour	• PMC incompetent to recruit skilled labour; • Unavailability of skilled labour in the locality; and • Incompetent labour.
Material Procurement	• Unavailability of non-local materials in local shops; • Lengthy tender process; • High transportation costs; and • Substandard materials purchased.
Technical Supervision and Quality Control	• Lack of work schedules; • Insufficient supervision; and • Inappropriate materials.

In the next section results from the analysis of the data collected from questionnaire surveys was outlined.

4.3.3 Analysis of data collected from Questionnaire Surveys

The second phase of the data collection involved a questionnaire survey. It has been stated in Chapter 3 of this report that the overriding advantage of this method is that broader generalisations can be made from data collected from a relatively small representative sample. The other advantage is that the method is less expensive. The overriding advantage of this method is that broader generalisations can be made from data collected from a representative sample. The other advantage is that the method is less expensive. The disadvantages of this method include the fact that questionnaires may not be responded to conclusively and provision of set responses may also limit gathering of additional information.

A questionnaire was developed using the feedback from the first phase of the research and the reviewed literature. The questionnaire was formatted in four sections. Section one dealt with general information, section two with risk identification, section three with risk probability assessment and section four with risk impact assessment. Apart from the questions in the first section, the questions in the last three sections were categorized according to possible sources of risk. The suggested responses were coded using the likert scale from 1 to 6 for ease of analysis. A copy of the survey questionnaire is in Appendix D.

The purpose of the questionnaire survey was twofold, firstly to validate the results obtained during the brainstorming sessions relating to risk identification and secondly to determine the probability and impact of the identified risks on project objectives.

A total of 36 questionnaires were distributed to various interest groups and individual stakeholders who were involved in community-based construction projects. Out of the number distributed, 22 were responded to and received back. This represented a response rate of 61%. Considering the difficulty experienced in getting back completed questionnaires, a response rate of more than 50 percent is acceptable to many researchers.

4.3.3.1 Profiles of respondents and general information

The respondents to the questionnaire survey included architects, civil engineers, quantity surveyors, technical officers and building officers. Their experience in the construction industry ranged from nine to thirty-one years. The respondents represented all the nine provinces of the country. One respondent each was from Eastern, Central, North-Western, Northern and Southern Provinces. Three respondents each were from Luapula and Western Provinces. Four respondents were from Copperbelt Province; and six respondents were from Lusaka Province.

The respondents were drawn from various organizations that were involved in community-based projects at one time or another. The organizations included Buildings

Department of the Ministry of Works and Supply, Micro-Projects Unit (MPU) and Ministry of Education (MOE). Others were Raptu Construction Consultants Ltd, Studio Architecture and Zambia Social Investments Fund (ZAMSIF).

4.3.3.2 General Information

Section one of the questionnaire elicited information relating to the type of community project, the funding agency and the initiator of the project. It was important to know the type of project because communities approach projects differently depending on the perceived benefits. It was also important to know the funding agency because the flow of funds to the project by and large depends on particular financial guidelines issued by the donor and these could have a bearing on the implementation of the project. It was also important to know the initiator of the project as communities tend to shun or contribute little to projects initiated by the government or any other interest group but themselves.

All respondents, representing 100 percent indicated that they were involved in school projects only. This could be so because a substantial amount of donor funds were channeled to the education sector.

It was found that sixty-three (63) percent of the respondents stated that projects were funded by Zambia Social Investment Fund (ZAMSIF). It is worth mentioning here that the ZAMSIF programmes came to an end in December 2006. Twenty-two (22) percent indicated that projects were funded by the Ministry of Education (MOE) and five (5) percent each for Micro-Projects Unit (MPU), FINNIDA and other sources. Figure 4.7 below shows percent share of funding for community projects by organization.

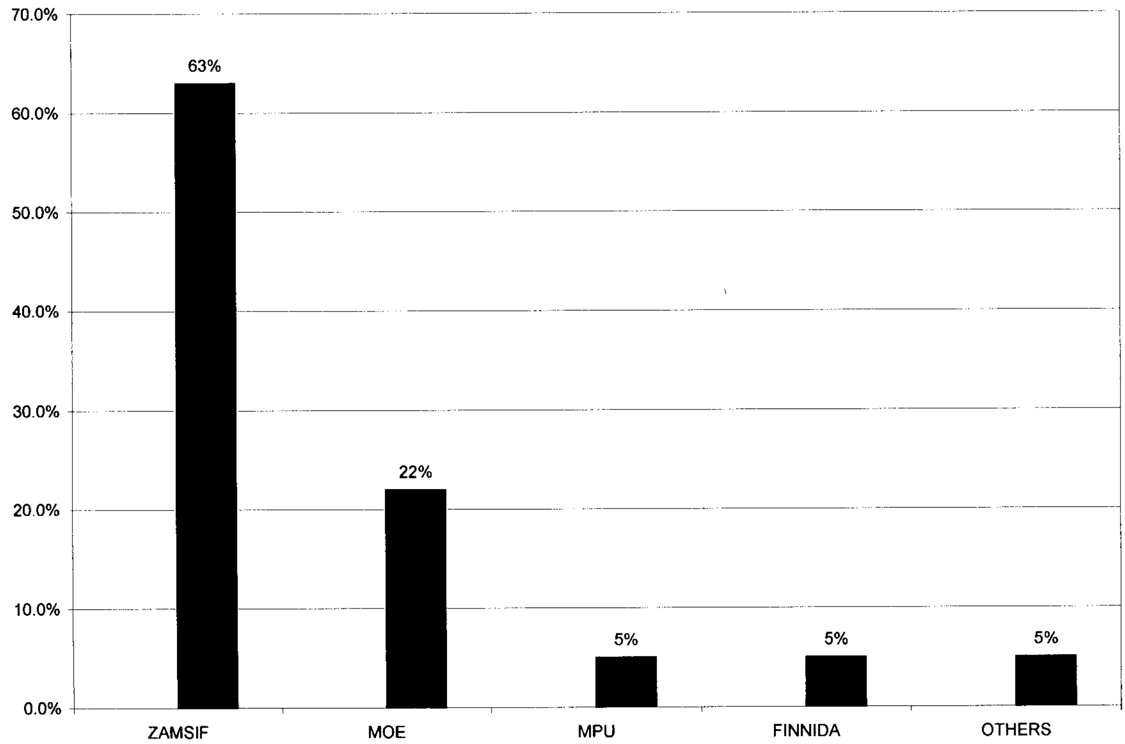

Figure 4.7 Community perception of funding agencies for projects

It was also established that eighty-two percent of the respondents stated that projects were initiated by the beneficiary community. Nine percent stated that projects were initiated by government. Five percent indicated that the projects were initiated by the school proprietor and four percent of the respondents could not remember who initiated the projects.

4.3.3.3 Risk Identification

Section two of the questionnaire sought to identify risks according to six categories as set out under the brainstorming sessions. Under each category possible problems were listed and respondents were asked whether they considered them as potential risks that could hinder implementation of projects.

During the analysis, the number of respondents that "agreed" or "strongly agreed" to the identified risks were considered to determine the significance of the risks. If the number exceeded 50 percent or more then the risk was considered significant and proceeded to the next stage of the analysis, which was risk probability assessment. The cut off percentage of fifty was good enough, considering that the other half was shared amongst the remaining four responses on the questionnaire. If the number was less than 50 percent, the risk was considered insignificant and would not proceed to the next stage of analysis.

a. Project Initiation risks

In order to obtain an insight of the type of risks that were associated with the initiation of projects, respondents were requested to state whether the following were sources of problems that impeded progress:

- organisational issues;
- scope definition;
- technical skills; and
- financial matters.

The results of the analysis are illustrated in Figure 4.8.

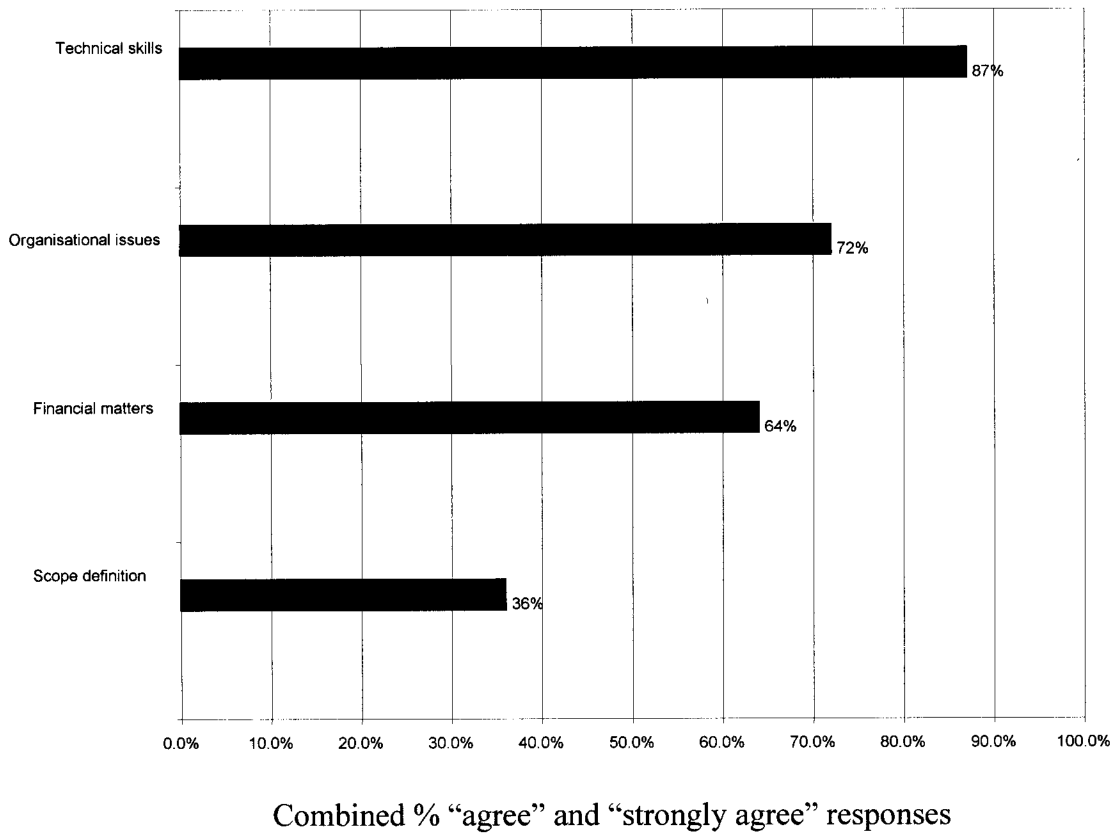

Figure 4.8: Identified project initiation risks

As shown in Figure 4.8, all the risks in question recorded responses of more than 50 percent except *scope definition* that scored 36 percent.

i. Identified project initiation risks

Following the above analysis, project initiation risks that were taken to the next stage of analysis included:

- technical skills;
- organisational issues; and
- financial matters.

b. Community Contribution and Participation risks

Contribution of upfront materials and voluntary participation of the community is an important aspect in the implementation of community-based construction projects. To identify risks in the category of community contribution and participation, respondents were requested to indicate whether the following formed part of the possible risks:

- lack of cooperation;
- lack of understanding of the concept of community participation;
- lack of understanding of the role of the implementing agency;
- stake holder conflicts;
- logistical problems;
- weather and environmental conditions;
- lack of appropriate materials;
- non-conformity to specifications;
- lack of technical skills; and
- inadequate supervision.

The results of the analysis are illustrated in Figure 4.9.

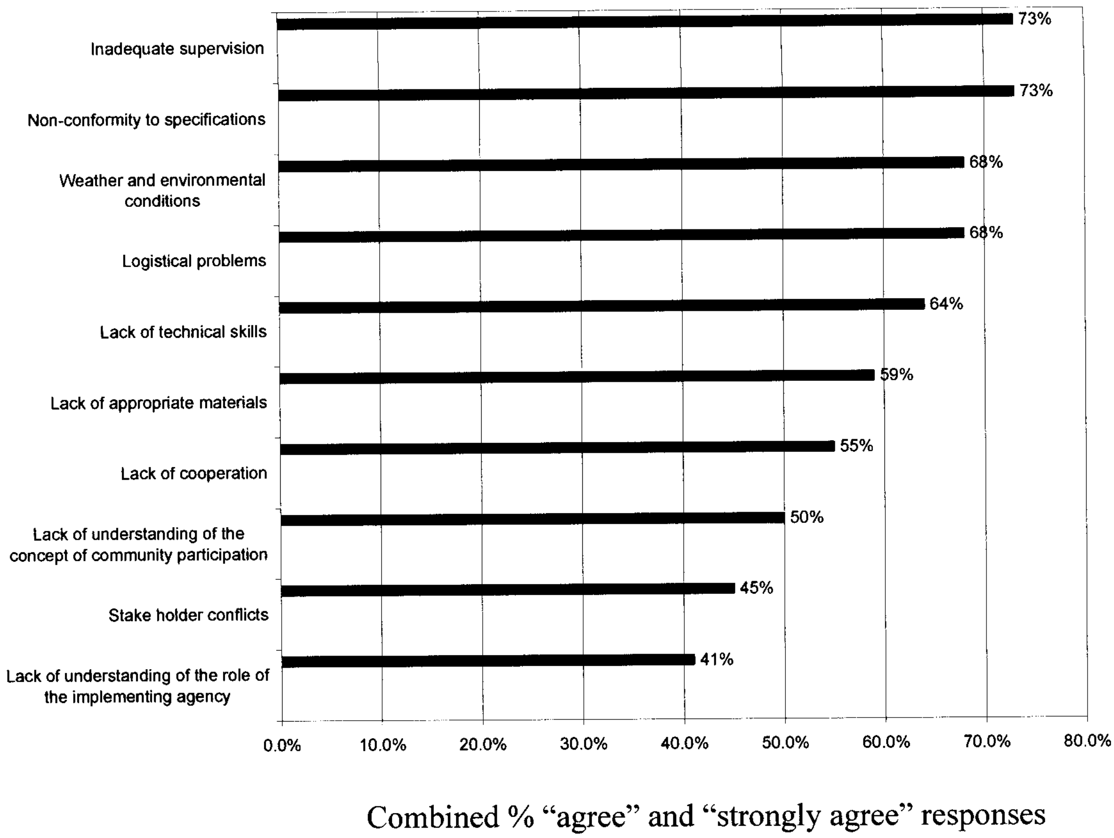

Figure 4.9: Identified community contribution and participation risks

As shown in Figure 4.9, all the risks in question recorded responses of 50 percent or more except *stake holder conflicts* and *lack of understanding of the role of the implementing agency* that scored 45 and 41 percent respectively.

i. Identified community contribution and participation risks

Following the above analysis, community contribution and participation risks that were taken to the next stage of analysis in priority order were:

- inadequate supervision;
- non-conformity to specifications;
- weather and environmental conditions;
- logistical problems;
- lack of technical skills;

- lack of appropriate materials;
- lack of cooperation; and
- lack of understanding of the concept of community participation.

c. **Budget and finance risks**

Budgeting and financing of projects, be they contractor-based or community-based, can be a source of risk during implementation. In this regard, risks associated with this aspect of project implementation should be identified. To this effect, respondents were requested to identify risks in this category and were asked to state whether the following were part of the possible risks:

- inadequate budgetary allocation;
- inadequate financial disbursements;
- delayed financial retirements;
- delayed and irregular disbursements; and
- financial mismanagement.

The results of the analysis are illustrated in Figure 4.10.

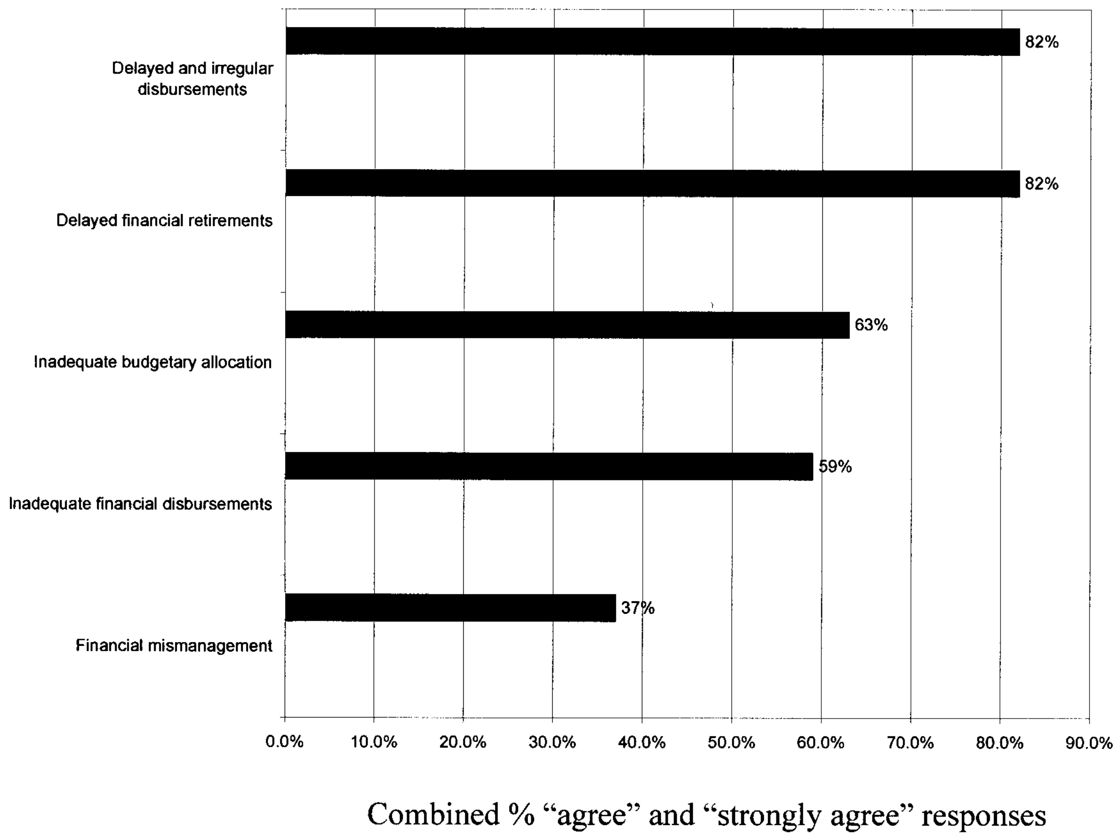

Figure 4.10: Identified budget and finance risks

As shown in figure 4.10, the risks in question recorded responses of more than 50 percent except *financial mismanagement* that scored 37 percent.

i. Identified budget and finance risks

Following the above analysis, budget and finance risks that were taken to the next stage of analysis were:

- delayed and irregular disbursements;
- delayed financial retirements;
- inadequate budgetary allocation; and
- inadequate financial disbursements.

d. Skilled labour risks

To have further insight on the risks pertaining to skilled labour, respondents were requested to state whether the following formed part of the potential risks under this category:

- lack of skilled labour;
- low levels of competence;
- inadequate contract conditions; and
- poorly trained crafts persons.

The results of the analysis are illustrated in Figure 4.11.

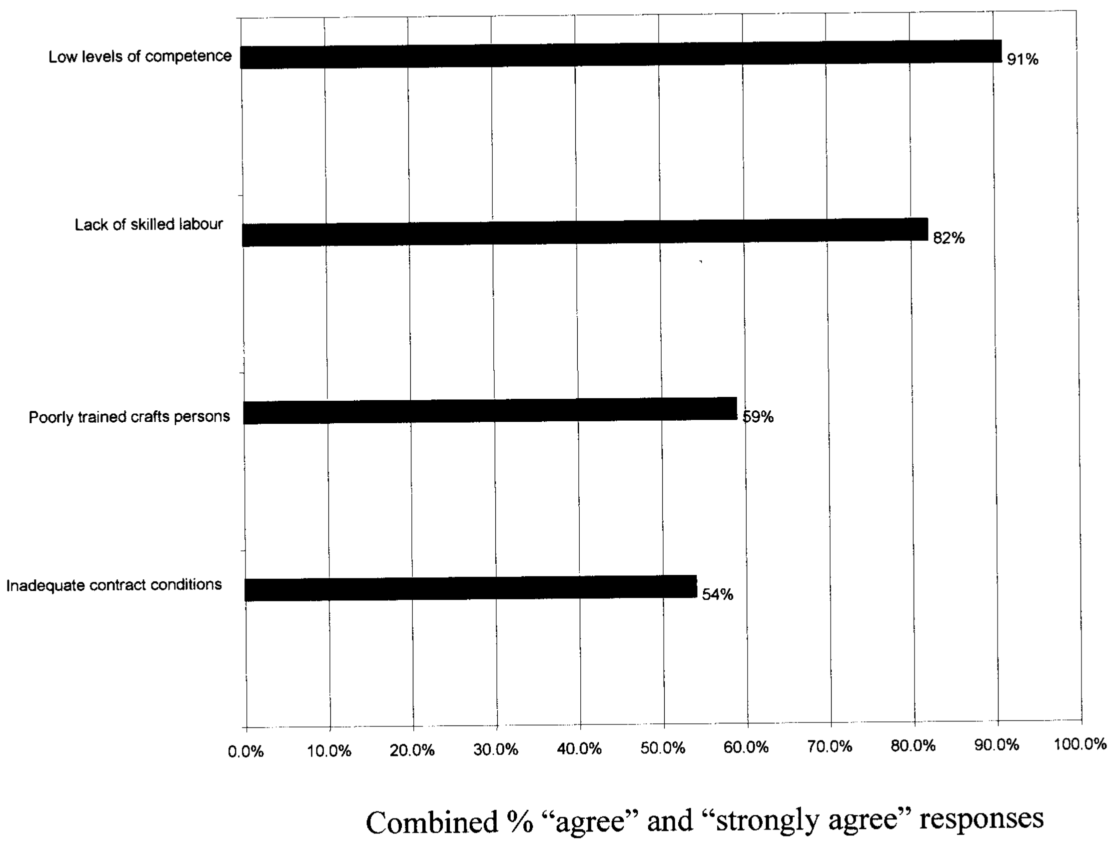

Figure 4.11: Identified skilled labour risks

As shown in Figure 4.11, all the risks in question recorded responses of more than 50 percent.

i. **Identified skilled labour risks**

From the above analysis, all the identified skilled labour risks were taken to the next stage of analysis and these were:

- low levels of competence;
- lack of skilled labour;
- poorly trained crafts persons; and
- inadequate contract conditions.

e. **Material procurement risks**

As already stated elsewhere in this report, material procurement and supply is an important aspect in the implementation of projects. It was therefore necessary to identify the risks pertaining to materials procurement. Respondents were, in this regard, requested to indicate whether the following would form part of potential risks under this category:

- availability of materials;
- poor quality of materials;
- high cost of materials;
- high transportation costs; and
- non-conformity to specifications.

The results of the analysis are illustrated in Figure 4.12.

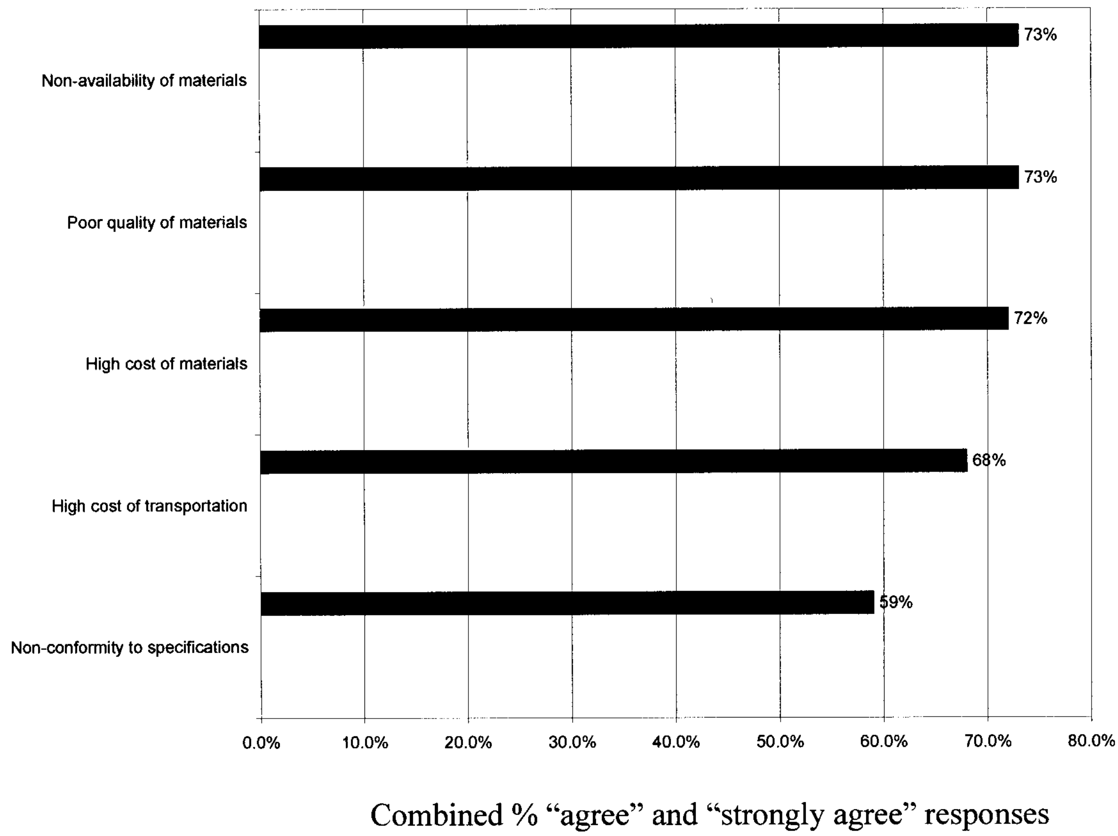

Figure 4.12: Identified material procurement risks

As shown in figure 4.12, all the risks in question recorded responses of more than 50 percent.

i. Identified material procurement risks

From the above analysis, all the identified material procurement risks were taken to the next stage of analysis and these were:

- non-availability of materials;
- poor quality of materials;
- high cost of materials;
- high transportation costs; and
- non-conformity to specifications.

f. Technical supervision and quality control risks

Supervision and quality control are cardinal aspects in project implementation. It was for this reason that respondents were asked to indicate whether the following could be part of risks obtaining under this category:

- generalisation of designs and lack of geo-technical considerations;
- incomplete designs;
- insufficient working details;
- failure to interpret designs;
- lack of work schedules;
- technical incompetence;
- lack of appropriate skills;
- inappropriate building materials; and
- insufficient supervision.

The results of the analysis are illustrated in Figure 4.13.

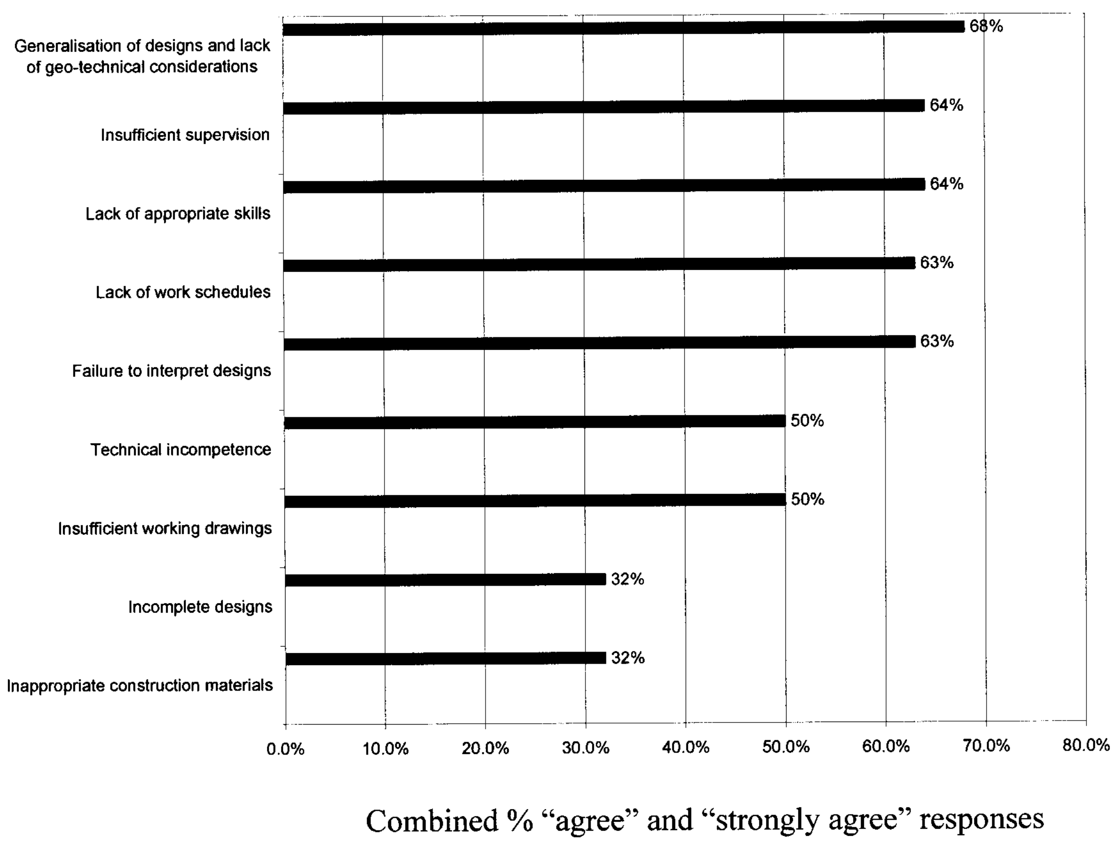

Figure 4.13: Identified technical supervision and quality control risks

As shown in Figure 4.13, all the risks in question recorded responses of 50 percent or more except *incomplete designs* and *inappropriate construction materials* that scored 32 percent between them.

i. **Identified technical supervision and quality control risks**

From the above analysis, technical supervision and quality control risks that were taken to the next stage of analysis were:

- generalisation of designs and lack of geo-technical considerations;
- insufficient supervision;
- lack of appropriate skills;
- lack of work schedules;
- failure to interpret designs;
- technical incompetence.
- insufficient working details; and

g. **Summary of identified risks from questionnaire survey by category**

All the identified risks that scored 50% or more in the questionnaire survey analysis were considered to be important and were taken to probability assessment. Below are the summaries of the risks category wise.

i. **Project initiation risks**

- lack of technical skills;
- organisational problems; and
- financial problems.

ii. **Community contribution and participation risks**

- inadequate supervision;
- non-conformity to specifications;
- weather and environmental conditions;
- logistical problems;
- lack of technical skills;

- lack of appropriate materials;
- lack of cooperation; and
- lack of understanding of the concept of community participation.

iii. **Budget/finance risks**

- delayed and irregular disbursements;
- delayed financial retirements;
- inadequate budgetary allocation; and
- inadequate financial disbursements.

iv. **Skilled labour risks**

- low levels of competence;
- lack of skilled labour;
- poorly trained crafts persons; and
- inadequate contract conditions.

v. **Material procurement risks**

- availability of materials;
- poor quality of materials;
- high cost of materials;
- high transportation costs; and
- non-conformity to specifications.

vi. **Technical supervision and quality control risks**

- generalisation of designs and lack of geo-technical considerations;
- insufficient supervision;
- lack of appropriate skills;
- lack of work schedules;
- failure to interpret designs;
- technical incompetence; and

- insufficient working details.

Table 4.8: Comparison of risks identified from brainstorming sessions and questionnaire surveys.

Category	**Risks identified from brainstorming sessions**	**Risks identified from questionnaire surveys**
Project Initiation	• Unconfirmed sources of funds; • Lack of technical advice; and • Lack of consensus.	• Lack of technical skills; • Organisational problems; and • Financial problems.
Community Contribution and Participation	• Adverse weather conditions; • Logistical problems; • Lack of cooperation; • Non-conformity to standard specification; and • Inadequate bricks.	• Inadequate supervision; • Non-conformity to specifications; • Poor weather and environmental conditions; • Logistical problems; • Lack of technical skills; • Lack of appropriate materials; • Lack of cooperation; and • Lack of understanding of the concept of community participation.
Budget / Finances	• Delayed financial retirements; • Inadequate budget due to delayed implementation; and • Delayed financial disbursements.	• Delayed and irregular disbursements; • Delayed financial retirements; • Inadequate budgetary allocation; and • Inadequate financial disbursements.
Skilled Labour	• Unavailability of skilled labour in the locality; • PMC incompetent to recruit skilled labour; and • Incompetent labour.	• Low levels of competence; • Lack of skilled labour; • Poorly trained crafts persons; and • Inadequate contract conditions.
Materials Procurement	• Unavailability of non-local materials in local shops; • Lengthy tender process; • High transportation costs; and • Substandard materials purchased.	• Unavailability of materials; • Poor quality of materials; • High cost of materials; • High transportation costs; and • Non-conformity to specifications.
Technical Supervision and Quality Control	• Lack of work schedules; • Insufficient supervision; and • Inappropriate materials.	• Generalisation of designs and lack of geo-technical considerations; • Insufficient supervision; • Lack of appropriate skills; • Lack of work schedules; • Failure to interpret designs; • Technical incompetence; and • Insufficient working details.

It can be seen from the above table that most of the risks identified in the brainstorming sessions were also identified by the questionnaire surveys. As stated earlier, the brainstorming sessions only identified risks whereas the questionnaire surveys went further to assess the probability and the impact of the risks. In the following sections of the report, probability and impact assessments were outlined.

4.3.3.4 Risk probability assessment

From the literature, it is important to determine the likelihood and impact of risk events on the project so as to devise effective and less costly responses for managing them. There are two methods used in the assessment of risks to determine their probability and impact on the project, qualitative risk analysis and quantitative risk analysis (Miller and Rubin 1979). Section three and four of the questionnaire sought to assess the probability and impact of the identified risks according to categories. The Statistical Package for Social Sciences (SPSS) was used in the analysis. The results of the risk probability assessment are outlined in this segment of the report, whilst the risk impact assessment results are shown in the next segment.

Risks that scored fifty (50) percent and more during risk identification were subjected to probability assessment through qualitative analysis by questionnaire survey. The respondents were requested to state the probability of each of the identified risks from five possible responses, namely low, medium, high, very high and extremely high. For all intents and purposes, risks that were found to have combined responses of "high", "very high" and "extremely high" probability exceeding fifty (50) percent were considered to be important and proceeded to impact assessment. The results from the analysis of the questionnaire responses category wise were as follows.

a. Probability of project initiation risks

The potential project initiation risks that scored 50 percent or more at identification stage were taken to the next level of analysis and these were:

- Organisational issues risk;
- Technical skills risk; and
- Financial matters risk.

The results of the analysis are illustrated in figure 4.14.

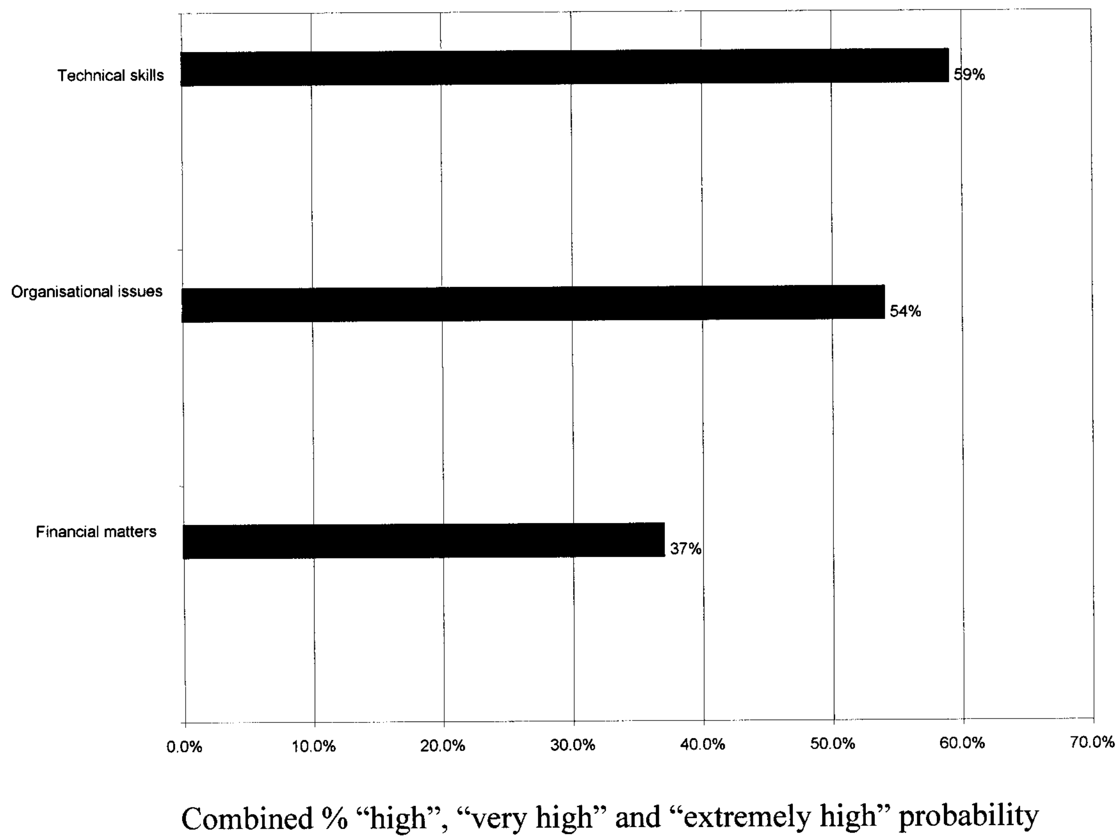

Figure 4.14: Probability of project initiation risks

The risks in question recorded probability of more than 50 percent except *financial matters* that scored 37 percent. Therefore, the risks were considered of high probability and taken to the next stage of analysis, which was impact assessment.

i. Project initiation risks with high probability

The project initiation risks with high probability of occurrence were:

- Lack of technical skills; and
- organisational problems.

b. Probability of community contribution and participation risks

The potential community contribution and participation risks that scored 50 percent or more at identification stage were taken to the next level of analysis and these were:

- lack of cooperation risk;
- lack of understanding of community participation concept risk;
- logistical problems risk;
- weather and environmental conditions risk;
- lack of appropriate materials risk;
- non-conformity to specifications risk;
- lack of technical skill risk; and
- inadequate supervision risk.

The results of the analysis are illustrated in figure 4.15.

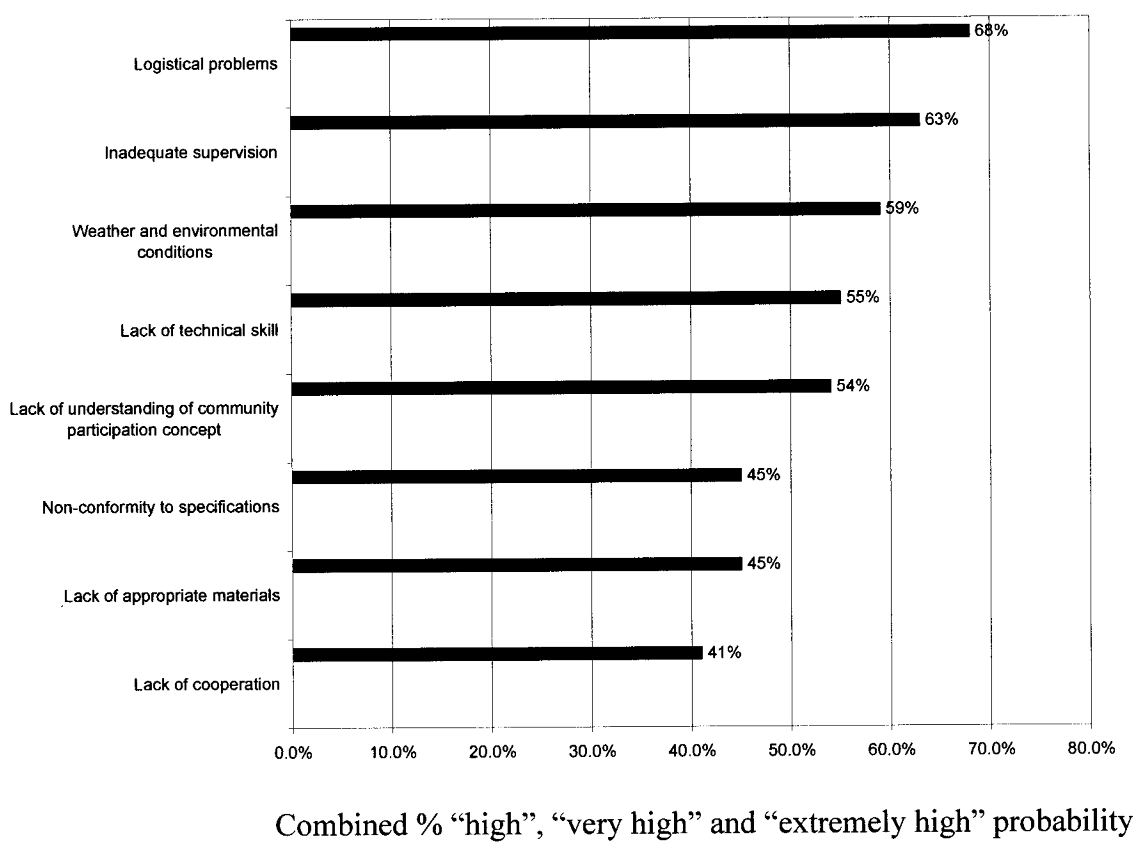

Figure 4.15: Probability of community contribution and participation risks

As illustrated in figure 4.15 above, the risks in question recorded probability of more than 50 percent apart from *lack of cooperation, lack of appropriate materials and non-conformity to specifications* that scored less than 50 percent.

i. **Community contribution and participation risks with high probability**

The community contribution and participation risks with high probability of occurrence and taken to the next stage of analysis were:

- logistical problems;
- inadequate supervision;
- weather and environmental conditions;
- lack of technical skill; and
- lack of understanding of community participation concept.

c. **Probability of budget/finance risks**

The potential budget/finance risks that scored 50 percent or more at identification stage were taken to the next level of analysis and these were:

- inadequate budgetary allocation risk;
- inadequate financial disbursements risk;
- delayed financial retirements risk; and
- delayed and irregular disbursements risk.

The results of the analysis are illustrated in figure 4.16.

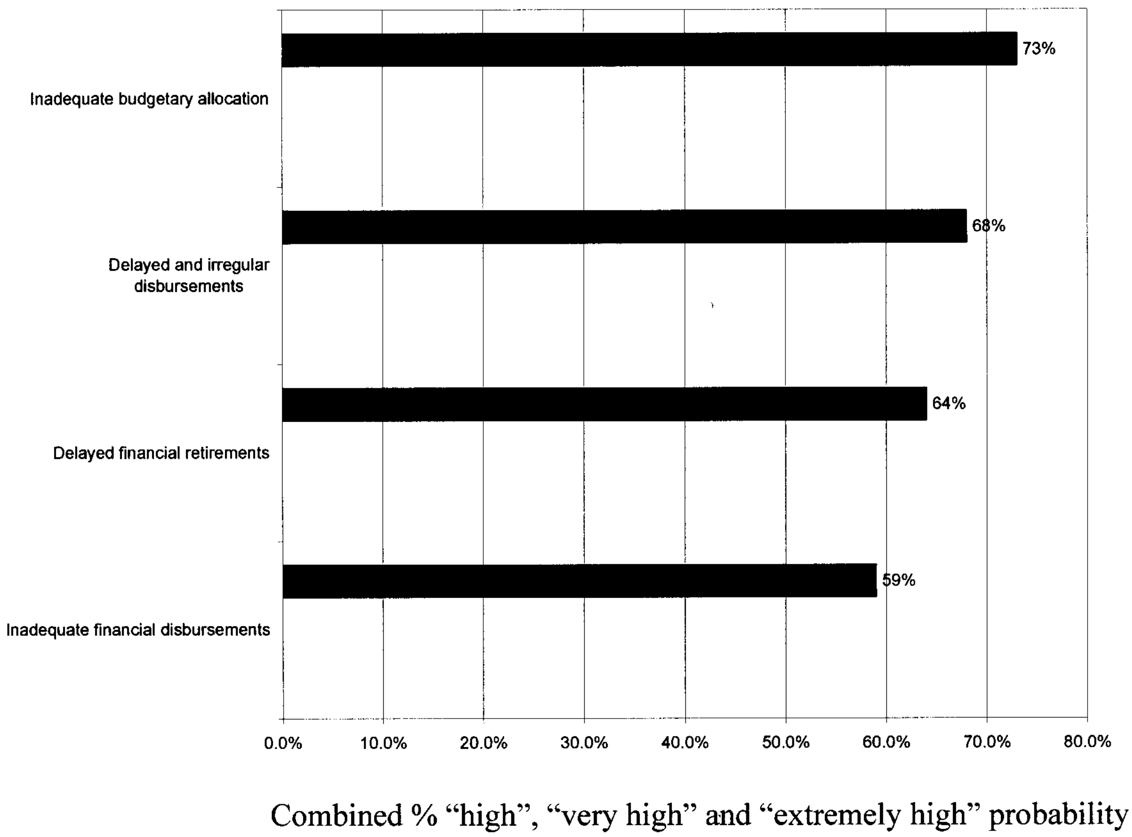

Figure 4.16: Probability of budget/finance risks

As shown in figure 4.16, all the risks in question recorded probability of more than 50 percent and were considered of high probability and taken to the next stage of analysis, which was impact assessment.

i. Budget/finance risks with high probability

The budget/finance risks with high probability of occurrence were:

- inadequate budgetary allocation;
- delayed and irregular disbursements;
- delayed financial retirements; and
- inadequate financial disbursements.

d. **Probability of skilled labour risks**

The potential skilled labour risks that scored 50 percent or more at identification stage were taken to the next level of analysis and these were:

- lack of skilled labour risk;
- low levels of competence risk;
- inadequate contract conditions risk; and
- poorly trained crafts persons risk.

The results of the analysis are illustrated in figure 4.17.

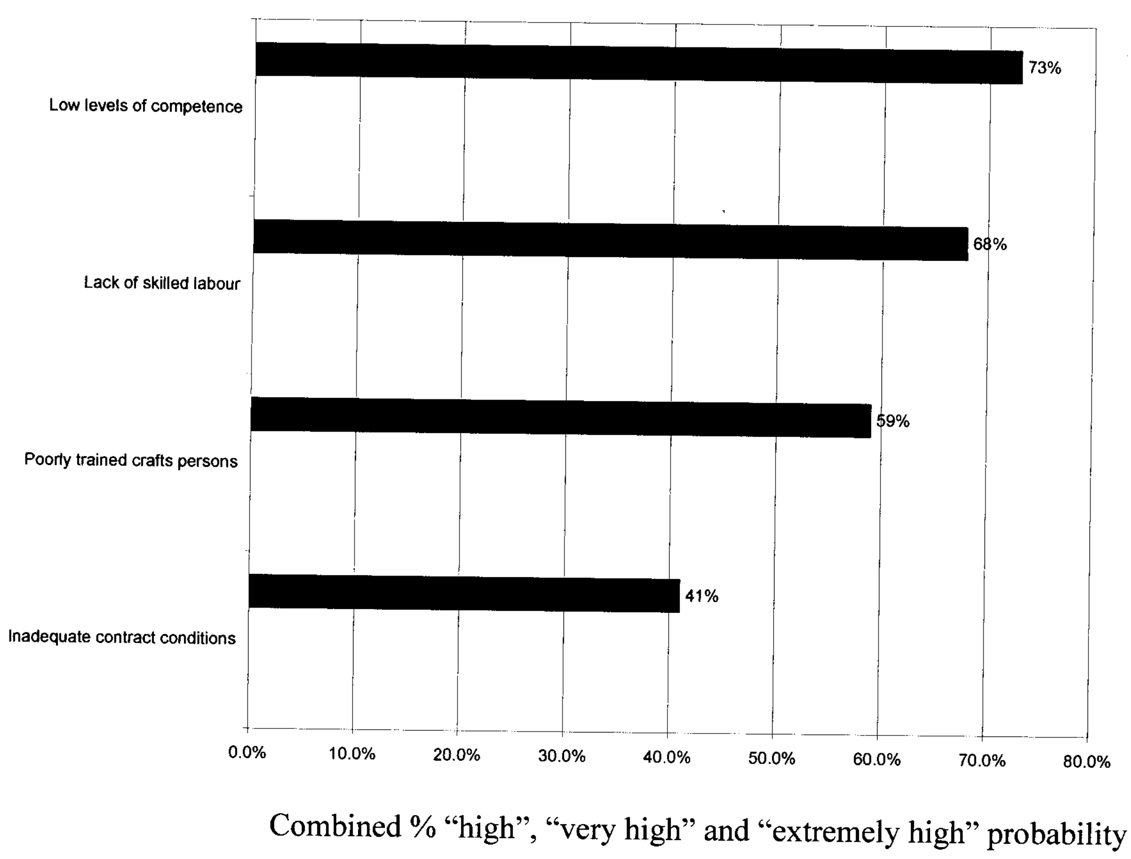

Figure 4.17: Probability of skilled labour risks

All the skilled labour risks in question recorded probability of more than 50 percent apart from those relating to *inadequate conditions of contract* that scored 41 percent.

i. Skilled labour risks with high probability

The skilled labour risks with high probability of occurrence were:

- low levels of competence;
- lack of skilled labour; and
- poorly trained crafts persons.

e. Probability of materials procurement risks

The potential materials procurement risks that scored 50 percent or more at identification stage were taken to the next level of analysis and these were:

- unavailability of materials risk;
- poor quality of materials risk;
- high cost of materials risk;
- high cost of transportation risk; and
- non-conformity to specifications risk.

The results of the analysis are illustrated in figure 4.18.

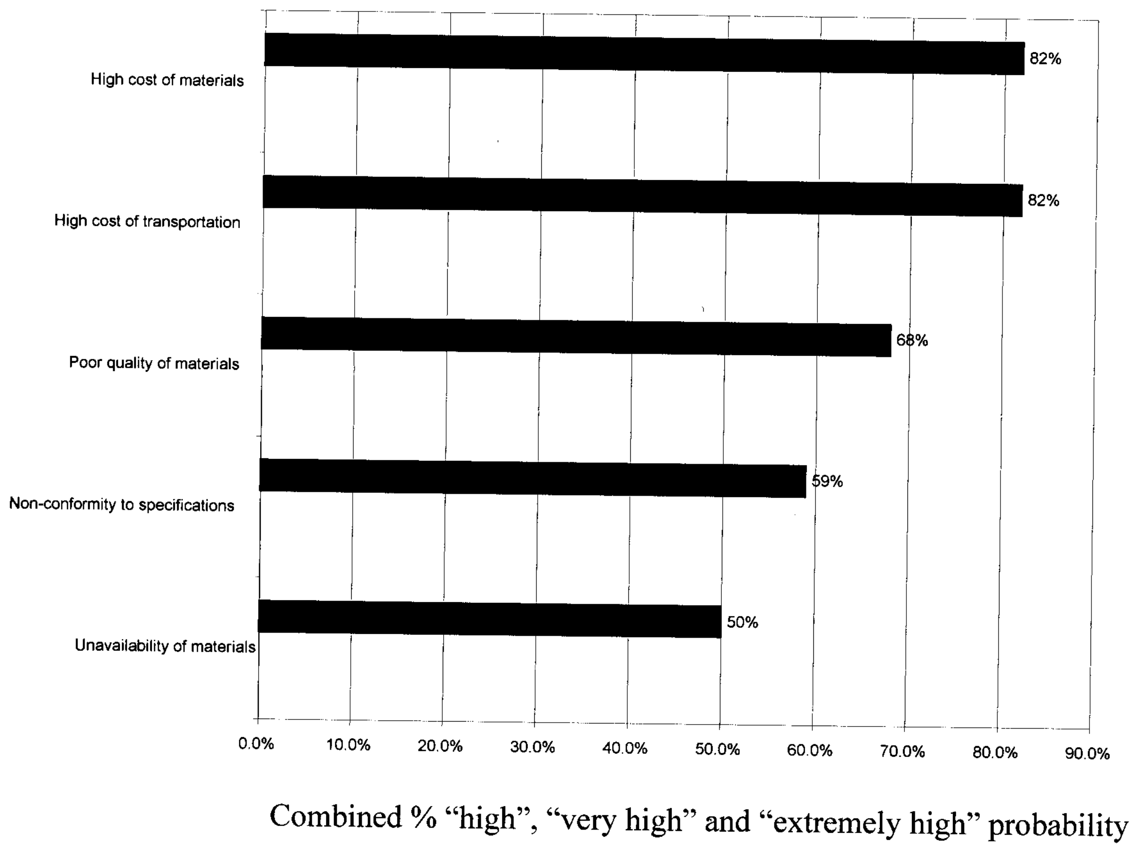

Figure 4.18: Probability of material procurement risks

As shown in figure 4.18, all the risks in question recorded probability of 50 percent or more and were considered of high probability and taken to the next stage of analysis, which was impact assessment.

i. Material procurement risks with high probability

The material procurement risks with high probability of occurrence were:

- high cost of materials;
- high cost of transportation;
- poor quality of materials;
- non-conformity to specifications; and
- unavailability of materials.

f. **Probability of technical supervision and quality control risks**

The potential technical supervision and quality control risks that scored 50 percent or more at identification stage were taken to the next level of analysis and these were:

- generalisation of designs and lack of geo-technical considerations risk;
- insufficient working details risk;
- failure to interpret designs risk;
- lack of work schedules risk;
- technical incompetence risk;
- lack of appropriate skills risk; and
- insufficient supervision risk.

The results of the analysis are illustrated in figure 4.19.

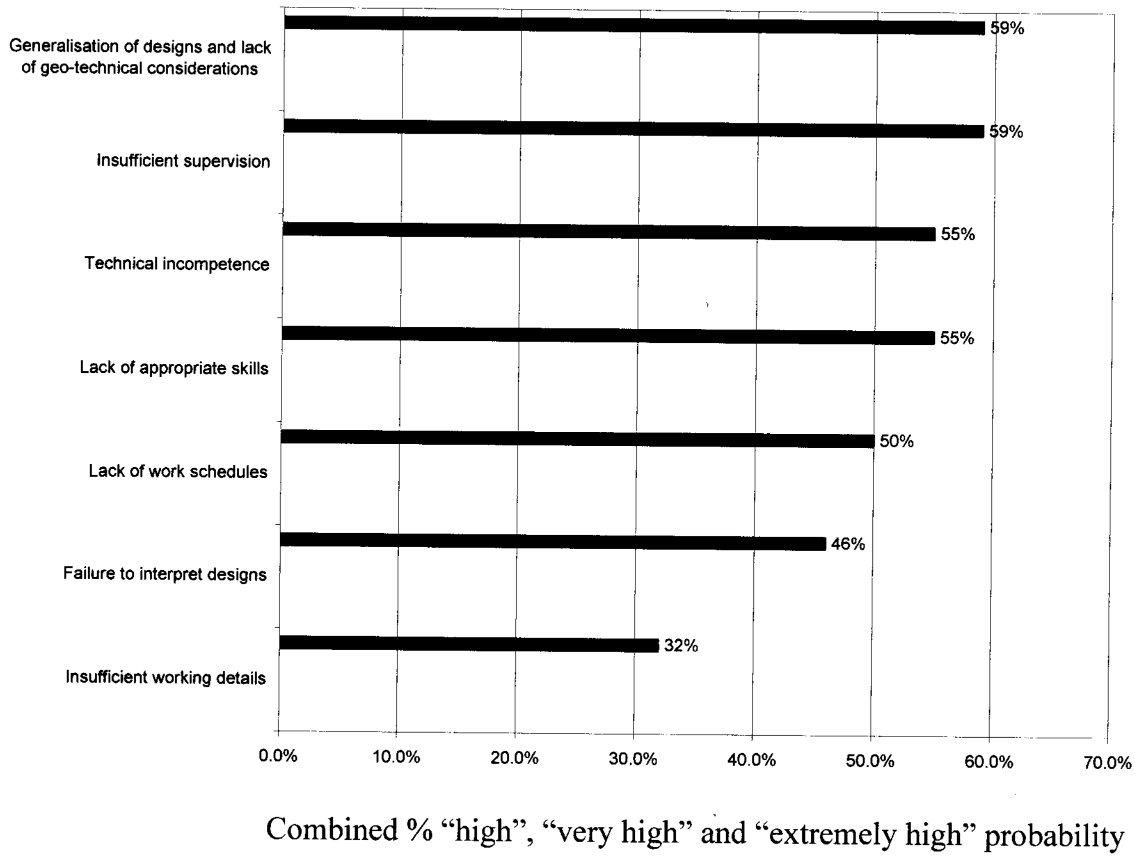

Figure 4.19: Probability of technical supervision and quality control risks

As shown in figure 4.19, all the risks in question recorded probability of more than 50 percent apart from those relating to *failure to interpret designs* and *insufficient working details* that scored less than 50 percent.

i. Technical supervision and quality control risks with high probability

The technical supervision and quality control risks with high probability of occurrence were:

- generalisation of designs and lack of geo-technical considerations;
- insufficient supervision;
- technical incompetence;
- lack of appropriate skills; and
- lack of work schedules.

g. **Summary of risks with high probability by category**

The risks that scored 50 percent or more in the probability assessment were considered to be important and were taken to risk impact assessment. Below are the summaries of the risks with at least high probability category wise.

i. **Project initiation risks**

- technical skills; and
- organisational issues.

ii. **Community contribution and participation risks**

- logistical problems;
- inadequate supervision;
- weather and environmental conditions;
- lack of technical skill; and
- lack of understanding of community participation concept.

iii. **Budget/finance risks with high probability**

- inadequate budgetary allocation;
- delayed and irregular disbursements;
- delayed financial retirements; and
- inadequate financial disbursements.

iv. **Skilled labour risks with high probability**

- low levels of competence;
- lack of skilled labour; and
- poorly trained crafts persons.

v. **Material procurement risks with high probability**

- high cost of materials;
- high cost of transportation;

- poor quality of materials;
- non-conformity to specifications; and
- availability of materials.

vi. Technical supervision and quality control risks with high probability

- generalisation of designs and lack of geo-technical considerations;
- insufficient supervision;
- technical incompetence;
- lack of appropriate skills; and
- lack of work schedules.

4.3.3.5 Risk Impact Assessment

The likelihood of occurrence of the identified risks was outlined in the Section 4.3.3.4 of this report. As stated in Chapter 2, not every risk will jeopardize a project but rather one that will have a high probability of occurrence and high impact on the objectives. Project managers must know how to discern the magnitude of a risk, develop potential responses to enhance and take advantage of opportunities and to mitigate the threats (del Caño and de la Cruz 2002). It is therefore imperative that the impact of the risks that were found to be of high probability of occurrence was assessed. In Section 4 of the questionnaire, respondents were requested to indicate the impact of each of the identified risks from five possible responses, namely low, medium, high, very high and extremely high. As already stated only risks that recorded probability of 50 percent and more were considered for impact assessment.

a. Impact assessment for project initiation risks

The potential project initiation risks that scored 50 percent or more at probability assessment stage and proceeded to impact assessment stage were:

- technical skills; and
- organisational issues.

The results of the analysis are illustrated in figure 4.20.

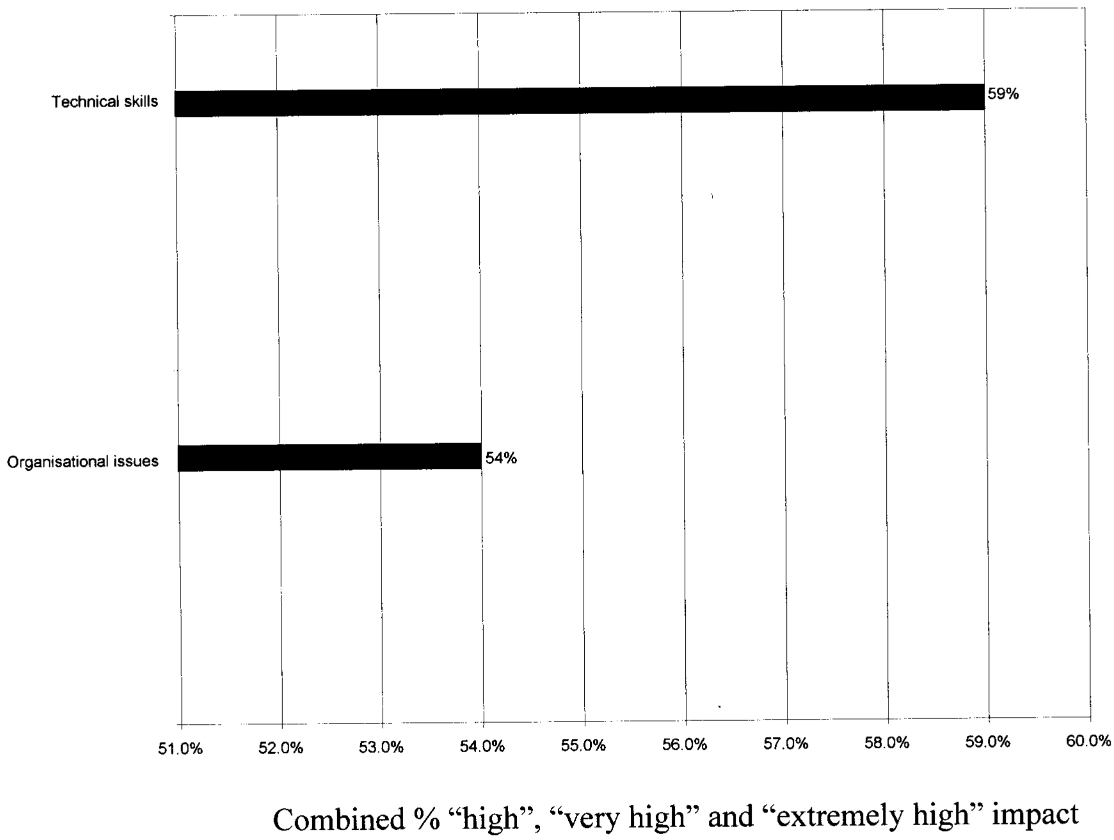

Figure 4.20: Impact of project initiation risks

As shown in figure 4.20, the project initiation risks in question recorded significant impact and were considered to be of high impact and taken to the next stage of risk management, which was risk mitigation and control.

i. Project initiation risks with high impact

The project initiation risks found to be of high impact on project objectives in priority order were:

- technical skills; and
- organisational issues.

b. **Impact assessment for community contribution and participation risks.**

The potential community contribution and participation risks that scored 50 percent or more at probability assessment stage and were taken to impact assessment stage were:

- logistical problems risks;
- inadequate supervision;
- weather and environmental conditions;
- lack of technical skills; and
- lack of understanding of community participation concept.

The results of the analysis are illustrated in figure 4.21.

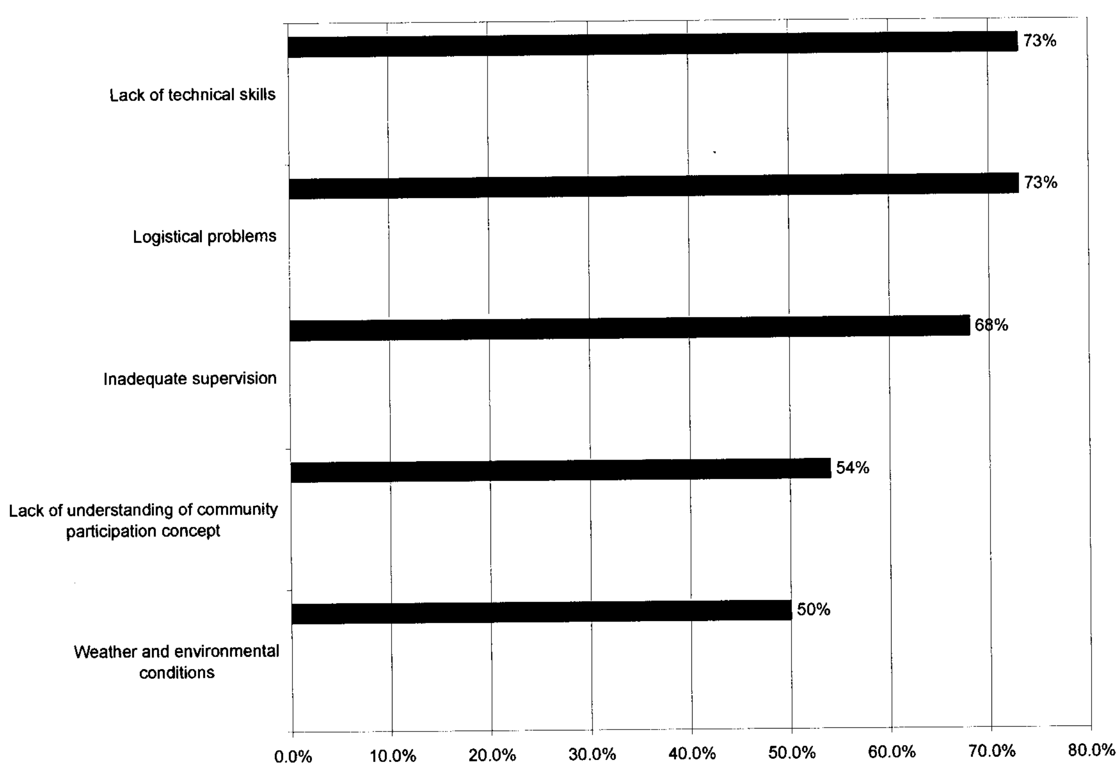

Figure 4.21: Impact of community contribution and participation risks

In this case and as illustrated in figure 4.21, all the risks were considered to be of high impact and taken to the next stage of risk management.

i. Community contribution and participation risks with high impact

The community contribution and participation risks found to be of high impact on project objectives in priority order were:

- lack of technical skills;
- logistical problems;
- inadequate supervision;
- lack of understanding of community participation concept; and
- weather and environmental conditions.

c. Impact assessment for budget/finance risks

The potential community contribution and participation risks that scored 50 percent or more at probability assessment stage and were taken to impact assessment stage were:

- inadequate budgetary allocations;
- delayed and irregular disbursements;
- delayed financial retirements; and
- inadequate financial disbursements.

The results of the analysis are illustrated in figure 4.22.

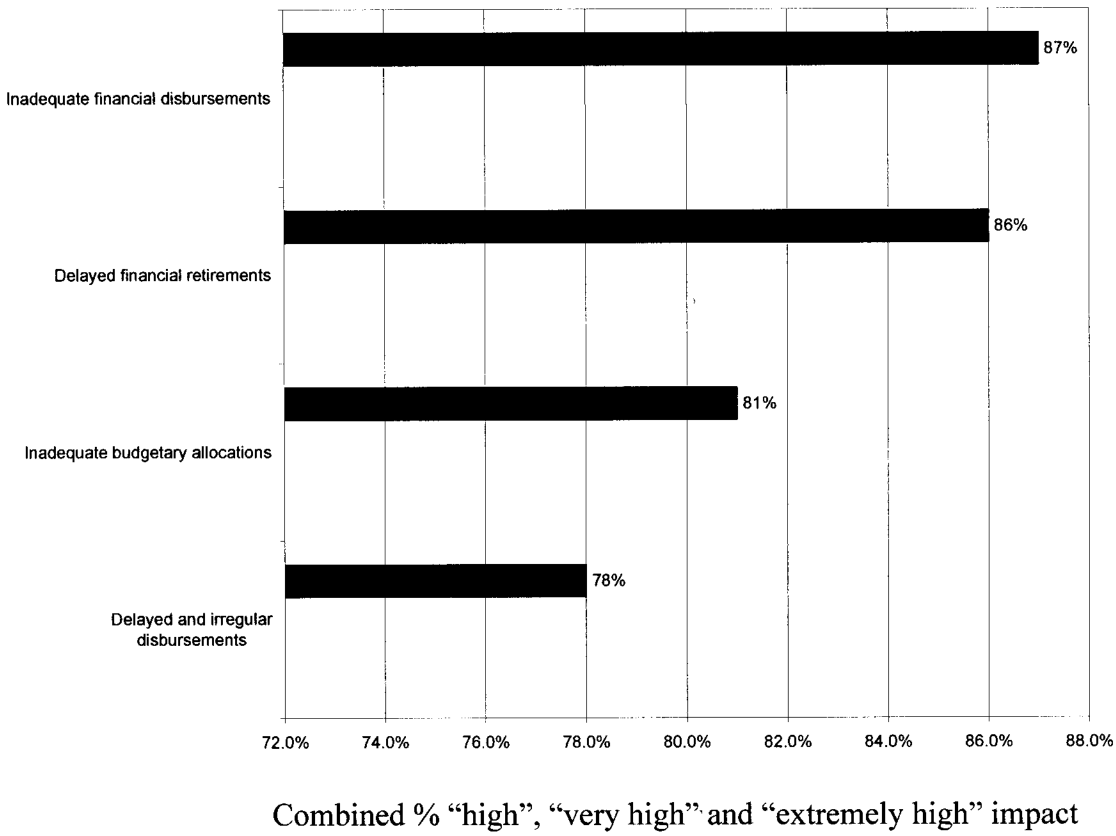

Figure 4.22: Impact of budget/finance risks

Figure 4.22 shows the impact analysis results for budget and finance risks. All the risks recorded significant impact and were taken to the next stage of risk management, which was risk mitigation and control.

i. Budget/finance risks with high impact

The budget/finance risks found to be of high impact on project objectives in priority order were:

- Inadequate financial disbursements;
- Delayed financial retirements;
- Inadequate budgetary allocations; and
- Delayed and irregular disbursements.

d. Impact assessment for skilled labour risks

The potential skilled labour risks that scored 50 percent or more at probability assessment stage and taken to impact assessment stage were:

- Low levels of competence;
- Lack of skilled labour; and
- Poorly trained crafts persons.

The results of the analysis are illustrated in figure 4.23.

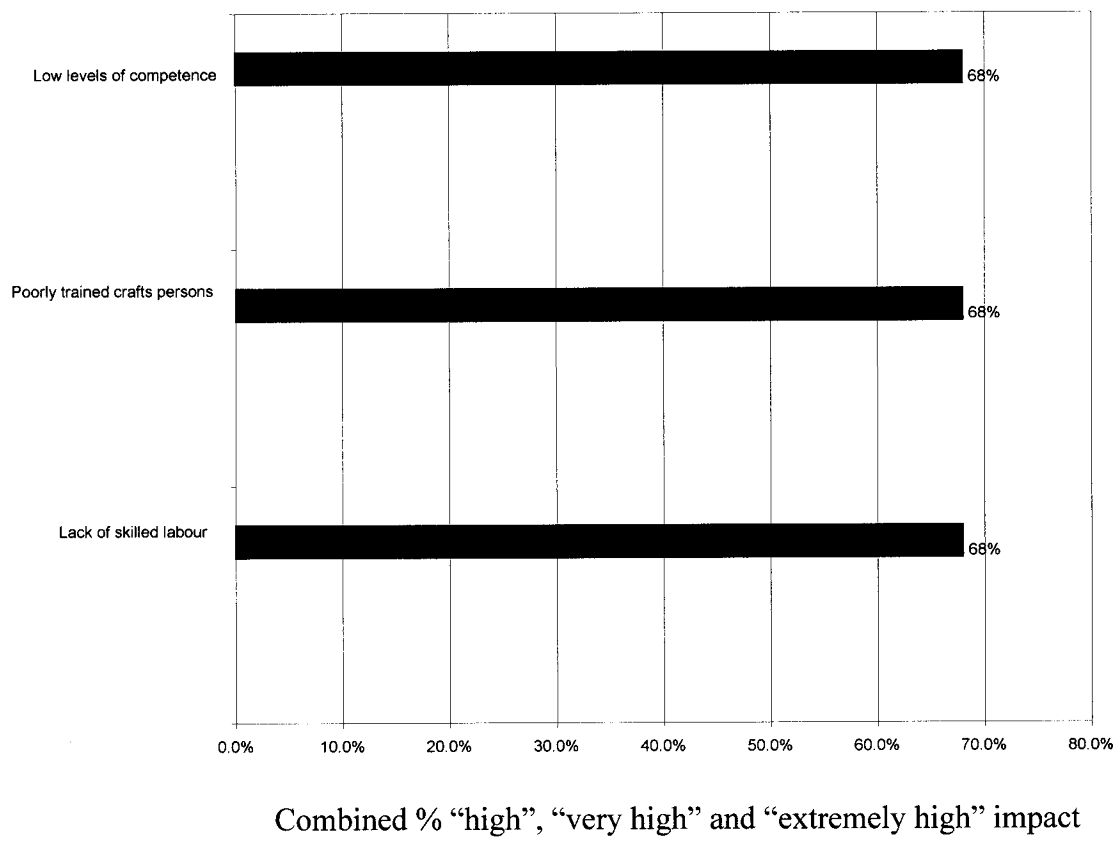

Figure 4.23: Impact of skilled labour risks

In the case of skilled labour risks and as shown in figure 4.23, all the risks recorded high impact and were taken to the next stage of risk management.

i. **Skilled labour risks with high impact**

The skilled labour risks found to be of high impact on project objectives in priority order were:

- lack of skilled labour;
- poorly trained crafts persons; and
- low levels of competence.

e. **Impact assessment for material procurement risks**

The potential material procurement risks that scored 50 percent or more at probability assessment stage and were taken to impact assessment stage were:

- high cost of materials;
- high cost of transportation;
- poor quality of materials;
- non-conformity to specifications; and
- availability of materials.

The results of the analysis are illustrated in figure 4.24.

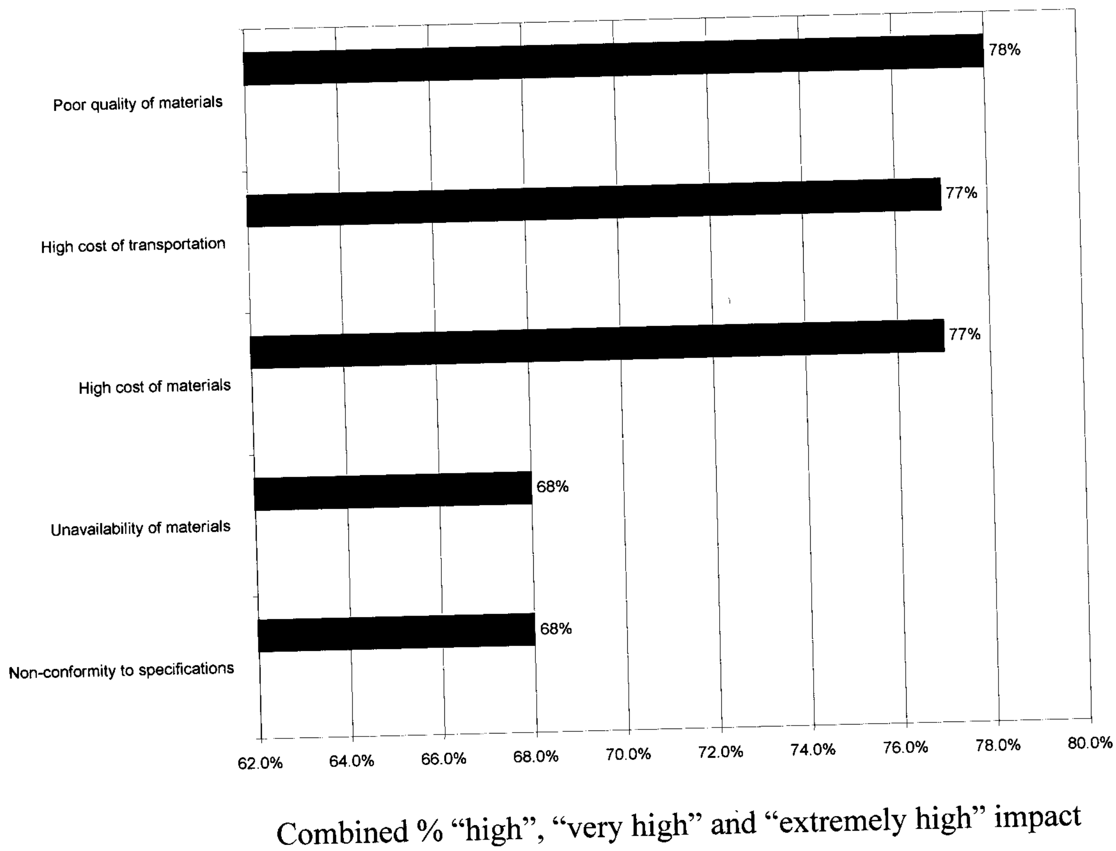

Figure 4.24: Impact of materials procurement risks

As shown in figure 4.24, all the materials procurement risks recorded high impact and were taken to the next stage of risk management.

i. Material procurement risks with high impact

The material procurement risks found to be of high impact on project objectives in priority order were:

- poor quality of materials;
- high cost of transportation;
- high cost of materials;
- unavailability of materials; and
- non-conformity to specifications.

f. **Impact assessment for technical supervision and quality control risks**

The potential technical supervision and quality control risks that scored 50 percent or more at probability assessment stage and were taken to impact assessment stage were:

- generalisation of designs and lack of geo-technical considerations;
- insufficient supervision;
- technical incompetence;
- lack of appropriate skills; and
- lack of work schedule.

The results of the analysis are illustrated in figure 4.25.

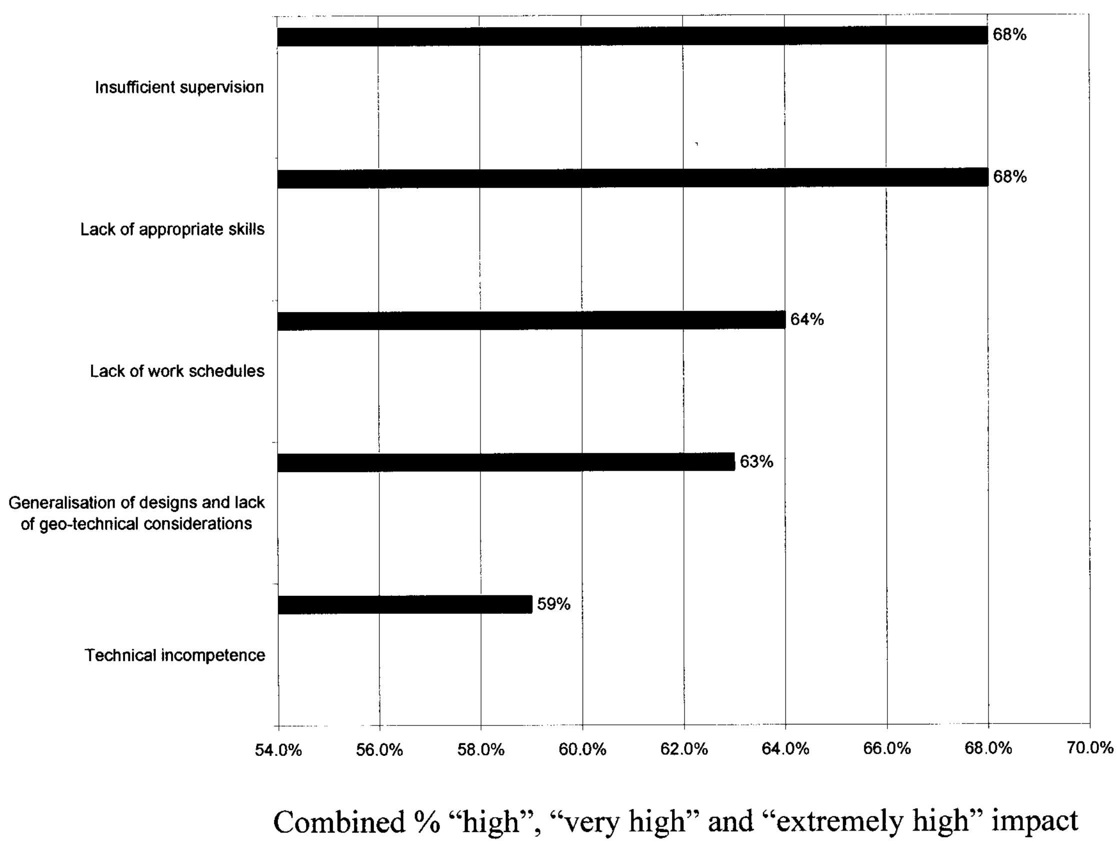

Figure 4.25: Impact of technical supervision and quality control risks

Finally, as shown in figure 4.25, all the risks were at least considered of high impact and taken to risk mitigation and control.

i. Technical supervision and quality control risks with high impact

The technical supervision and quality control risks found to be of high impact on project objectives in priority order were:

- insufficient supervision;
- lack of appropriate skills;
- lack of work schedule;
- generalisation of designs and lack of geo-technical considerations; and
- technical incompetence.

g. Summary of risks with high impact by category

The risks that scored 50 percent or more in the risk impact assessment were considered to be important and were taken to risk mitigation and control stage. Below are the summaries of the risks with at least high impact category wise.

i. Project initiation risks

- lack of technical skills; and
- organisational problems.

ii. Community contribution and participation risks

- lack of technical skills;
- logistical problems;
- inadequate supervision;
- lack of understanding of community participation concept; and
- weather and environmental conditions.

iii. Budget and finance risks

- inadequate financial disbursements;

- delayed financial retirements;
- inadequate budgetary allocations; and
- delayed and irregular disbursements.

iv. Skilled labour risks

- lack of skilled labour;
- poorly trained crafts persons; and
- low levels of competence.

v. Material procurement risks

- poor quality of materials;
- high cost of transportation;
- high cost of materials;
- availability of materials; and
- non-conformity to specifications.

vi. Technical supervision and quality control risks

- insufficient supervision;
- lack of appropriate skills;
- lack of work schedule;
- generalisation of designs and lack of geo-technical considerations; and
- technical incompetence.

4.3.3.6 General comments on risks and risk management

The last question in the questionnaire was an open ended question that elicited additional information on risks and risk management in community-based construction projects. Following is a summary of the general comments made by the respondents categoriwise:

i. Project initiation

- some community-based projects not demand driven;

- lack of adequate sensitization of community;
- lack of field appraisals to verify community contributions;
- lack of cooperation between community, technical staff and other stakeholders; and
- lack of understanding of project cycle and community role.

ii. **Community contribution and participation**

- community contributions in terms of building materials were limited to the geographical location of the project site/surrounding areas. This also affected the type and quality of materials contributed;
- crushed stones and river sand were difficult to obtain in some areas. This compromised the quality of concrete;
- transportation of course aggregates was difficult to arrange in the absence of motor vehicles. In some cases ox-carts were employed;
- under stakeholder conflict, the major problem was with the politicians' interference in the management of projects;
- conflict of interest especially with Non-governmental organizations (NGOs) who implemented projects in communities and schools without the involvement of line departments e.g. school projects have been implemented without involving the Ministry of Education at Headquarters, provincial or district level;

iii. **Budget and finances**

- delayed disbursement of funds caused the projects to delay in completion. This also led to material price escalations thereby offsetting the budget allocation; and
- insistence of implementation agencies on low budgets.

iv. **Skilled labour**

- community-based construction projects lacked skilled labour and technical competence in the construction process;

- skilled labour obtained in rural communities was incompetent and could not work without supervision; and
- employment of low/unskilled community volunteers.

v. **Materials procurement**

- some PMC members defrauded the community/financing agency through procurement of materials from dubious suppliers who gave kick backs.

vi. **Technical supervision and quality control**

- generalization of designs had a negative impact in areas of poor ground conditions;
- inadequate funds for supervision and lack of skills on the part of the project monitors;
- lack of work schedules caused lapses in implementation. This caused increase in construction costs (over running the budget) and escalated the risks associated with weather and environmental conditions;
- technical competence in risk management skills was lacking though most of the risks associated with the construction could be predicted, mitigated and managed. For example, failure to interpret designs could be managed by way of re-training the skilled labour;
- level of competence of some supervisors was still low. This led to risks associated with technical supervision and quality control;
- lack of adequate and reliable transport hindered regular supervision by district technical staff;
- poor remuneration and other conditions of service led to difficulties in recruitment of competent technical supervisors; and
- lack of project management structure at community level.

4.4 Summary

In this chapter, the analysis of the data collected from both the brainstorming sessions with project management committees and questionnaire surveys was carried out. The objectives were to identify the important risks in community projects, determine their probability and establish the impact of risks with high probability on project objectives.

Table 4.9 shows the risks with high probability and high impact on project objectives by category. It is interesting to note that risks with high probability were also found to be of high impact.

Table 4.9: Identified risks with high probability and impact

Category	Identified risks with high probability	Identified risks with high impact
Project Initiation	• Lack of technical skills; and • Organisational problems.	• Lack of technical skills; and • Organisational problems.
Community Contribution and Participation	• Logistical problems; • Inadequate supervision; • Poor weather and environmental conditions; • Lack of technical skills; and • Lack of understanding of the concept of community participation.	• Lack of technical skills; • Logistical problems; • Inadequate supervision; • Lack of understanding of the concept of community participation; and • Poor weather and environmental conditions.
Budget and Finances	• Inadequate budgetary allocation; • Delayed and irregular disbursements; • Delayed financial retirements; and • Inadequate financial disbursements.	• Inadequate financial disbursements; • Delayed financial retirements; • Inadequate budgetary allocation; and • Delayed and irregular disbursements.
Skilled Labour	• Low levels of competence; • Lack of skilled labour; and • Poorly trained crafts persons.	• Low levels of competence; • Poorly trained crafts persons; and • Lack of skilled labour.
Materials Procurement	• High cost of materials; • High transportation costs; • Poor quality of materials; • Non-conformity to specifications; and • Unavailability of materials.	• Poor quality of materials; • High transportation costs; • High cost of materials; • Unavailability of materials; and • Non-conformity to specifications.
Technical Supervision and Quality Control	• Generalisation of designs and lack of geo-technical considerations; • Insufficient supervision; • Technical incompetence; • Lack of appropriate skills; and • Lack of work schedules.	• Insufficient supervision; • Lack of appropriate skills; • Lack of work schedules; • Generalisation of designs and lack of geo-technical considerations; and • Technical incompetence.

In the next chapter, results of the data analysis are discussed.

CHAPTER FIVE: DISCUSSION OF RESULTS

5.1 Introduction

In the previous chapter, risks obtaining in community-based projects were identified and analysed to determine their likelihood and impact on project objectives. At the end of the analysis, a number of risks were determined to be of high impact and were classified into six categories. In this chapter, the results from the previous chapter are discussed.

5.2 Discussion of results

The risks described below were identified in the course of this study.

5.2.1 Project initiation

Out of the identified project initiation risks, lack of technical skills and organizational problems were found to be of considerable significance and impact. The two risk factors were important in the initial stages of a community project. Since most community members were non-technical, it would have been important that details of technical aspects of the project were availed to them so that they could appreciate the full extent of their involvement.

The lack of technical skills in terms of project scope, material specifications and quantities may have led to problems during implementation. Poor organisation at project initiation may have caused apathy during implementation. It was only when the community had been fully sensitized about their role and benefits of the project that consensus was reached and full cooperation achieved.

5.2.2 Community contribution and participation

In the category of community contribution and participation, poor weather and environmental conditions, logistical problems, lack of technical skills, lack of understanding of the concept of community participation and inadequate supervision were found to be of considerable significance and impact. In many cases, adverse weather conditions, for example heavy rainfall affected both the preparation of materials such as bricks and actual execution of works. Since most of the projects were located in rural areas which lacked good roads, logistical problems posed a big challenge in the implementation of community projects and was therefore a significant risk factor that required mitigation.

Lack of technical skills was another risk factor that was important in the category of community contribution and participation since the community was mandated to contribute specified materials of the right quality and quantity. For example large size, ungraded crushed stones could not produce good quality concrete. In many cases inadequate bricks in relation to the project targets had been prepared or moulded, leading to delayed execution. This posed a great challenge especially that moulding of bricks was a seasonal activity. The other important factor was that of not understanding the concept of community participation. This led to the community demanding to be paid for the services rendered to the project. Inadequate supervision was another risk factor identified to have high impact. This created problems relating to quality control and quality of work. The above risks required a good risk management plan to mitigate.

5.2.3 Budget and finance

In the category of budget and finance, identified risks of delayed financial retirements, inadequate budget due to delayed implementation, delayed financial disbursements and inadequate financial disbursements were found to be of considerable significance and high impact. Funds for projects were most frequently released in phases. Delayed retirements of funds already used often led to delayed release of funds for the next phase because the financial regulations stated that no funds would be released for the project before retirements of used funds were submitted to the funding agency.

Another important factor in this category was the inadequacy of the budget due to delayed implementation arising from other risk factors. Price escalations had many a time led to budget overruns and it was important that measures were taken to avoid such scenarios. Delayed disbursement of funds in some cases as a consequence of delayed retirements was yet another risk factor that led to delayed project implementation. There was therefore need to devise ways of addressing problems that arose from these risk factors.

5.2.4 Skilled labour

Lack of skilled labour, low levels of competence and poorly trained crafts persons were the identified risks with considerable probability and high impact in the category of skilled labour. Very little construction activities took place in most rural areas where the projects were located. This meant that there was a shortage of skilled labour in the locality of projects. In some locations, semi-skilled personnel with low levels of competence were found. This scenario often led to poor quality work. As indicated, where some skilled labour was available, these had been poorly trained and this led to the third risk factor in this category namely poorly trained crafts persons.

5.2.5 Materials procurement

In the category of materials procurement, unavailability of materials, high cost of materials, high transportation costs, poor quality materials and non-conformity to specifications were found to be of considerable significance and impact. Since most community projects were located in rural areas, non-availability of non-local materials was a significant risk factor. The high cost of transportation was another important risk factor that required mitigation especially that most of the projects were remotely located and the road network was rather poor.

Another important risk factor in this category was poor quality of materials. A good number of poor quality materials were available on the market and the pricing of these tended to be on the lower side. Unfortunately the applicable tender regulations were such that the lowest bidder secured the order. This scenario impacted negatively on the quality of work. High cost of materials was yet another risk factor with high impact. Due to distances from sources of materials to project locations and the poor state of roads, the landed costs of materials tended to be on the higher side. Another risk factor of significance was the non-conformity to specifications at purchase stage. There was a tendency of purchasing similar items not meeting the actual specifications and therefore not durable. There was therefore need to devise ways of mitigating the risks of high impact in order to meet the project objectives.

5.2.6 Technical supervision and quality control risks

Lack of work schedules, insufficient supervision, technical incompetence, lack of appropriate skills and generalization of designs and lack of geo-technical considerations were the identified risks with high significance and impact under this category. Out of the nine sample projects visited, only one had a semblance of a work schedule. This was a serious omission since projects have a life span.

The absence of work schedules was an important risk factor in that it was difficult to track progress and mitigate implementation hurdles. Due to low levels of competence amongst the local skilled labour, insufficient supervision was an important risk factor that required forward planning and mitigation. Another important risk factor in this category was lack of appropriate skills provided by the community. There was need to plan and programme for short training sessions for the key players in the implementation of the projects. Generalisation of designs and lack of geo-technical considerations was another significant factor relating to soil conditions and foundation design of the buildings. All these risk factors required good forward planning with regard to mitigation measures and subsequent successful project implementation.

5.3 Summary

In this chapter, risks found to be of high impact were determined and taken to the next stage of developing responses for mitigation.

In the next chapter, a risk management model to mitigate and control risks in community-based construction projects was developed. The model developed would guide the implementation of community projects.

CHAPTER SIX: RISK MANAGEMENT MODEL FOR COMMUNITY PROJECTS AND ITS VALIDATION

6.1 Introduction

Chapter 5 discussed the results obtained in this study. In this chapter a risk management model was developed to assist in the mitigation of the risks with high impact and improve the likelihood of meeting project objectives, which include: cost effectiveness; quality assurance; and timely delivery.

6.2 Proposed risk management model

The study demonstrated that there were a number of risks in community-based construction projects just as there are in conventional construction projects. The risks identified in the brainstorming sessions with PMCs were similar to those identified through the questionnaire survey except for a few in categories of project initiation, skilled labour and community contribution and participation. It was therefore important that risk management techniques were employed to improve the implementation and delivery of community-based construction projects. A model was developed in this study in form of a flow chart that could be adopted in the implementation of community-based projects. The model is presented in Figure 6.1 and the different risk management activities are described in the sub-sections that follow.

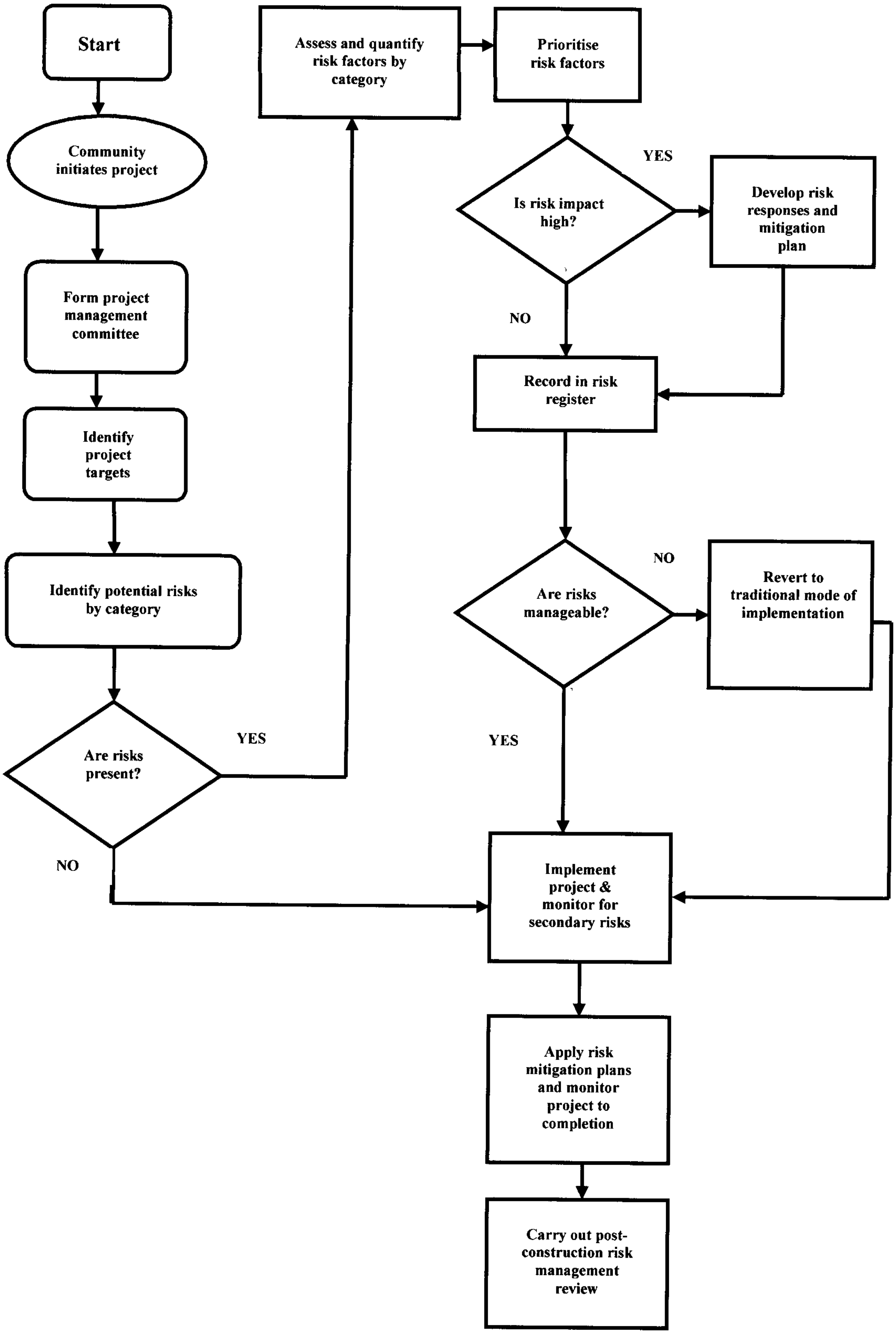

Figure 6.1 Risk management model for community-based construction projects

6.2.1 Community initiates project

The major characteristic feature of community-based projects is the fact that the community initiates the project as opposed to a project being imposed on them by external interest groups. Therefore, the starting point of the risk management process is the initiation of the project by the beneficiary community. All the stakeholders convene an initiation meeting. At this meeting a number of pertinent issues relating to the scope of the project, financing, role of the community and other modalities of the project are discussed in an open-minded atmosphere. It is important at this stage for the stakeholders and other interest groups to reach a consensus regarding the direction of the project.

6.2.2 Form PMC

The PMC is the management entity of a community-based project and is recognized as such. The committee is formed at the project initiation meeting. However, there is need to streamline its composition and structure. This is the team that should be charged with the responsibility of carrying out the risk management process. Therefore the level of education and qualifications should enable them to analyse, plan and control risks that may be identified in the process of project implementation.

It is proposed that technical persons with experience in project management be part of the PMC. Since technically qualified persons may not be found in the locality of the projects, it is advisable that these are recruited from other areas. It is further proposed that short training programmes be arranged to train the PMC in construction and project management techniques, including basics in risk management.

6.2.3 Identify project targets

The technical aspects and materials inputs can only be determined following the agreement regarding the targets for the project i.e. scope of works. The PMC must play a pivotal role in this aspect and should be able to make assumptions relating to capacity and participation of the community vis a vis the available financial resources. It should also ensure that adequate resources are available. The community should settle for the target range that is manageable and implementable within the confines of other external factors.

Details of the requirements for the projects and other technical issues should be determined and explained to the participants. These should include project design, estimated project cost, project duration and material specifications. The assignments of the tasks and other modalities of implementation should be clearly understood for effective participation by all.

6.2.4 Identify potential risks by category

The first task of the PMC is to call for a brainstorming meeting at which potential risks will be identified. Guiding questions should be used for this purpose and potential risks should be listed in order of severity categoriwise. The categories are:

- project initiation;
- community contribution and participation;
- budget and finance;
- skilled labour;
- material procurement; and
- technical supervision and quality control.

6.2.5 Presence of potential risks

If potential risks are present, these should be assessed to determine their probability and impact. In case there are no potential risks identified initially, project implementation may commence and the project should continue to be monitored for secondary risks. Any secondary risks identified should also pass through the assessment stage. If there are no secondary risks discovered, the project should be monitored up to completion stage.

6.2.6 Assessment and quantification of risks

Potential risks must be assessed to determine their likelihood of occurrence and impact on project objectives, the objectives being cost effectiveness, quality assurance and timely delivery. The techniques for assessment may be either qualitative or quantitative.

By and large, the preferred method is qualitative and the experience and judgement of PMC members with technical knowledge becomes handy.

6.2.7 Prioritisation of risk factors

After the assessment and quantification, a priority list should then be made in each of the six categories starting with those with highest impact. Risks that are of moderate to high impact on the list should be taken to the treatment stage of response development.

6.2.8 Risks with high impact

If the impact of a risk factor on any of the project objectives is rated medium to high, then the PMC should develop a response and mitigation plan. Generally the PMC should develop a risk management and mitigation plan for all the risks with medium to high impact before recording them in the risk register. In case the response shows that the impact of the risks is low, these should equally be recorded in the risk register. It is also important at this stage to provide a budget line for risk responses and mitigation plans.

6.2.9 Record in risk register

All potential risks that were identified at identification stage should be recorded in the risk register. This is important for reference purposes on future projects. In addition, construction risks are dynamic by nature, meaning that those with low impact in one phase may have high impact in the next project or phase hence the need to keep records.

6.2.10 Determine manageability of risks

If it is determined that the mitigation measures put in place are effective and adequate to minimize and control the high impact risks, then implementation of project can commence. If it is found that the high impact risks in each of the categories cannot be managed by the mitigation plans devised, it is recommended that traditional modes of project implementation be employed as an option.

6.2.11 Implement projects

Having determined the manageability of the risks and the options available in case they are not, the project can be sanctioned and commenced. Allocation of risks can be done at this stage so that all participants are aware of their responsibility from the beginning. However, projects should be monitored for secondary risks up to the end of the project cycle. Even under the traditional mode of implementation, the risk management process should apply.

6.2.12 Apply risk mitigation plans

Having developed the response and mitigation plans for the risks with high impact, the next most important activity is to implement the plans. In addition, the projects should be monitored and controlled throughout the life cycles due to the dynamic nature of construction risks.

6.2.13 Post-construction risk review

After the completion of the project, the PMC should convene a meeting with other stakeholders to review the risks and the effectiveness of the mitigation measures undertaken during implementation. Lessons learnt and suggested improvements must be recorded for incorporation in future projects.

6.3 Model Validation

Following the construction of the model, the process of validating it was undertaken. Validation in this context is the assessment of the validity of the model in relation to the proposed usage and functionality. It is therefore dependant on judgement and accepted norms in a particular subject under scrutiny.

Table 6.1 Validation of risk management model for community-based projects

Name of organisation	Type of organization	Occupation of respondent	Respondent's years of experience	The model addresses the activities necessary for managing risks on community-based construction projects in practice			Do you agree that the steps identified in the model can help in the management of risks on community-based construction projects?			Do you think the proposed steps are easy to follow and implement?			Would you be willing to use the model for risk management on community-based construction projects?			Can you suggest any improvements to make the model more responsive to community-based projects in Zambia?
				Agree	Neutral	Disagree	Yes	Not sure	No	Yes	Not sure	No	Yes	Not sure	No	
Habiconsult	Consultants	Architect	19	√			√			√			√			"Community initiates project" is too specific as community-based projects are not necessarily initiated by communities. Adopt a more general statement for the second step after "Start".
Buildings Department	Government Department	Architect	13	√			√			√			√			Risk management is new phenomena in this field. Therefore it has to be introduced by a specialist and mention why it is necessary.
Ministry of Education	Government Department	Quantity Surveyor	17	√			√			√			√			Training of project management committees in identifying and managing risks should be addressed in the model
ZEPIU	Government Department	Civil Engineer	20	√			√			√				√		The model should allow for budgeting for risk responses and mitigation plans.
Ministry of Education	Government Department	Architect	20	√			√			√			√			Introduce "Understanding the nature of project" after "Form project management committee"
Colmak Associates	Consultants	Quantity Surveyor	15	√			√			√			√			Training of the community in project management should include a module focusing on risk management
Buildtrust contractors	Contractor	Civil Engineer	10	√			√			√			√			-
Ministry of Education	Government Department	Construction Technologist	10	√			√			√			√			The model should provide for training on primary and secondary risk identification at initiation stage.
Total				8			8			8			7	1		

The questionnaire for validating the risk management model for community-based projects was designed and sent to ten individuals who were selected randomly. The respondents were either involved in community-based construction projects or were professionals in construction. The number ten was considered to be representative of the construction industry given that the major professions in the industry, (i.e. architecture, civil engineering and quantity surveying) were represented. The model validation questionnaire sample is given in Appendix E and summarized responses of the respondents are displayed in Table 6.1.

Out of the 10 validation questionnaires distributed, 8 were received. This represented a response rate of 80 percent. It was worthwhile to note that the years of experience of the respondents were more than ten. The responses are indicated in Table 6.1. As outlined in the questionnaire, the validation exercise sought to assess the model in terms of its:

- relevance of activities;
- usefulness;
- user-friendliness; and
- acceptability.

6.3.1 Relevance of activities

Question 1 on the questionnaire asked the respondents to state whether or not the model addressed the activities necessary for managing risks on community-based construction projects in practice. All the eight respondents "agreed" that the activities in the model were necessary in the management of risks obtaining in community-based projects in practice.

6.3.2 Usefulness of model

Question 2 on the questionnaire asked the respondents whether the steps in the model could help in the management of risks on community-based construction projects. All of the respondents indicated that the steps outlined in the model could assist in the management of risks on community-based projects. This shows that the model was useful.

6.3.3 User-friendliness

Question 3 on the questionnaire requested respondents to state whether the steps in the model were easy to follow and implement. All the eight respondents indicated that the proposed steps in the model were easy to follow and implement and therefore the model was user-friendly.

6.3.4 Acceptability

Question 4 on the questionnaire asked whether the respondents would be willing to use the model in the management of risks on community-based projects. Seven out of the eight respondents indicated that they would use the model. This confirmed the acceptability of the model.

In response to question 5 of the questionnaire, seven respondents made suggestions on how the model could be improved as shown in Table 6.1. Some suggestions have been incorporated in the activities and not necessarily in the model to avoid crowding it. The main suggestions were: provision of risk management training for the PMCs; and budget line for risk responses and mitigation plans.

6.4 Summary

This chapter presented the risk management model building process and its validation. It is clear from the validation exercise results that the model is useful, user-friendly and accepted in the construction industry and it is strongly recommended that organizations and stakeholders intending to implement community-based construction projects adopt it.

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

In the previous chapter, the results of the study were discussed and a risk management model developed for adoption during implementation of community-based projects was validated. This chapter presents the conclusions and recommendations of the study.

The aim of the research was to develop a Risk Management Model (RMM) to be used or adopted in the procurement of community-based construction projects in Zambia in order to improve their implementation. The import of such a model would be to help the communities to improve the implementation of projects by way of mitigation of risks with high impact to minimize adverse effects and improve the likelihood of meeting project objectives. Project objectives being improved delivery time, cost-effectiveness and improved quality. The specific objectives of the study were to:

- identify all possible construction management risks that were associated with community-based construction projects from initiation to commissioning stage;
- determine the probability and likelihood of occurrence of the identified risks;
- rank the risks according to severity on project objectives;
- determine the impact and consequences on project targets of risks with medium or high probability. The targets being completion of projects within budget, expected quality achievement and timely completion; and
- develop responses for mitigating, controlling and monitoring the risks with negative effects on the project targets so as to minimize costs, improve quality and efficiency of project delivery.

The aim and objectives of the research were achieved through: brainstorming sessions with 9 PMCs in the nine provinces of Zambia; questionnaires administered to 51 persons involved with community-based projects in one way or another; and a risk management model validation exercise with 8 professionals through a questionnaire. The conclusions drawn from the study are presented below.

7.2 Conclusions

7.2.1 Risk identification

It has been established through this study that brainstorming sessions were the easiest and quickest technique that could be used in the process of identifying risks in community-based projects. A group consisting of between ten to fifteen members may sit and go through the process using a set of guiding questions according to categories suggested or most appropriate to a project situation. The study showed that the risks identified by the brain storming sessions were similar to those identified through a questionnaire survey. The difference was that it took a long time to distribute and receive completed questionnaires.

The results of this study showed that there were a number of risks in the implementation of community-based projects. The identified risks were classified into six categories, namely: project initiation; community contribution and participation; budget and finance; skilled labour; materials procurement and technical supervision and quality control. The identified risks by category and order of importance were as follows:

Project initiation risks

- lack of technical skills;
- organisational problems; and
- financial problems.

Community contribution and participation risks

- inadequate supervision;
- non-conformity to specifications;
- poor weather and environmental conditions;
- logistical problems;
- lack of technical skills;
- lack of appropriate materials;
- lack of cooperation; and

- lack of understanding of the concept of community participation.

Budget/finance risks

- delayed and irregular disbursements;
- delayed financial retirements;
- inadequate budgetary allocation; and
- inadequate financial disbursements.

Skilled labour risks

- low levels of competence;
- lack of skilled labour;
- poorly trained crafts persons; and
- inadequate contract conditions.

Material procurement risks

- non-availability of materials;
- poor quality of materials;
- high cost of materials;
- high transportation costs; and
- non-conformity to specifications.

Technical supervision and quality control risks

- generalisation of designs and lack of geo-technical considerations;
- insufficient supervision;
- lack of appropriate skills;
- lack of work schedules;
- failure to interpret designs;
- technical incompetence; and
- insufficient working details.

Whilst the involvement of the community in construction projects minimizes the cost of construction in addition to instilling a sense of ownership within the beneficiary community, it was clear from the results of this study that a number of risks arise in the course of implementation. The results showed that some identified risks were peculiar to community-based projects due to a number of factors that include lack of expertise, organizational problems, location and logistical problems.

7.2.2 Risk probability determination

Whereas more rigorous methods could be used to determine the probability of occurrence for the identified risks, qualitative methods could suffice through brainstorming sessions specifically called to assess the probability. This could be achieved though a scoring method that could be devised by the group.

The identified risks were further analysed to determine the probability and likelihood of occurrence. It was found that the risks with significant probability were also the ones that impacted negatively on the project objectives and were as follows:

Project initiation risks

- lack of technical skills; and
- organisational problems.

Community contribution and participation risks

- logistical problems;
- inadequate supervision;
- poor weather and environmental conditions;
- lack of technical skill; and
- lack of understanding of community participation concept.

Budget/finance risks

- inadequate budgetary allocation;
- delayed and irregular disbursements;

- delayed financial retirements; and
- inadequate financial disbursements.

Skilled labour risks

- low levels of competence;
- lack of skilled labour; and
- poorly trained crafts persons.

Material procurement risks

- high cost of materials;
- high cost of transportation;
- poor quality of materials;
- non-conformity to specifications; and
- unavailability of materials.

Technical supervision and quality control risks

- generalisation of designs and lack of geo-technical considerations;
- insufficient supervision;
- technical incompetence;
- lack of appropriate skills; and
- lack of work schedules.

7.2.3 Risk impact determination

The assessment of impacts of risks found to be of high probability could still be done descriptively in the same brainstorming sessions for probability determination. This study indicated that in most cases the risks found to be of high probability were the same ones with high impact that would require mitigation.

Some of the consequences of not managing risks with high probability and impact are: high maintenance costs of poorly constructed infrastructure; and the need for re-investment in infrastructure development within a short period of time. It is therefore important that risk management techniques are employed to assess, mitigate and control the risks in each of the six categories throughout the life cycle of the project.

7.2.4 Response development

The study showed that a number of risks were of high impact in community-based projects and require mitigation. Risk reduction is one of the methods or strategies used to control the negative effects of risks if they occur. There are four main ways of reducing risks and these include transference, avoidance or elimination, mitigation and acceptance (Choi et al., 2004). Out of these, risk transfer and mitigation are more suitable for risk reduction in community-based projects.

Lack of work schedules and poor material estimates were cited as some of the significant risks identified. One way of controlling these risks and others is to develop reliable project estimates and schedules. In order to reduce the negative effects of the critical risks, the risk management model (RMM) was developed.

7.3 Recommendations

Arising from the research results, a risk management model was developed for the management of risks in community-based construction projects. The model could be used by PMCs and other interest groups in the implementation of projects. The model is presented in Figure 6.1 of Chapter 6. It was validated and found to be suitable, functional and practical after incorporating changes suggested by eight respondents through a self-completion questionnaire.

It is strongly recommended that the model be used to improve delivery of projects in time, within budget and with good quality. If the model cannot be applied to the satisfactory implementation of projects, then it is recommended that conventional ways of procurement be employed through the already existing public service structures.

7.4 Limitations of the study and recommendations for further work

At the time the research was carried out, there was very little activity relating to community-based construction projects in other sectors of the economy other than school infrastructure. ZAMSIF that funded construction of other types of infrastructure were winding up their activities. It was therefore very difficulty to obtain data from such projects. In addition, complex projects such as bridge construction were not carried out using this mode of procurement. In exceptional cases, communities were involved in basic road maintenance in what was called "Food for work" type of activity in which the World Food Programme (WFP) would encourage communities to work for food. However, there was no management structure for this temporal activity meant to provide food for the community. This scenario tended to limit the research activities in this study to "school infrastructure". However, it must be pointed out that the construction activities are similar for any other type of single storey building.

It is worth pointing out that the research topic considered in this study is quite exhaustive in terms of qualitative methods and further work that may be recommended is that involving quantitative methods of analysis.

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Appendix A

Cover letter for Brainstorming Sessions

The University of Zambia
School of Engineering
Department of Civil and Environmental Engineering
P.O. Box 32379 Lusaka
Tel/Fax: +260-1-290962
Lusaka, ZAMBIA

28th June 2006

The District Education Board Secretary,
<<Name of District>>
<<Address>>
<<Town>>

Dear Sir/Madam,

Research into risk management of community-based construction projects in Zambia

I am a research student at the University of Zambia carrying out research in the topic outlined above. My research supervisor is Dr. M. Muya of the Department of Civil and Environmental Engineering at the University of Zambia.

The research is intended to improve the management of construction risks obtaining in the implementation of community-based projects to minimize delivery time, reduce costs and improve the quality of the projects.

The research will be done in two parts. The first part will be brainstorming sessions with project management committees (PMC) to identify the risks and the second part will be structured questionnaires administered to individuals working with agencies involved in the funding and implementation of community-based construction projects to establish the impact and relative importance of the risks.

This letter serves to request your organization to allow me to carry out brainstorming sessions with selected project management committees (PMCs) for the purpose of collecting data. The data collected in this research will be treated with the strictest confidence. Your assistance in this exercise will be appreciated.

Awaiting to hear from you.

Yours faithfully,

………………..

I. Mañelele
Research Student (M.Eng)
E-mail: imangelele@moe.gov.zm; Tel. 260 95 992188; Fax: 260 1 254342.

Appendix B
Questionnaire for group discussion

UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

RISK MANAGEMENT IN THE PROCUREMENT OF COMMUNITY-BASED CONSTRUCTION PROJECTS IN ZAMBIA.

LIST OF GUIDING QUESTIONS FOR BRAINSTORMING SESSIONS WITH PROJECT MANAGEMENT COMMITEES.

PROVINCE……………………………………………………………………

DISTRICT……………………………………………………………………

NAME AND TYPE OF PROJECT…………………………………………………

NAME OF IMPLEMENTING AGENCY……………………………………………

DATE OF MEETING…………………………………………………………

1. **Project Initiation**
   - What were the problems encountered by your committee during the initiation of your project?
   - Which of the identified problems had a greater effect on project implementation, starting with the one that caused the greatest impact to the one that had the least effect?
   - How did the PMC and other stakeholders solve the problems that caused serious impact?

2. **Community contribution and participation**
   - What were the problems encountered by your committee regarding community contribution and participation in your project?
   - Which of the identified problems had a greater effect on project implementation, starting with the one that caused the greatest impact to the one that had the least effect?
   - How did the PMC and other stakeholders solve the problems that caused serious impact?

3. **Budget/Finances**
   - What were the problems encountered by your committee regarding the budget/finances for your project?
   - Which of the identified problems had a greater effect on project implementation, starting with the one that caused the greatest impact to the one that had the least effect?
   - How did the PMC and other stakeholders solve the problems that caused serious impact?

4. **Skilled labour**

- What were the problems encountered by your committee regarding skilled labour for your project?
- Which of the identified problems had a greater effect on project implementation, starting with the one that caused the greatest impact to the one that had the least effect?
- How did the PMC and other stakeholders solve the problems that caused serious impact?

5. **Material procurement**

- What were the problems encountered by your committee pertaining to procurement of materials for your project?
- Which of the identified problems had a greater effect on project implementation, starting with the one that caused the greatest impact to the one that had the least effect?
- How did the PMC and other stakeholders solve the problems that caused serious impact?

6. **Technical supervision and Quality control**

- What were the problems encountered by your committee pertaining to technical supervision and quality control for your project?
- Which of the identified problems had a greater effect on project implementation, starting with the one that caused the greatest impact to the one that had the least effect?
- How did the PMC and other stakeholders solve the problems that caused serious impact?

7. **Other challenges**

- What other problems apart from the above did you encounter in the implementation of your project?
- Which of the identified problems had a greater effect on project implementation, starting with the one that caused the greatest impact to the one that had the least effect?
- How did the PMC and other stakeholders solve the problems that caused serious impact?

Appendix C

Sample form for list of participants in group discussions

UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

LIST OF PARTICIPANTS IN GROUP BRAINSTORMING SESSION WITH PROJECT MANAGEMENT COMMITTEES.

PROVINCE……………………………………………………………………………

DISTRICT…………………………………………………………………………..

NAME OF PROJECT………………………………………………………………

TYPE OF PROJECT……………………………………………………………….

DATE OF MEETING……………………………………………………………….

S/N	NAME OF PARTICIPANT	POSITION/STATUS	ORGANISATION REPRESENTED	SIGNATURE
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				

Appendix D

Questionnaire for risk management

UNIVERSITY OF ZAMBIA

QUESTIONNAIRE FOR

RISK MANAGEMENT IN THE PROCUREMENT OF COMMUNITY BASED CONSTRUCTION PROJECTS IN ZAMBIA.

PROVINCE...

DISTRICT...

NAME OF ORGANISATION:...

OCCUPATION OF RESPONDENT...
(Please indicate if you are Director, Operational Manager, Regional facilitator Procurement officer etc.)

YEARS OF EXPERIENCE IN CONSTRUCTION INDUSTRY...

SECTION ONE: GENERAL INFORMATION

1. What type of community construction project(s) are you or have you been involved in? **(Please tick wherever relevant)**
   - School project ☐
   - Health Center project ☐
   - Road project ☐
   - Other (specify)..

2. Which organization funds or funded the project? **(Please tick wherever relevant)**
   - Zambia Social Investment Fund ☐
   - Ministry of Education ☐
   - Development Corporation Ireland ☐
   - Save the Children Norway ☐
   - Other (specify)..

3. Who initiated the project? **(Please tick wherever relevant)**

- The beneficiary community ☐
- The government ☐
- The implementing/funding agency ☐
- The area member of Parliament ☐
- Other (specify)......................................

SECTION TWO: RISK IDENTIFICATION

4. **Project Initiation**
   Problems encountered by the Project Management Committee (PMC) during the initiation of the project were more to do with: **(Please tick)**

	Strongly agree (6)	Agree (5)	Neutral (4)	Disagree (3)	Strongly disagree (2)	Don't know (1)
• Organisational issues	☐	☐	☐	☐	☐	☐
• Scope definition	☐	☐	☐	☐	☐	☐
• Technical skills	☐	☐	☐	☐	☐	☐
• Financial matters	☐	☐	☐	☐	☐	☐

5. **Community contribution and participation**
   Problems encountered by the PMC during the provision of the community contribution include: **(Please tick)**

	Strongly agree (6)	Agree (5)	Neutral (4)	Disagree (3)	Strongly disagree (2)	Don't know (1)
• Lack of cooperation	☐	☐	☐	☐	☐	☐
• Lack of understanding of concept of community participation	☐	☐	☐	☐	☐	☐
• Lack of understanding of role of implementing agency.	☐	☐	☐	☐	☐	☐
• Stake holder conflicts	☐	☐	☐	☐	☐	☐
• Logistical problems	☐	☐	☐	☐	☐	☐
• Weather and environmental conditions	☐	☐	☐	☐	☐	☐
• Lack of appropriate materials	☐	☐	☐	☐	☐	☐
• Non-conformity to specifications	☐	☐	☐	☐	☐	☐
• Lack of technical skills	☐	☐	☐	☐	☐	☐
• Inadequate supervision	☐	☐	☐	☐	☐	☐

6. **Budget/Finances**
   Problems encountered by the PMC regarding the budget/finances for the project include: **(Please tick)**

	Strongly agree (6)	Agree (5)	Neutral (4)	Disagree (3)	Strongly disagree (2)	Don't know (1)
• Inadequate budgetary						

allocation	☐	☐	☐	☐	☐	☐
• Inadequate financial disbursements	☐	☐	☐	☐	☐	☐
• Delayed financial retirements	☐	☐	☐	☐	☐	☐
• Delayed and irregular disbursements	☐	☐	☐	☐	☐	☐
• Financial mismanagement	☐	☐	☐	☐	☐	☐

7. **Skilled labour**
Problems encountered by the PMC regarding skilled labour for the project include the following: **(Please tick)**

	Strongly agree (6)	Agree (5)	Neutral (4)	Disagree (3)	Strongly disagree (2)	Don't know (1)
• Lack of skilled labour	☐	☐	☐	☐	☐	☐
• Low levels of competence	☐	☐	☐	☐	☐	☐
• Inadequate contract conditions	☐	☐	☐	☐	☐	☐
• Poorly trained craftspersons	☐	☐	☐	☐	☐	☐

8. **Procurement of materials**
Problems encountered by the PMC regarding procurement of materials for the project include the following: **(Please tick)**

	Strongly agree (6)	Agree (5)	Neutral (4)	Disagree (3)	Strongly disagree (2)	Don't know (1)
• Availability of materials	☐	☐	☐	☐	☐	☐
• Poor quality of materials	☐	☐	☐	☐	☐	☐
• High cost of materials	☐	☐	☐	☐	☐	☐
• High transportation costs	☐	☐	☐	☐	☐	☐
• Non-conformity to specifications	☐	☐	☐	☐	☐	☐

9. **Technical supervision and Quality control**
Problems encountered by the PMC regarding quality control and workmanship for the project include the following: **(Please tick)**

	Strongly agree (6)	Agree (5)	Neutral (4)	Disagree (3)	Strongly disagree (2)	Don't know (1)
• Generalisation of designs and lack of geo-technical considerations	☐	☐	☐	☐	☐	☐
• Incomplete designs	☐	☐	☐	☐	☐	☐
• Insufficient working details	☐	☐	☐	☐	☐	☐
• Failure to interpret designs	☐	☐	☐	☐	☐	☐

• Lack of work schedules	☐	☐	☐	☐	☐	☐
• Technical incompetence	☐	☐	☐	☐	☐	☐
• Lack of appropriate skills	☐	☐	☐	☐	☐	☐
• Inappropriate building materials	☐	☐	☐	☐	☐	☐
• Insufficient supervision	☐	☐	☐	☐	☐	☐

SECTION THREE: RISK PROBABILITY ASSESSMENT

10. Project initiation

What was the probability of occurrence of the risks associated with the following? **(Please tick)**

	Extremely high (5)	**Very High (4)**	**High (3)**	**Medium (2)**	**Low 1)**
• Organisational issues	☐	☐	☐	☐	☐
• Scope definition	☐	☐	☐	☐	☐
• Technical skills	☐	☐	☐	☐	☐
• Financial matters	☐	☐	☐	☐	☐

11. Community Contribution and Participation

What was the probability of occurrence of the risks associated with the following? **(Please tick)**

	Extremely high (5)	**Very High (4)**	**High (3)**	**Medium (2)**	**Low (1)**
• Lack of cooperation	☐	☐	☐	☐	☐
• Lack of understanding of community participation concept	☐	☐	☐	☐	☐
• Lack of understanding of role of implementing agency	☐	☐	☐	☐	☐
• Stake holder conflicts	☐	☐	☐	☐	☐
• Logistical problems	☐	☐	☐	☐	☐
• Weather and environmental conditions	☐	☐	☐	☐	☐
• Lack of appropriate materials	☐	☐	☐	☐	☐
• Non-conformity to specifications	☐	☐	☐	☐	☐
• Lack of technical skill	☐	☐	☐	☐	☐
• Inadequate supervision	☐	☐	☐	☐	☐

12. Budget/Finances

What was the probability of occurrence of the risks associated with the following? **(Please tick)**

	Extremely high (5)	**Very High (4)**	**High (3)**	**Medium (2)**	**Low (1)**
• Inadequate budgetary allocation	☐	☐	☐	☐	☐
• Inadequate financial disbursements	☐	☐	☐	☐	☐

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low (1)
• Delayed financial retirements	☐	☐	☐	☐	☐
• Delayed and irregular disbursements	☐	☐	☐	☐	☐
• Financial mismanagement	☐	☐	☐	☐	☐

13. Skilled labour

What was the probability of occurrence of the risks associated with the following? **(Please tick)**

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low (1)
• Lack of skilled labour	☐	☐	☐	☐	☐
• Low levels of competence	☐	☐	☐	☐	☐
• Inadequate contract conditions	☐	☐	☐	☐	☐
• Poorly trained craftspersons	☐	☐	☐	☐	☐

14. Procurement of materials

What was the probability of occurrence of the risks associated with the following? **(Please tick)**

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low (1)
• Non-availability of materials	☐	☐	☐	☐	☐
• Quality of materials	☐	☐	☐	☐	☐
• Cost of materials	☐	☐	☐	☐	☐
• Cost of transportation	☐	☐	☐	☐	☐
• Non-conformity to specifications	☐	☐	☐	☐	☐

15. Technical supervision and Quality control

What was the probability of occurrence of the risks associated with the following? **(Please tick)**

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low (1)
• Generalisation of designs and lack of geo-technical considerations	☐	☐	☐	☐	☐
• Incomplete designs	☐	☐	☐	☐	☐
• Insufficient working details	☐	☐	☐	☐	☐
• Failure to interpret designs	☐	☐	☐	☐	☐
• Lack of work schedule	☐	☐	☐	☐	☐
• Technical incompetence	☐	☐	☐	☐	☐
• Lack of appropriate skills	☐	☐	☐	☐	☐
• Inappropriate building materials	☐	☐	☐	☐	☐
• Insufficient supervision	☐	☐	☐	☐	☐

SECTION FOUR: RISK IMPACT ASSESSMENT

16. Project Initiation

*What was the impact on project objectives of the risks associated with the following? **(Please tick)***

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low 1)
• Organisational issues	☐	☐	☐	☐	☐
• Scope definition	☐	☐	☐	☐	☐
• Technical skills	☐	☐	☐	☐	☐
• Financial matters	☐	☐	☐	☐	☐

17. Community Contribution and Participation

What was the impact on project objectives of the risks associated with the following? **(Please tick)**

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low (1)
• Lack of cooperation	☐	☐	☐	☐	☐
• Lack of understanding of community participation concept	☐	☐	☐	☐	☐
• Lack of understanding of role of implementing agency	☐	☐	☐	☐	☐
• Stake holder conflicts	☐	☐	☐	☐	☐
• Logistical problems	☐	☐	☐	☐	☐
• Weather and environmental conditions	☐	☐	☐	☐	☐
• Lack of appropriate materials	☐	☐	☐	☐	☐
• Non-conformity to specifications	☐	☐	☐	☐	☐
• Lack of technical skill	☐	☐	☐	☐	☐
• Inadequate supervision	☐	☐	☐	☐	☐

18. Budget/Finances

What was the impact on project objectives of the risks associated with the following? **(Please tick)**

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low (1)
• Inadequate budgetary allocation	☐	☐	☐	☐	☐
• Inadequate financial disbursements	☐	☐	☐	☐	☐
• Delayed financial retirements	☐	☐	☐	☐	☐
• Delayed and irregular disbursements	☐	☐	☐	☐	☐
• Financial mismanagement	☐	☐	☐	☐	☐

19. Skilled Labour

What was the impact on project objectives of the risks associated with the following? **(Please tick)**

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low (1)
• Lack of skilled labour	☐	☐	☐	☐	☐
• Low levels of competence	☐	☐	☐	☐	☐
• Inadequate contract conditions	☐	☐	☐	☐	☐
• Poorly trained craftspersons	☐	☐	☐	☐	☐

20. Procurement of materials

What was the impact on project objectives of the risks associated with the following? **(Please tick)**

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low (1)
• Non-availability of materials	☐	☐	☐	☐	☐
• Quality of materials	☐	☐	☐	☐	☐
• Cost of materials	☐	☐	☐	☐	☐
• Cost of transportation	☐	☐	☐	☐	☐
• Non-conformity to specifications	☐	☐	☐	☐	☐

21. Technical supervision and Quality control

What was the impact on project objectives of the risks associated with the following? **(Please tick)**

	Extremely high (5)	Very High (4)	High (3)	Medium (2)	Low (1)
• Generalisation of designs and lack of geo-technical considerations	☐	☐	☐	☐	☐
• Incomplete designs	☐	☐	☐	☐	☐
• Insufficient working details	☐	☐	☐	☐	☐
• Failure to interpret designs	☐	☐	☐	☐	☐
• Lack of work schedule	☐	☐	☐	☐	☐
• Technical incompetence	☐	☐	☐	☐	☐
• Lack of appropriate skills	☐	☐	☐	☐	☐
• Inappropriate building materials	☐	☐	☐	☐	☐
• Insufficient supervision	☐	☐	☐	☐	☐

22. What else would you say regarding construction risks and risk management in community-based construction projects in Zambia? (Use space provided).

....

....

....

Appendix E

Cover letter and Model Validation Questionnaire

Inambao Mañelele
P.O. Box 39241
Lusaka.
2nd January 2008.

....
....

Dear Sir/Madam,

RE: Risk management model validation- Questionnaire survey.

In concluding the study titled "Risk management in the procurement of community-based construction projects in Zambia" a model has been developed. I write to kindly request that you complete the attached questionnaire meant for validation of the model developed after a research survey that commenced in August 2006 through to April 2007.

There are two (2) sections in the questionnaire:

1. **General information**
2. **Insights of the Model**

All information presented in this questionnaire will be treated with strictest confidence.

I will be most appreciative if you could find the time to complete the questionnaire at your earliest convenience. If you are interested in the findings of the survey, they can be availed to you at your request. Should you have any queries concerning the questionnaire, please contact me on:

Mobile: 097 7 772955 or 095 5 992188
Email: imangelele2005@yahoo.co.uk or imangelele@moe.gov.zm

Your assistance in this exercise will be highly appreciated.

Yours faithfully,

Inambao Mañelele
MEng Research Student
Department of Civil and Environmental Engineering
University of Zambia.

Section One: General information

1. Name of organisation: ....

2. Type of organisation: ....

3. Occupation of respondent:..

4. Respondent's years of experience in construction sector: ....

Section Two: Insights of the Model

The proposed model is shown in the Appendix.

1. The model addresses the activities necessary for managing risks on community-based construction projects in practice. **(Please tick)**

Agree	Neutral	Disagree
1	**2**	**3**
☐	☐	☐

2. Do you agree that the steps identified in the model can help in the management of risks on community-based construction projects? **(Please tick)**

Yes	Not sure	No
1	**2**	**3**
☐	☐	☐

3. Do you think the proposed steps are easy to follow and implement? **(Please tick)**

Yes	Not sure	No
1	**2**	**3**
☐	☐	☐

4. Would you be willing to use the model for risk management on community-based construction projects? **(Please tick)**

Yes	Not sure	No
1	**2**	**3**
☐	☐	☐

5. Can you suggest any improvements to make to the model that would render it more responsive to community-based projects in Zambia?

Appendix F
Risk management model for community projects